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EXECUTIVE SUMMARY

The project site consists of a single 3.08-acre parcel, as well as an approximate 0.24 acre area of improvements on the west-adjoining property in partnership with the neighboring owner, and an approximate 0.25-acre area of improvements in the public Right-of-Way. The total project area is approximately 3.57 acres. The proposed project is located on the northwest corner of the intersection of 44th Ave W and 209th St SW (a dedicated ROW) in the City of Lynnwood, Washington. The existing parcel is currently developed as an asphalt paved parking lot with drive aisles, landscaping, and lighting and drainage infrastructure. The project is bordered by a wetland to the north with the 20800 Block (a private street) beyond; by a developed commercial property to the west; by 209th St SW to the south with single family residences beyond; and by 44th Avenue W to the east. The project involves construction of a mixed-use building with multi-family apartments and ground-floor commercial retail (café or other). The building will be 6 stories over 2 levels of below grade parking garage. The building will include roughly 8,300 sf of indoor amenity space and leasing office, as well as approximately +/- 21,000-sf of courtyard amenity space. The property is zoned PCD (Planned Commercial Development), and the site lies within the Lake Washington Watershed.

Proposed Drainage System:
Stormwater runoff generated from the proposed improvements will generally maintain the existing/historic drainage patterns. Stormwater onsite will be collected by a network of curbs, gutters, catch basins, and underground pipes. The runoff will be conveyed to a water quality treatment system prior to discharge into the existing wetland, maintaining the existing point of discharge and the wetland hydroperiods per Department of Ecology requirements. Due to the wetland hydroperiod protection requirement, the project will not provide Flow Control.

Design Criteria:
The stormwater requirements for the project have been updated to the 2019 Western Washington Stormwater Manual as required by the city. Due to the Wetland Hydrology Minimum Requirement #8, the project will forgo flow control to better match monthly and daily flow rates into the critical area.

Table 1 (2019 DOE SMMWW)

Jurisdictional Requirements	
Peak Runoff Control:	Match the pre-developed discharge rates from 50% of the 2-year peak flow up through the full 50-year peak flow. Projects discharging directly to approved water bodies may omit this requirement. As MR #8 is deemed more critical to the site, Peak runoff control under MR#7 will not be utilized.
Water Quality:	91% of runoff volume
Conveyance Design:	100-year event
Hydrologic Design Method:	Western Washington Hydrology Model for water quality, water quantity, and wetland hydrology analysis (Method 2)
Wetland Hydroperiod:	*Method 2* –Projects seeks an exception per LMC 13.40.030 for Appendix I-C.4 of the 2019 Western Washington Stormwater Manual.

SECTION 1 –PROJECT OVERVIEW

Location
NW corner of 44th Ave W and 209th St SW

Section/Township/Range
SE 1/4 Section 21, Township 27 N, Range 4 E, W.M.

Parcel/Tax Lot(s)
Snohomish County Tax Parcel No. 27042100407500
134,168 square feet (3.08 acres)
Total Project Area = 3.32 acres

City, County, State
Lynnwood, Snohomish County, Washington

Governing Agency
City of Lynnwood

Design Criteria
2019 Stormwater Management Manual for Western Washington

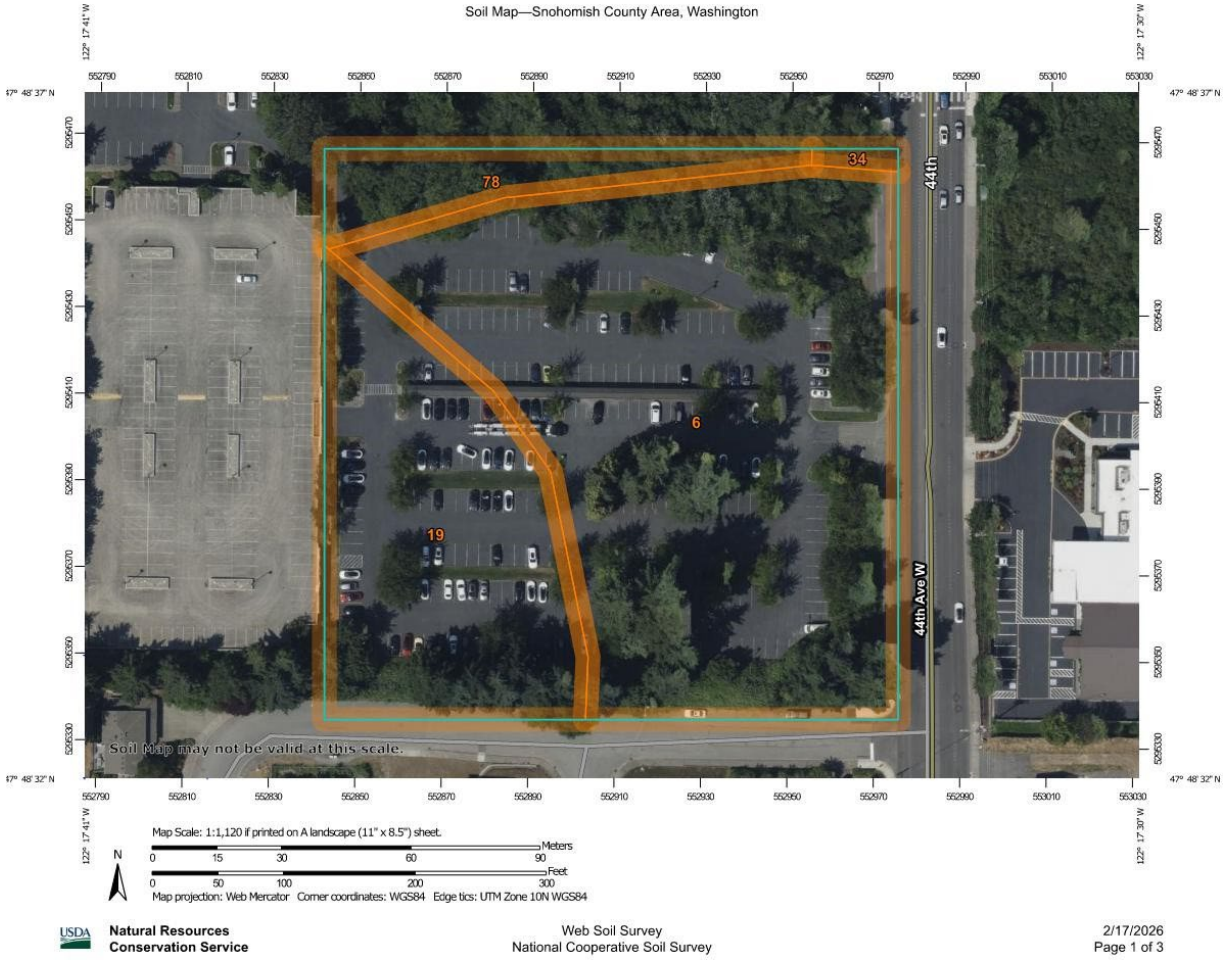
Drainage Basin
Lake Washington

Figure 1.1 –Site Location Map

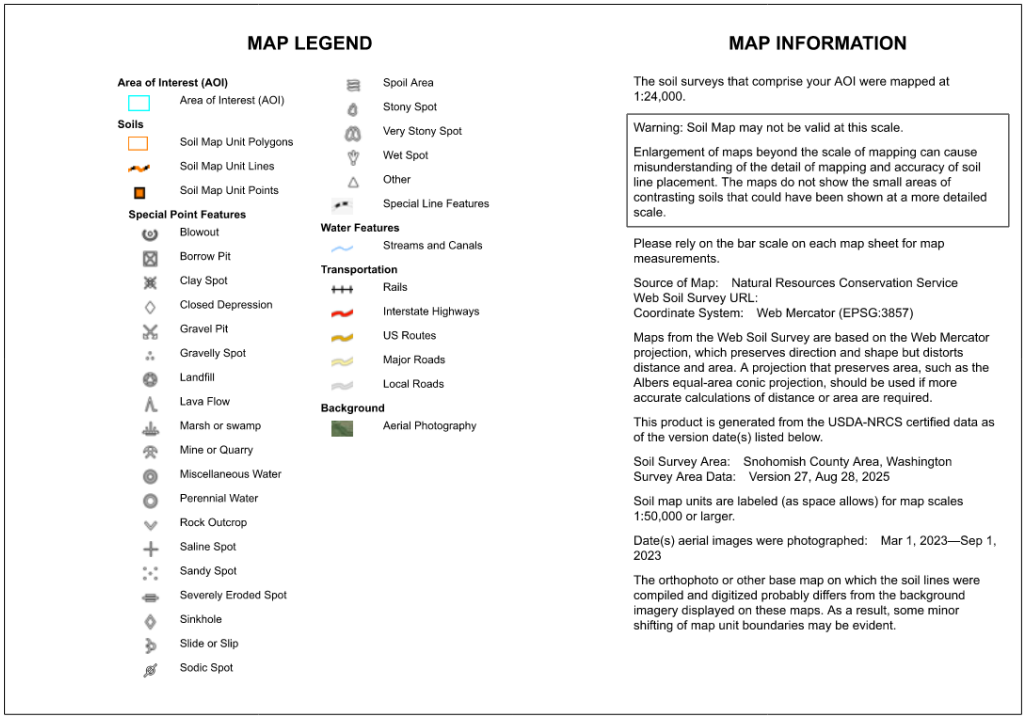


Soils

Websoil Survey



Soil Map—Snohomish County Area, Washington



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6	Alderwood-Urban land complex, 8 to 15 percent slopes	2.8	64.8%
19	Everett very gravelly sandy loam, 15 to 30 percent slopes	1.2	27.5%
34	Mukilteo muck	0.0	0.5%
78	Urban land	0.3	7.2%
Totals for Area of Interest		**4.3**	**100.0%**

Geotechnical Report

A geotechnical report was prepared for the project by GeoEngineers, dated March 28, 2023, and is included as **Appendix F.** The geotechnical characterization of the on-site soils is summarized as follows in the GeoEngineers report:

"The subsurface conditions at the site have been evaluated by completing six geotechnical borings for the current study and reviewing logs of test pits completed by others at the project site…Subsurface conditions encountered three soil units; fill, recent deposits, and glacially consolidated soils.

The borings encountered approximately 1 to 2 inches of asphalt concrete pavement and 3 to 5 inches of ¾-inch minus crushed rock. The asphalt and crushed rock was underlain by fill, where encountered, and recent deposits. Fill was encountered in boring GEI-5 below the asphalt and crushed rock and extended approximately 2 feet below existing site grades. The fill material consisted of loose to medium dense silty sand with gravel and occasional brick debris.

Recent deposits were encountered below the asphalt and crushed rock in each of the borings except GEI-5. The recent deposits generally consisted of very loose to medium dense sand with variable silt and gravel content and extended up to 14½ feet below existing site grades (GEI-3).

Glacially consolidated soils were encountered below the fill or recent deposits and extended to the depths explored. The glacially consolidated soils generally consisted of dense to very dense silty sand with variable gravel content".

According to the report, groundwater at the site was measured at elevations of approximately 334.2 to 337.9 feet. The lowest level of underground parking will be constructed to a finished floor elevation of 331.00. Based on the analysis in the report, GeoEngineers anticipates that permanent dewatering of the below-grade slab will be required, and a system of perimeter and interior foundation drains is recommended. The report goes on to state that permanent dewatering from the foundation drainage system is anticipated to be 5 gallons per minute or less.

Existing Drainage Basins

The existing project area is a single drainage basin that currently flows from the south property line to the north property line. The collected runoff is directed to catch basins which then discharge to the wetland area to the north of the site.

The upstream and downstream analysis of this basin will be described in detail in **Section 2**. An exhibit showing the existing conditions of the basin is provided in **Appendix B**.

Developed Drainage Basins

The developed site will continue to be evaluated as a single drainage basin. Runoff from new and replaced impervious surfaces on the site will be collected and conveyed through a water quality system prior to being discharged to an existing wetland to the north of the site.

An exhibit showing the developed conditions is provided in **Appendix B**.

SECTION 2 –OFF-SITE ANALYSIS

Upstream Analysis

There are no upstream basins that contribute significant runoff to the project location. The area to be developed is bound to the north by a downstream wetland, to the east and south by 44th Ave W and 209th Street, and to the west by an office parking structure. Stormwater runoff within the public and private rights-of-way is collected and managed separately from on-site runoff, and the commercial property does not appear to convey significant runoff to the property. There is an existing 24-inch stormwater culvert that runs beneath the western portion of the site from south to north, discharging to the existing downstream wetland that adjoins the site to the north. This culvert serves properties south of the site across 209th Street SW. The project will require re-routing of this existing stormwater culvert while maintaining continuous service to the upstream properties.

Downstream Analysis

The property, currently developed as an asphalt-paved parking lot, presently drains towards the north. Stormwater onsite is captured in existing catch basins and conveyed directly to the north-adjoining wetland.

In the mitigated condition, a network of curbs, gutters, catch basins, and underground pipes will collect surface water runoff throughout the site. The runoff will be conveyed to a water quality treatment system prior to discharge into the buffer of the existing wetland, maintaining the existing point of discharge and the wetland hydroperiods per Department of Ecology requirements. Wetland hydroperiod analysis is discussed further in Section 4 of this report. The wetland itself will not be utilized for stormwater treatment or flow control. Treated stormwater will discharge into the existing wetland buffer at rates based on the designed impervious area condition without flow control. This is due to the existing condition of the site, developed as a parking lot with a comparable percent coverage of impervious surfaces to the designed condition. The appropriately designed discharge rates are not anticipated to adversely impact wetland hydrology, including all wetlands downstream of the project, Scriber Creek, or the Scriber Creek Basin. Stormwater in this basin ultimately discharges into Lake Washington.

There is a culvert on the downstream end of the existing wetland that conveys drainage to Scriber Creek, and eventually Lake Washington.

Per SMMWW I-3.5.3, this qualitative downstream analysis is intended to assess the potential for off-site water quality, erosion, slope stability, and drainage impacts associated with the project, and extends 1/4 mile downstream of the project site.

SECTION 3 –CONDITIONS AND REQUIREMENTS

As indicated above in the Executive Summary section of this report, the project will create greater than 5,000 square feet of new hard surfaces. Per the flow charts in Figure 3.1 and 3.2, all minimum requirements will apply to new and replaced hard surfaces.

Figure 3.1 –Flow Chart for Determining Requirements for New Development

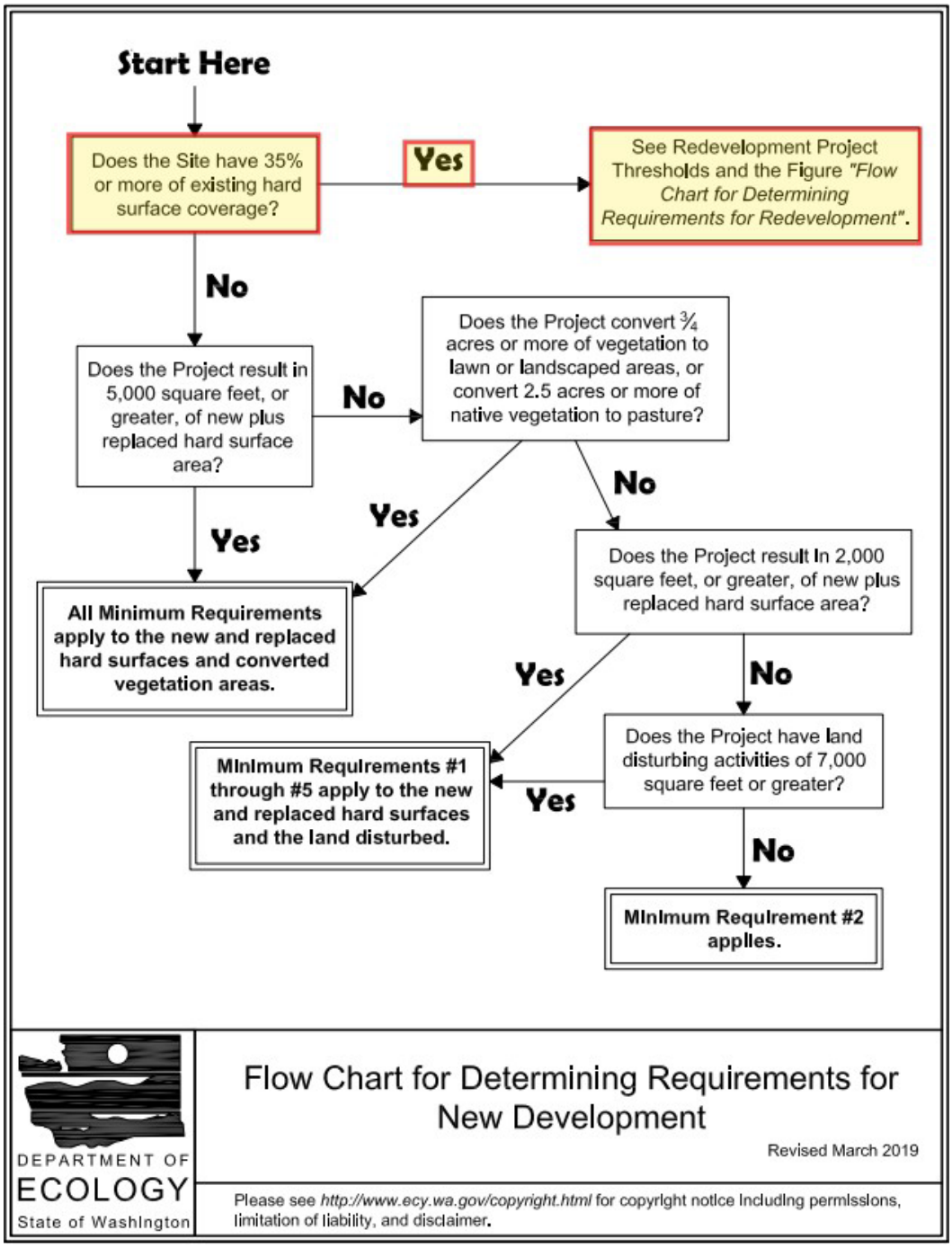
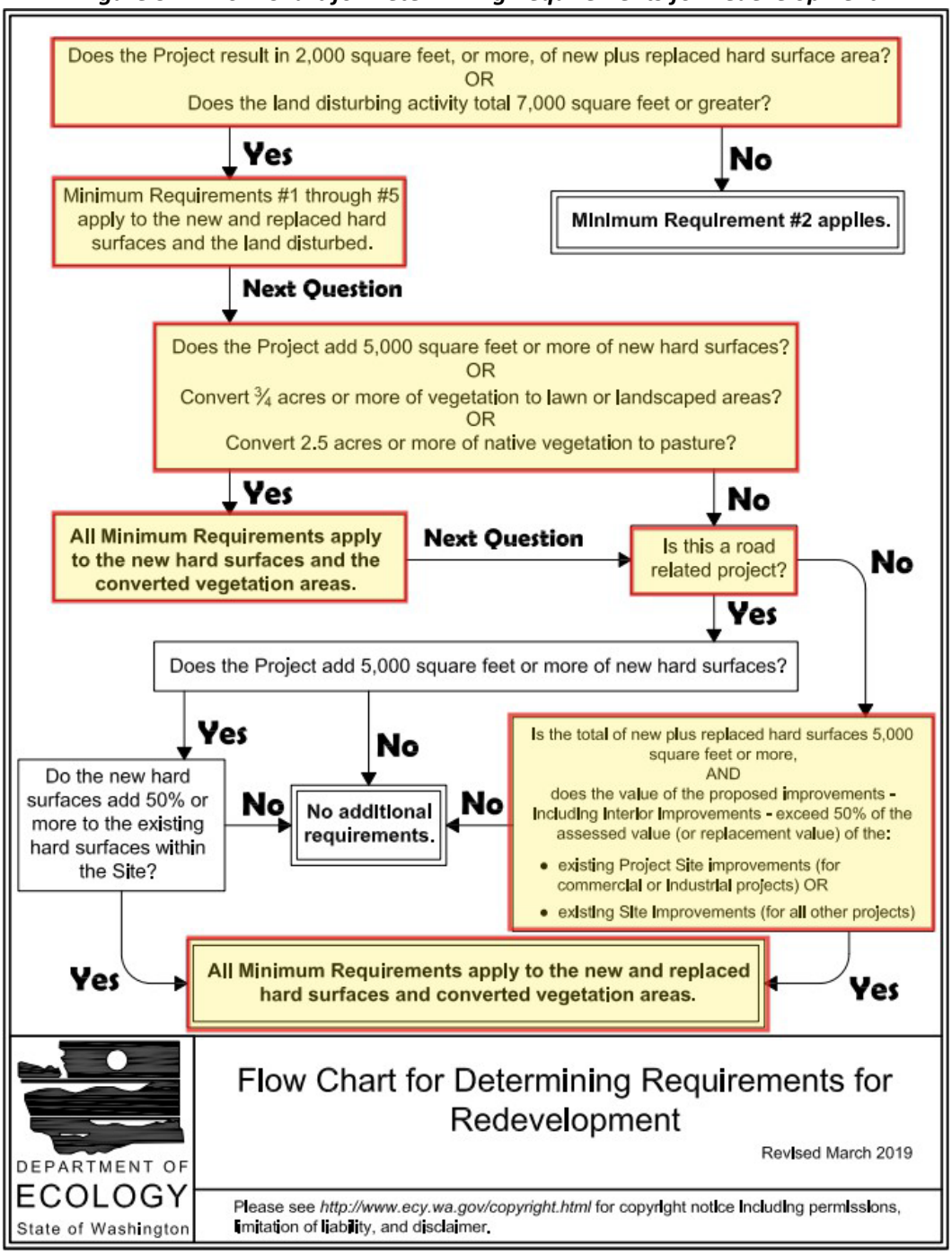


Figure 3.2 –Flow Chart for Determining Requirements for Redevelopment



The requirements have been met as follows:

Minimum Requirement #1: Preparation of Stormwater Site Plans

This project involves greater than 5,000 square feet of new impervious surface, thus, Minimum requirement #1 applies and a Stormwater Site Plan must be prepared for review by the local jurisdiction.

Response: *This report has been prepared to address this requirement.*

Minimum Requirement #2: Construction Stormwater Pollution Prevention

All erosion and sediment control measures shall be governed by the requirements of Department of Ecology's SWMMWW and the General Permit for Construction Stormwater. The thirteen elements as identified in the manual and provided below will be incorporated into the TESC plans:

Element 1: Preserve Vegetation/Mark Clearing Limits
Element 2: Establish Construction Access
Element 3: Control Flow Rates
Element 4: Install Sediment Controls
Element 5: Stabilize Soils
Element 6: Protect Slopes
Element 7: Protect Drain Inlets
Element 8: Stabilize Channels and Outlets
Element 9: Control Pollutants
Element 10: Control De-watering
Element 11: Maintain BMPs
Element 12: Manage the Project
Element 13: Protect Low Impact Development BMPs

Response: *Temporary Erosion and Sediment control plans have been prepared to address the elements identified. Since the project will result in greater than 1 acre of soil disturbance, a Stormwater Pollution Prevention Plan (SWPPP) will be required to obtain coverage under the NPDES Construction Stormwater General Permit prior to construction. See Section 6 of this report for a complete description of the construction and erosion control strategies being implemented. As required by City of Lynnwood, a Spill Prevention Control and Countermeasure (SPCC) Plan shall also be prepared. The SWPPP and SPCC shall be provided as part of the Development Engineering Permit.*

Minimum Requirement #3: Source Control of Pollution

All known, available, and reasonable source control BMPs must be applied to all projects. Source control BMPs must be selected, designed, and maintained according to the SWMMWW.

Response: *No fueling, chemicals, fertilizers, or any other hazardous materials, unpaved parking areas, manufacturing, painting, automotive repair, etc. will occur or be present on this site. Therefore, this site does not require source control of pollution.*

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

Natural drainage patterns shall be maintained, and discharges from the project site shall occur at the natural location, to the maximum extent practicable. The manner by which runoff is discharged from the

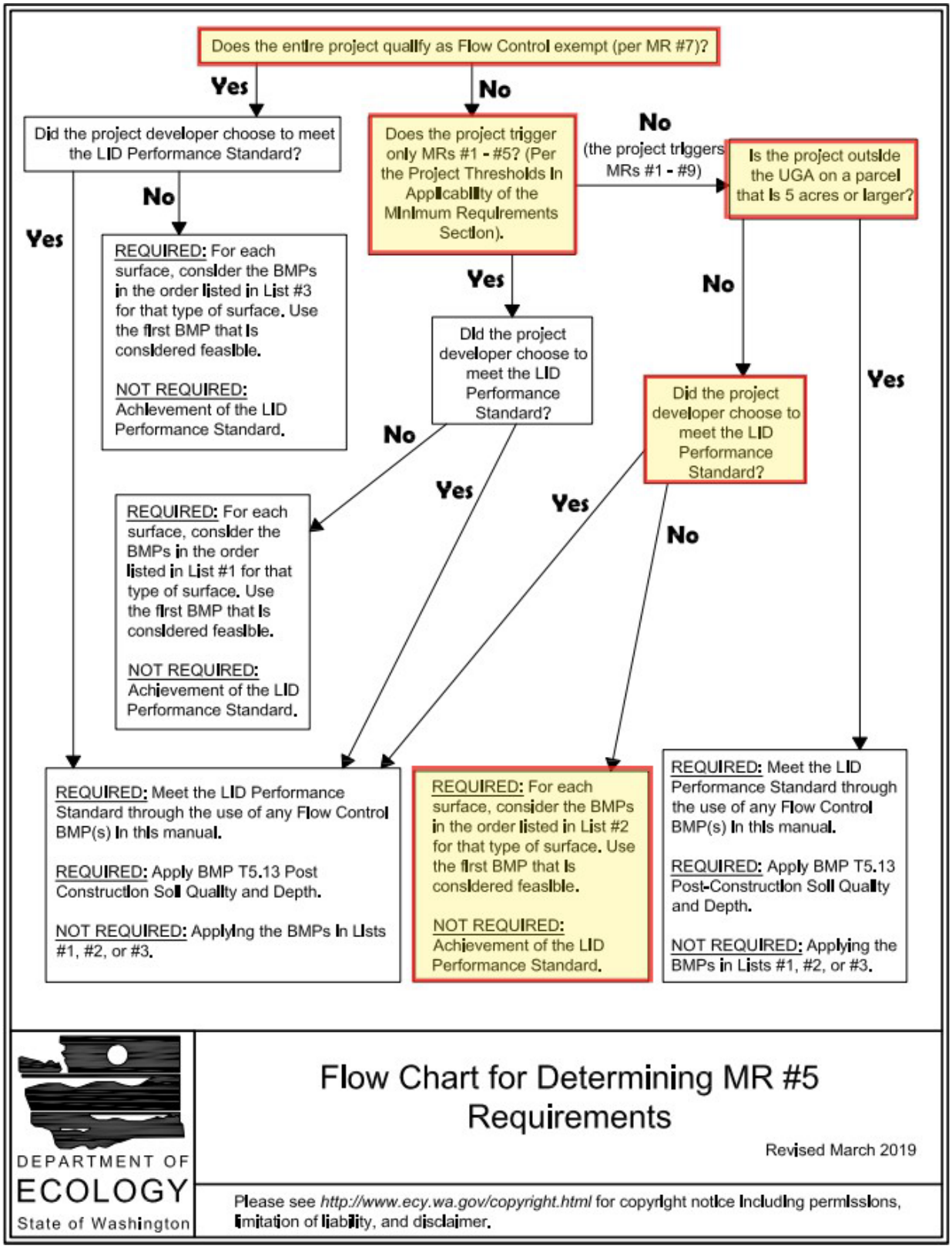
project site must not cause a significant adverse impact to downstream receiving waters and downgradient properties. All outfalls require energy dissipation.

Response: *Runoff from the area to be redeveloped is currently captured in catch basins throughout the existing parking lot and conveyed directly to the existing wetland. All runoff from proposed developed site will be treated and discharged into the wetland buffer, thus preserving the natural discharge point. . The construction of the new storm drainage facilities will be in accordance with the Washington State Department of Ecology's SMMWW. Therefore, no adve anticipated.*

Minimum Requirement #5: On-site Stormwater Management

Projects shall employ On-site Stormwater Management BMPs in accordance with the following projects thresholds, standards, and lists to infiltrate, disperse, and retain stormwater runoff on-site to the extent feasible without causing flooding or erosion impacts.

Figure 3.2 –Flow Chart for Determining LID MR #5 Requirements



Response: *Because the project will include greater than 5,000 square feet of new impervious surfaces, on-site stormwater BMPs will be evaluated per the requirements of the SWMMWW.*

The project is responsible for evaluating Best Management Practices per the SMMWW flow chart for determining MR #5 provided in Figure 3.2. BMPs have been evaluated using List #2 approach for all new and replaced project surfaces.

BMPs for On-site Stormwater Management will be installed per Section 3.1 of Volume III of the SMMWW to the greatest extent feasible. Site topography, setbacks, and lack of sufficient surface area due to wetlands significantly impacts the useable area of the site. As such, LID BMPs have been considered within List #2 of Minimum Requirement #5:

Lawn and Landscaped Areas:

- BMP T5.13: Post Construction Soil Quality and Depth.
  Response: *The soil disturbed within landscaped areas shall be amended to meet the specifications of BMP T5.13.*

Roofs:

- BMP T5.30: Full Dispersion
  Response: *Not feasible given site conditions; limited site area, proximity to wetlands, and site topography, therefore this BMP will not be implemented.*
- BMP T5.10A: Downspout Full Infiltration
  Response: *Not feasible given requirement for wetland recharge.*
- BMP T7.30: Bioretention Cells, Swales, and Planter Boxes
  Response: *Not feasible given site conditions; limited site area, proximity to wetlands, and site topography, therefore this BMP will not be implemented.*
- BMP T5.10B: Downspout Dispersion
  Response: *Not feasible given site conditions; limited site area, proximity to wetlands, and site topography, therefore this BMP will not be implemented.*
- BMP T5.10C: Perforated Stub-out Connections
  Response: *Not feasible given requirement for wetland recharge.*

Other Hard Surfaces:

- BMP T5.30: Full Dispersion
  Response: *Not feasible given site conditions; limited site area, proximity to wetlands, and site topography, therefore this BMP will not be implemented.*
- BMP T5.15: Permeable Pavements
  Response: *Site grading is not ideal nor feasible for permeable pavements. Therefore, this BMP will not be implemented. Refer to Geotechnical Report in* ***Appendix F*** *for details.*
- BMP T5.14A: Rain Gardens
  Response: *Not feasible given site conditions; limited site area, proximity to wetlands, and site topography, therefore this BMP will not be implemented.*
- BMP T7.30: Bioretention Cells, Swales, and Planter Boxes
  Response: *In lieu of a bioretention cell, a modular wetland is proposed to provide equivalent or greater water quality treatment.*
- BMP T5.12: Sheet Flow Dispersion
  Response: *Not feasible given site conditions; limited site area, proximity to wetlands, and site topography, therefore this BMP will not be implemented.*

Minimum Requirement #6: Runoff Treatment

Projects in which the total of effective, pollution-generating impervious surface (PGIS) is 5,000 SF or more in a threshold discharge area of the project require construction of stormwater treatment facilities. Projects in which the total of pollution-generating pervious surfaces (PGPS) is three-quarters (3/4) of an acre or more in a threshold discharge area, and from which there is a surface discharge in a natural or man-made conveyance system from the site also require treatment facilities. 91% of the runoff volume of an approved continuous runoff model will be required to be treated for water quality. The project use is considered to be commercial, thus treatment facilities are required to provide Enhanced Treatment.

Response: *The project includes greater than 5,000 square feet of new pollutant-generating impervious surfaces, and as such is responsible for providing water quality treatment. Because the project is a commercial development, Enhanced Treatment is required. Treatment will be provided downstream of detention via a Modular Wetland unit, which provides Enhanced Treatment (General Use Level Designation) per the Department of Ecology documentation provided in* ***Appendix H****.*

Minimum Requirement #7: **Flow Control**

Projects must provide flow control to reduce the impacts of stormwater runoff from hard surfaces and land cover conversions. The requirement below applies to projects that discharge stormwater directly, or indirectly through a conveyance system, into a fresh waterbody. Stormwater discharges shall match 50% of the pre-developed 2-year peak flow up to the full 50-year peak flow. The pre-developed condition should match a forested land cover. Proper Flow Control BMPs shall be selected and designed according to the current SWMMWW.

Response: *Per SMMWW requirements, existing conditions do not allow MR #7 to be met while also working to meet MR #8. See MR#8 for a requested exception.*

Minimum Requirement #8: Wetlands Protection

The thresholds identified in Minimum Requirement #6 and Minimum Requirement #7 shall also be applied for any discharge to wetlands.

Response: *A single wetland (Wetland A) is located on the northern portion of the site and extends offsite. No direct impacts to Wetland A are anticipated with this project. The project will restore and enhance the wetland buffer area which will dramatically improve the wetland and buffer functions. A water quality Modular Wetland facility will be placed adjacent to the northern drive aisle to improve the critical area functions and habitat values. A Critical Areas Report (CAR) report addressing the existing wetlands and buffer restoration/enhancement area is provided in* ***Appendix G****. Flow downstream of the Modular Wetland will be conveyed to the wetland buffer area via a dispersion trench.*

To provide adequate wetland recharge rates to match the existing conditions, flow control is not feasible on this project. As such, the project is requesting an exception as allowed under LMC 13.40.030 to Appendix I-C.4 in the 2019 Western Washington Stormwater Manual for wetland flows.

The project has demonstrated wetland hydroperiod protection. *Discussion related to the hydrologic modeling of the wetland hydroperiod is included in* ***Section 4****.*

Minimum Requirement #9: Operation and Maintenance
An operation and maintenance manual that is consistent with the provisions in the SWMMWW shall be provided for proposed stormwater facilities and BMPs, and the parties responsible for maintenance and operation shall be identified.

Response: *An Operations and Maintenance Manual for this project will be prepared as part of the Development Engineering Permit.*

Minimum Requirement #10: Off Site Analysis and Mitigation
Development projects that discharge stormwater off-site shall submit as part of their Stormwater Site Plan report an off-site analysis that assesses the potential off-site impacts of stormwater discharge.

Response: *A qualitative analysis of the downstream stormwater system has been provided in Section 2 of this report. Due to the incorporation of wetland protection and water quality elements, and preservation of the existing discharge location, no downstream drainage issues are anticipated as a result of the proposed development.*

SECTION 4 –ON-SITE STORMWATER MANAGEMENT AND WATER QUALITY

The City of Lynnwood standards reference the 2019 SMMWW and require that the developed discharge durations match the pre-developed durations for 50% of the pre-developed 2-year peak flow up to the full 50-year peak flow. Due to the Wetland Hydrology Minimum Requirement #8, the project will forego flow control to match the monthly and daily volumes into the existing wetland.

The project is creating more than 5,000 SF of pollution-generating impervious surface (PGIS) in a threshold discharge area of the project and therefore requires construction of stormwater treatment facilities. According to MR #6, water quality treatment facilities are designed to treat 91% of the total runoff volume.

Hydrologic Analysis

Hydrologic analysis of water quality and water quantity for the project was performed using the Washington State Department of Ecology's Western Washington program. The model utilizes design data for specific soil types and vegetative cover to simulate runoff. The software program routes the flows generated from the basin analysis through a proposed conveyance system to storm water management facility. The model is designed to meet the standard requirements stated in the Department of Ecology's Stormwater Manage Washington.

Existing Site Hydrology

The existing project area consists of a single basin. The project area is developed as an asphalt paved parking lot. The pre-developed conditions for the project site are shown in **Table 4.1** below. An exhibit showing the existing conditions is provided in **Appendix B**. Existing peak runoff rates were determined using the WWHM2012 modeling software and the calculations can be found in **Appendix D**.

Table 4.1 –Pre-Developed Conditions

Land Cover Description	Area (ac)
Roof	0.053
Pavement (PGIS)	2.181
Hard Surface (NPGIS)	0.014
Landscape	1.074
Total Project Area	*3.320*

*Per the requirements of the SMMWW, all existing conditions shall be modeled as forested conditions.

Developed Site Hydrology

The developed conditions are shown below in **Table 4.2**, which were utilized in drainage calculations for peak flows. An exhibit depicting the proposed developed conditions is provided in **Appendix B.**

Table 4.2 –Developed Conditions

Land Cover Description	Area (ac)
Roof	1.469
Pavement (PGIS)	0.642
Hard Surface (NPGIS)	0.223
Landscape	0.986
Total Project Area	*3.320*

Wetland Hydroperiod Protection

Wetland recharge volumes were modeled by determining existing and proposed land coverage areas as discharging into or onto the wetland buffer area. The project utilizes Method 2 Site Discharge Modeling, demonstrated by the WWHM2012 model to match daily and monthly discharge volumes into the wetland buffer within the required tolerances. Exhibits showing the predeveloped and developed wetland tributaries are included in **Appendix B**. Runoff volumes for the wetland hydroperiod are included under "Wetland Hydroperiod" in the Critical Areas Report that covers the north-adjoining wetland is included in **Appendix G.**

Water Quality

Per the SMMWW, the water quality facilities shall be sized to treat 91% of project runoff. Water quality shall be provided by Modular Wetland or equivalent method approved by the Department of Ecology for Enhanced Treatment as is required for treatment of runoff from PGIS. The Ecology General Use Level Designation documentation is provided in **Appendix H**. Based on a Water Quality Flow Rate of 0.2017 cubic feet per second, an 8x8' underground Modular Wetland wa at the site. A detail for the Modular Wetland is included in **Appendix C**. The hydrologic model used to calculate the water quality treatment flow is pro Appendix D.

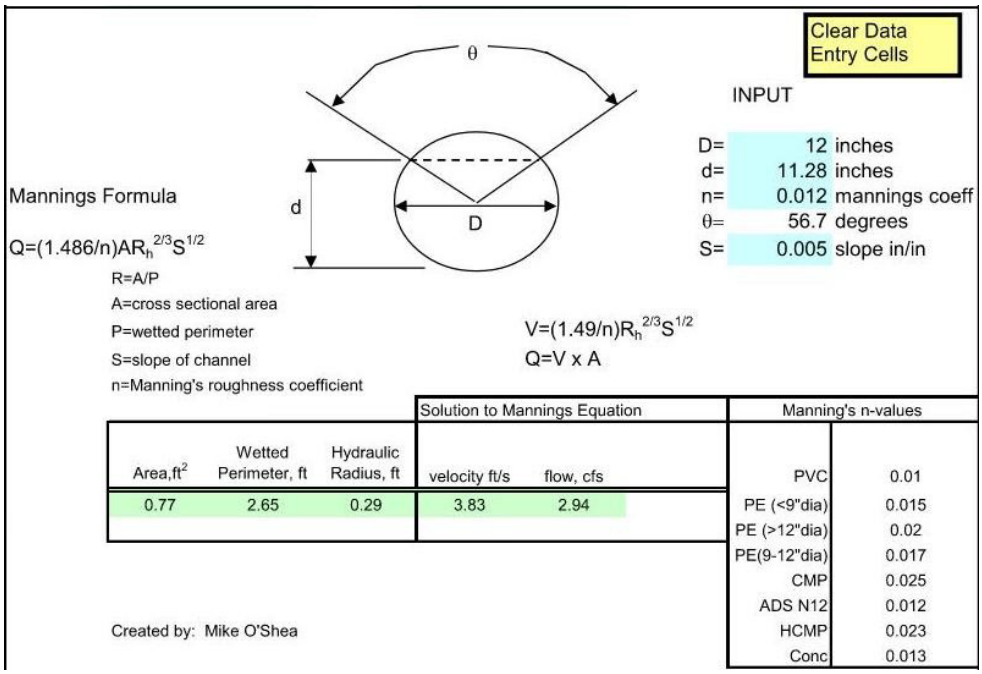
SECTION 5 –CONVEYANCE ANALYSIS

Storm drainage pipes have been evaluated to confirm that they are able to convey the anticipated peak flow rate generated by the 25-year, 24-hour design storm event.

Design flows were generated utilizing the peak 25-year flow generated by the new and replaced surfaces, as calculated by a continuous runoff modeling program. The 25-year peak flow is 2.21 cubic feet per second (see **Appendix D** for WWHM results).

Per Figure 5.1 below, a 12" pipe sloped at 0.5% is adequate to c
The 100-year peak flow is 2.94 cfs; therefore the conveyance system is adequate to convey the developed 100-year storm for the entire site as well. In the event of an overflow, stormwater would generally overtop the northern curb of the drive aisle and discharge to the wetland buffer. No adverse effects to the site or downstream properties are anticipated if the storm conveyance system were to overflow.

Figure 5.1 –Pipe Capacity Calculations



SECTION 6 –CSWPPP ANALYSIS AND DESIGN

All erosion and sediment control measures shall be governed by the requirements Department of Ecology's SMMWW and the General Permit for Construction Storm Water (CSWGP). Since the project will cause greater than an acre of soil disturbance, a National Pollutant Discharge Elimination System (NPDES) Permit will be needed to obtain coverage under the Construction Stormwater General Permit.

A temporary erosion and sedimentation control plan has been prepared to assist the contractor in complying with these requirements. The Erosion and Sediment Control (ESC) plan is included along with the construction plans. Per Minimum Requirement #2, the following CSWPPP elements have been evaluated to determine both applicability and feasibility of each element.

Element 1: Preserve Vegetation/Mark Clearing Limits
Before beginning land disturbing activities, temporary fencing shall be installed around the perimeter of the project to clearly identify the project limits.

Element 2: Establish Construction Access
Entrance(s) shall be inspected regularly for trackout –any sediment found shall be swept or shoveled from the pavement immediately.

Element 3: Control Flow Rates
A sediment pond is proposed to control flow rates during construction, as the developed site is greater than 3 acres in size. Sizing of the sediment pond (BMP C240) is based on the 2-year developed peak flow rate of 1.058 cubic feet per second, which is shown in the analysis included in **Appendix D**.

Per the sizing methodology included in SMMWW, the required surface area of the sediment trap is equal to the 2-year developed peak flow rate multiplied by 2080. This results in a required surface area of 2,200 SF (1.058 x 2,080 = 2,200).

The upstream water quality unit should not be brought online until the site has been stabilized to prevent overburdening the unit with sediment during construction.

Element 4: Install Sediment Controls
Silt fence per BMP C233 shall be installed around the perimeter of the site where runoff has the potential to flow off-site. Inlet protection shall be installed in all existing catch basins that have the potential to receive runoff from the project site or construction activities. Inlet protection shall be installed per SWMMWW BMP C220.

Element 5: Stabilize Soils
Soils must not remain exposed and unworked for more than 7 days during the dry season (May 1 — September 30) or 2 days during the wet season (October 1 –April 30). Soils to remain unworked for longer than these specified periods shall be covered per BMP C123 Plastic Covering.

Element 6: Protect Slopes

Although there are no slopes designated as critical steep slopes, it may be necessary to install slope protection per SWMMWW BMP C120 in sloped portions of the site, typically along the western portion of the site and along 188th Street SW.

Element 7: Protect Drain Inlets

Inlet protection shall be installed in all existing catch basins that have the potential to receive runoff from the project site or construction activities. Inlet protection shall be installed per SWMMWW BMP C220.

Element 8: Stabilize Channels and Outlets

Pipe velocities are minimal, as pipe velocities will be less than 2 feet per second in the 100-year design event discharge. No additional outlet protection is proposed.

Element 9: Control Pollutants

No significant pollutants are anticipated during construction. The contractor shall implement concrete handling (BMP C151) and sawcutting and surfacing pollution prevention (BMP C152) as needed.

Element 10: Control Dewatering

Per the geotechnical report, groundwater is assum

seasonal groundwater fluctuations, dewatering may be required to facilitate construction of the subsurface stormwater detention system and connection to the existing sanitary sewer system.

Element 11: Maintain BMPs

All temporary and permanent erosion and sediment control BMPs shall be regularly inspected and repaired as needed to assure continued performance of their intended function in accordance with BMP specifications. All temporary BMPs shall be removed within 30 days after achieving final site stabilization or after the temporary BMPs are no longer needed.

Element 12: Manage the Project

The project shall be phased/sequenced in such a manner as to reduce the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking, as identified in BMP C162 Scheduling. It is anticipated that sitework will be performed outside of the wet weather season.

Element 13: Protect Low Impact Development BMPs

No low impact development BMPs (e.g., permeable pavement, bioretention) are proposed. As such, no protection of LID BMPs is required during construction.

1. Construction Sequence and Procedure

The proposed development will include an erosion/sedimentation control plan designed to prevent sediment-laden run-off from leaving the site during construction. The erosion potential of the site is influenced by four major factors: soil characteristics, vegetative cover, topography, and climate. Erosion/sedimentation control is achieved by a combination of structural measures, cover measures, and construction practices that are tailored to fit the specific site.

The contractor will be responsible for implementing the following erosion control and storm water management control measures. The contractor may designate these tasks to certain subcontractors as they see fit, but the ultimate responsibility for implementing these controls and ensuring their proper functioning remains with the contractor. The order of activities will be as follows.

Phase 1

1. Prior to any construction work on the site, representatives from the City of Lynnwood must approve the storm water pollution prevention plan.
2. Mark clearing limits.
3. Install inlet protection to all existing catch basins.
4. Install perimeter fencing.
5. Begin clearing and grubbing operations. Clearing and grubbing done from October 1st through April 30th is authorized as long as there are erosion and sediment control measures.
6. Commence site grading.

Phase 2

1. Disturbed areas of the site where construction activity has ceased for more than 7 days between May 1 and September 30 or 2 days between October 1 and April 30 shall be temporarily seeded and watered.
2. Install storm drainage and curbs.
3. Prepare site for paving. Finalize pavement subgrade preparation.
4. Remove inlet protection around inlets and manholes no more than 48 hours prior to placing stabilized base course.
5. Install base material as required for pavement. Pave site. Do not pave over catch basins.
6. Complete final grading in non-parking areas and install permanent seeding and planting.
7. Remove fencing only after all paving is complete and exposed surfaces are stabilized.

2. Temporary Soil Stabilization

Temporary stabilization practices for this project include:

- Temporary seeding and planting of all unpaved areas using the hydro-mulching grass seeding technique (as needed).

Structural practices for this project include the following. Refer to the Erosion Control plans for specific locations and details:

- Inlet protection using fiber fabric.

Daily inspection of the erosion control measures will be required during construction. Any sediment buildup shall be removed and disposed offsite at an appropriate disposal facility.

Vehicle tracking of mud off-site shall be avoided. In the event that mud is tracked off site, it shall be swept and disposed of offsite on a daily basis.

Because vegetative cover is the most important form of erosion control, construction practices must adhere to stringent cover requirements. More specifically, the contractor will not be allowed to leave soils open for more than 7 days between May 1st and September 30th and 2 days between October 1st and April 30th. Soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast. Applicable practices include, but are not limited to, temporary and permanent seeding, sodding, mulching, plastic covering, and soil application of polyacrylamide.

3. Permanent Erosion Control and Site Restoration

Upon completion of the project, areas of the site that are not stabilized with paving, rooftops, or landscaping as shown on the site plans will be protected with either grass, ground cover/plantings or existing vegetation.

4. Inspection Sequence

The construction site operator will periodically inspect the site to evaluate how ESC measures are functioning and shall install or repair BMPs as needed based on site conditions to ensure erosion and sediment are controlled. Because the project does disturb more than one acre, a certified erosion and sediment control lead will be required.

5. Control of Pollutants Other than Sediments

Pollutants shall be controlled on the work site through the utilization of a centralized area for equipment. No significant pollutants are anticipated.

SECTION 7 –SPECIAL REPORTS AND STUDIES

The following Special Reports and Studies were used or have been completed for this project:

- *FEMA FIRM Map number 53061C1320F,* dated June 19, 2020.
- *Geotechnical Engineering Study,* provided by GeoEngineers, dated March 28, 2023.
- *Critical Areas Impact & Mitigation Memo,* prepared by Wet.Land, dated December 15, 2025.
- *Critical Areas Report,* prepared by Wet.Land, dated March 31, 2026

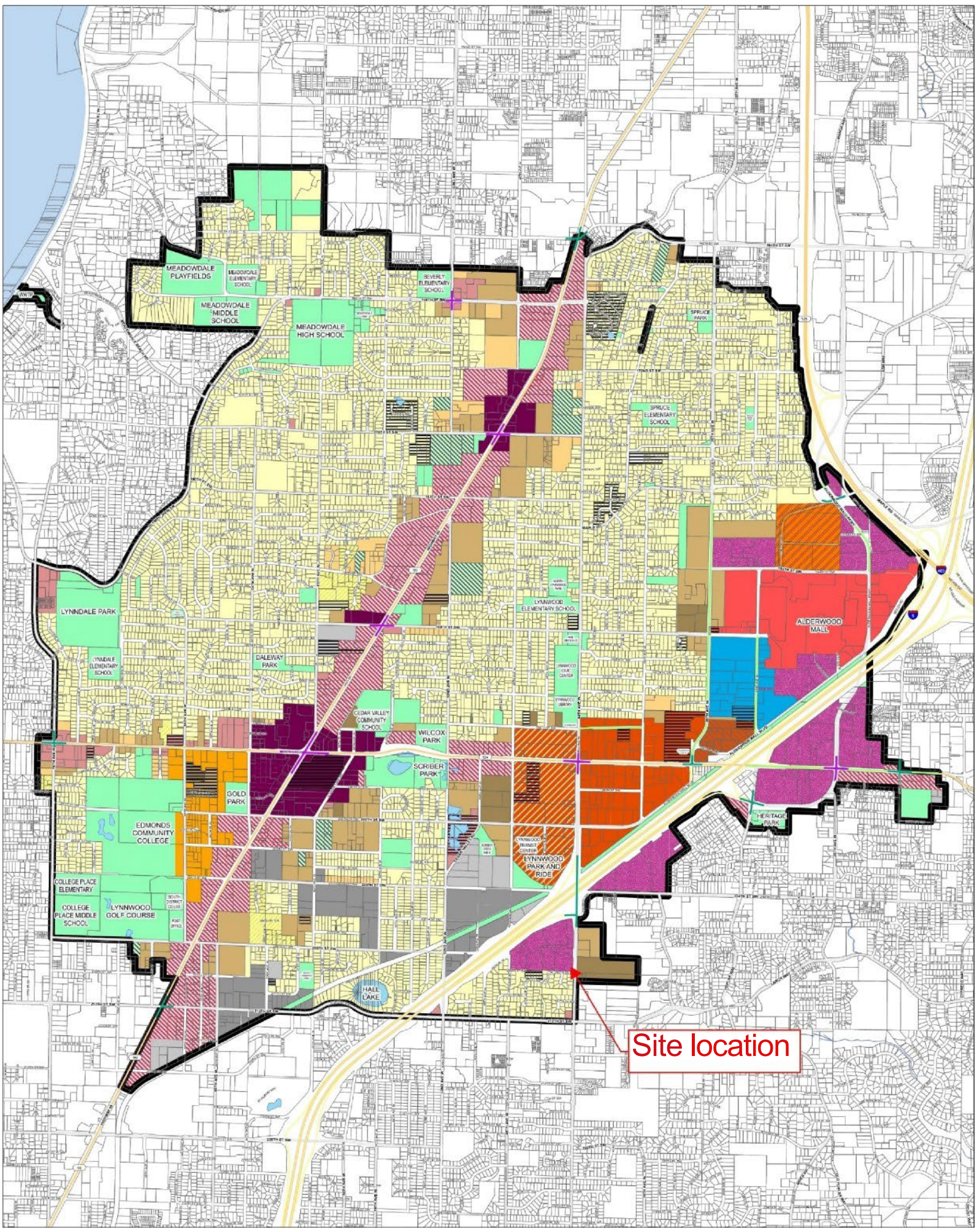
SECTION 8 –OTHER PERMITS

The following governmental approvals or permits will likely be required for this project:

- City of Lynnwood Building Permit
- City of Lynnwood Project Design Review (PDR) Process I
- City of Lynnwood Development Engineering Permit
- Department of Ecology General Permit Coverage (NOI)

APPENDIX A –FIGURES

City of Lynnwood Zoning Map



RESIDENTIAL

- R5-B - Residential 6400 Sq Ft
- RS-7 - Residential 7200 Sq Ft
- RS-4 - High Densay Single Family 4000 Sq F1
- RML - Multiple Residential Low Density
- RMM - Multiple Residential Medium Density
- RMH - Muhiple Residential High Oensily
- MHP - Mobile Home Park

COMMERCIAL

- ACC - Alderwood-City Cen1er Transition Area
- NC - NefghDorhood Commercial
- CG - General Commercial
- PRC- Planned Regional Center
- PCD - Planned Commercial Development

MIXED-USE

- CC-C - City Center Core
- CG-W - City Center West
- CC-N - City Center Nonh
- CDM - College Oistrict Mixed Use
- CR - Commercial-Residential
- HMU - Highway 89 Mixed Use

INDUSTRIAL

- BTP - Bus ness/Technical Park
- LI - Light Industrial

OTHER

- P-1 - Public
- Planned Unit Development
- Gateway
- Prominent
- Ff0Nta8• Landscaping
- City Limits

LY NN WOO g
WASNINGTON

CITY OF LYNNWOOD
OFFICIAL ZONING MAP

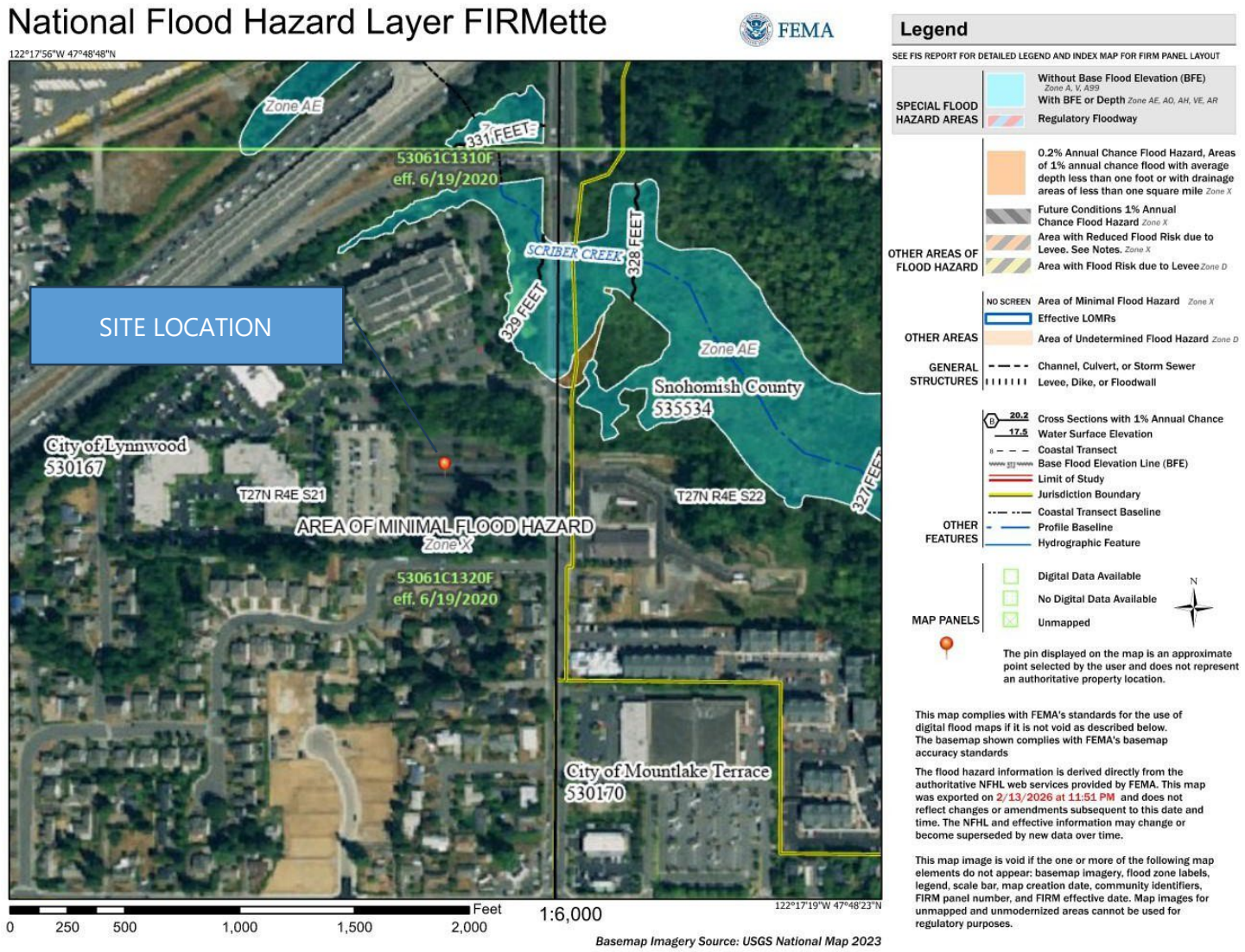
Updated: November 22, 2021
(Ordinance #3403)

'ntained bv the Citv of Lvnnwood Development and Business Services Department

No:es. 1. TheersenoeoCen?‹onmenm|zens0eaes snsalareasandpopeny<pxdc‹:ond#ons may affect the extent of land development allowed. 2. Source of parcel data: Snohomish County. 3. This map may contain inadvertent error Inrormation daplcled nere ahould be verfflad by the uaer.

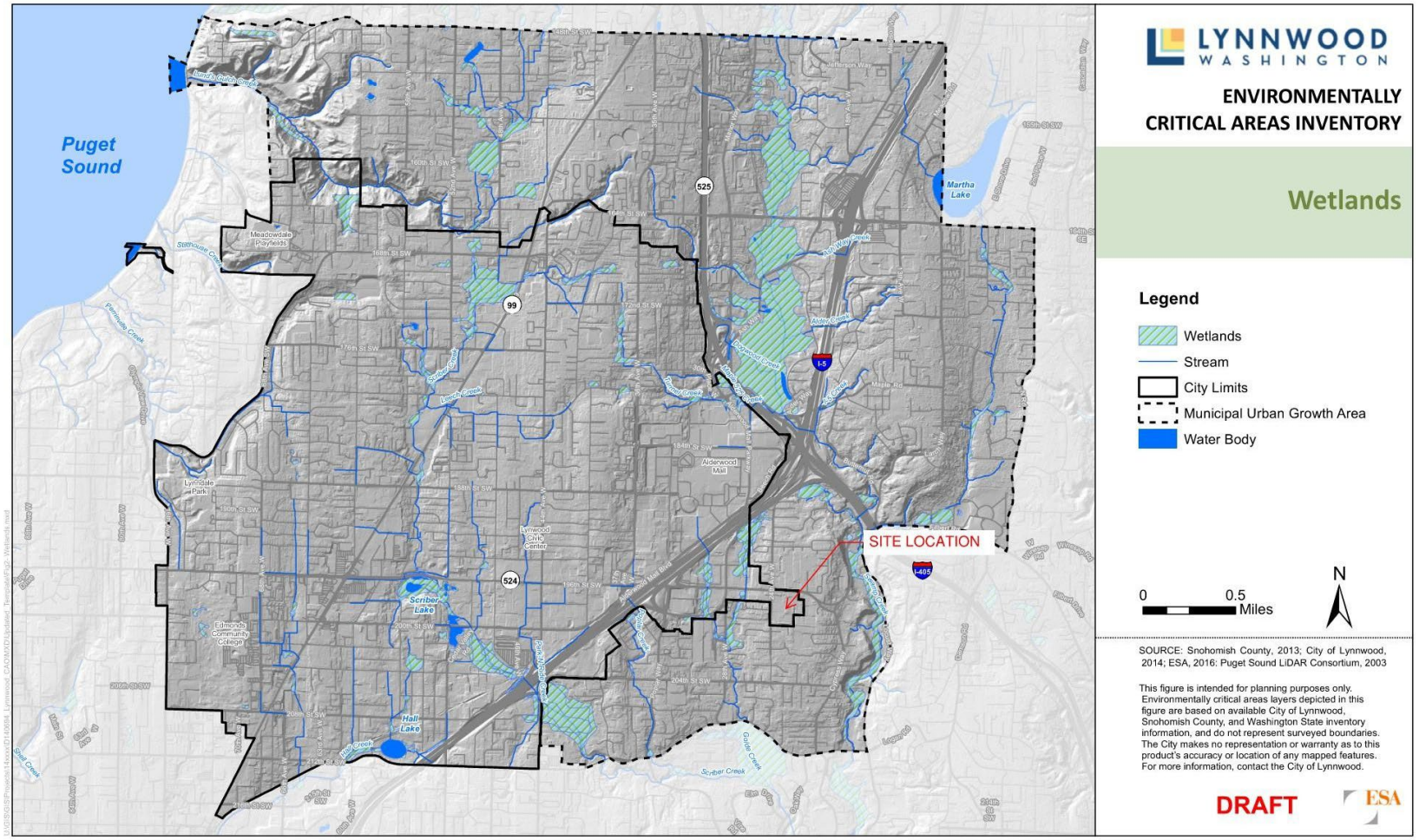
0 0.45 0.9 Miles

FEMA Flood Insurance Rate Map



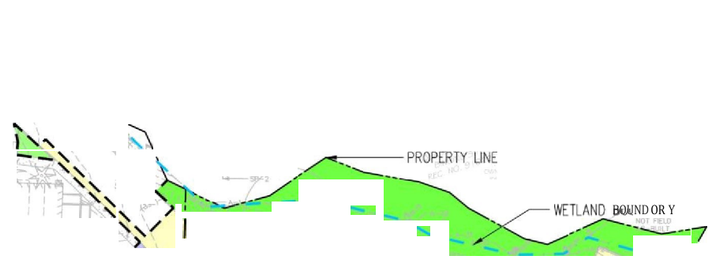
Per the Flood Insurance Rate map, the project is located in Zone X, and is identified as being an area of minimal Flood Hazard.

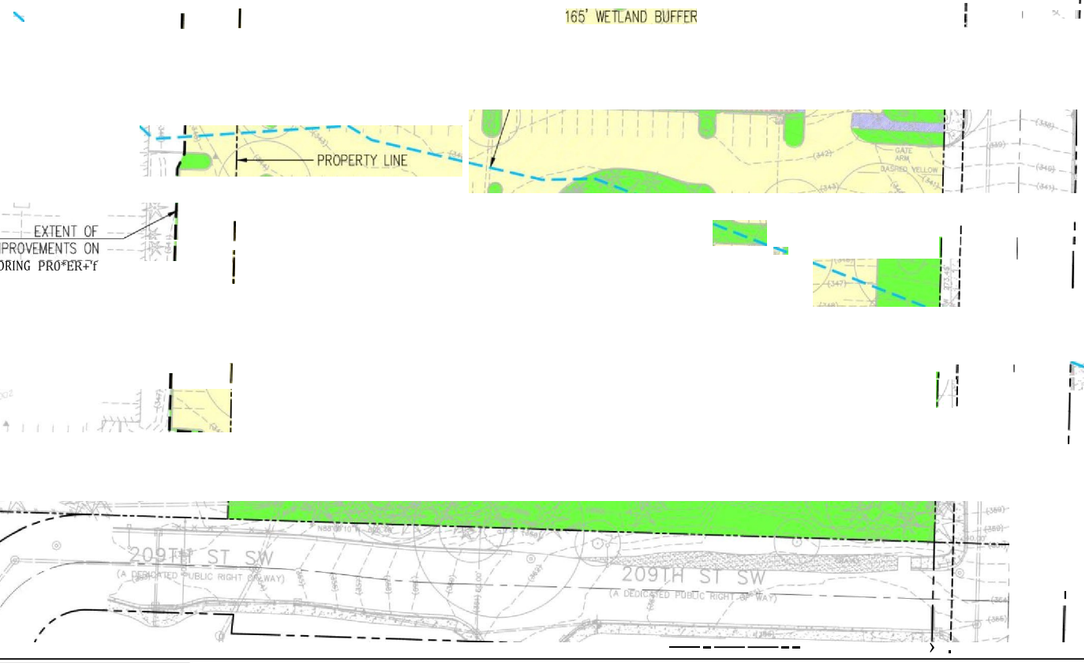
Environmentally Critical Areas - Wetlands Map



APPENDIX B –EXHIBITS

T0+4L PRE— DEVELOPED SITE AREAS	S*	DC
R00*	2,293	0.053
PA\/EMENT (°cIs)	9‹,96c	2.181
HARD SURFACE (NPGIS)	550	0,014
LAXDSCA*E/*ENVIOUS AREA	46,803	1.074
t0+AL	144,608	3520





GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)

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No.	Date	By	Revision Description

Designed By:	Issue Date:
SPL	03/30/2026
Drawn By:	PDR SET
SPL	
Checked By:	Project No:
SMM	10-760-015

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Seattle, WA 98103
t (206) 527-6510
www.PacLand.com

INLAND
POLARIS LYNNWOOD
20800 44TH AVE W, LYNNWOOD, WA

PRE-DEVELOPED AREAS

EX-1.0

TOTAL POST-DEVELOPMENT

SITE AREAS	SF	AC
R00*	63,985	1.469
PAVEMENT (EGIS)	27,933	0.642
HARD S R ACT (°clS)	9, 0	0.223
L NDSCA E/°C \I10us rrEA	42,965	0.986
T>+AL	144,b0B	3. z0



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No.	Date	By	Revision Description

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Drawn By:	PDR SET
SPL	
Checked By:	Project No:
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DEVELOPED AREAS

EX-2.0

*0T@ PPE—PEYEOPEO uETr Ns *R8U*4PY +RfA/	sF	C
ROOF	0	0.000
PAVrMErT (Psl3)	4‹,814	1 D29
HERO ScrFrCE (x GPS)	›99	c.003
LA›DSCAPE/PERVIOUS AREA	41,013	C.942
IUI AL	bb,Uzb	1.9/

WETLAND BUFFER AREA	SF	AC



GRAPHIC SCALE

1 inch = 30 ft.

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No.	Date	By	Revision Description

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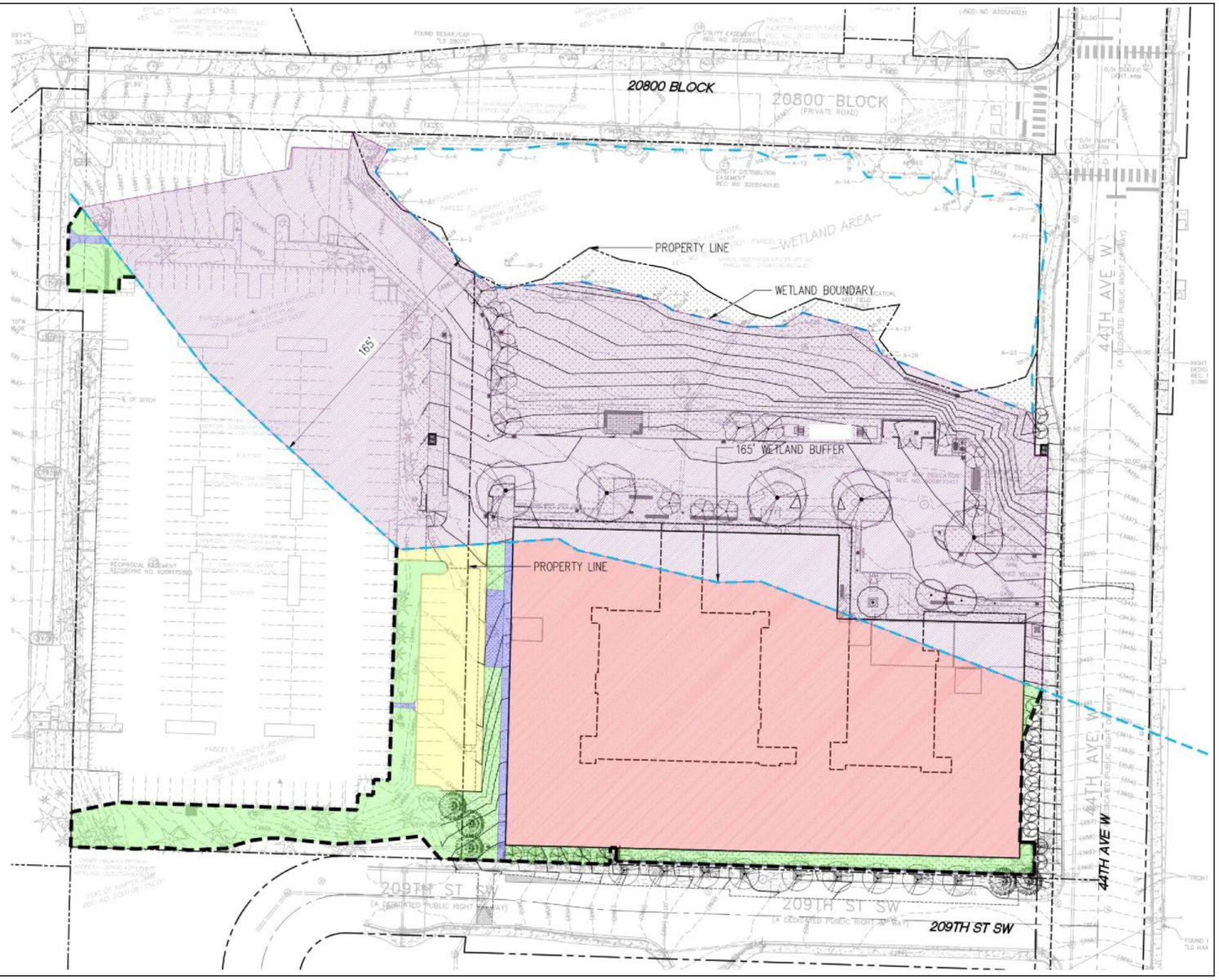
PRE-DEVELOPED WETLAND TRIBUTARY

EX-3.0

TOTAL POST— DEVELOPED \`/ETLAND 9IB|+AR+ AREAS	SF	AC
ROOF	54,57B	1.255
PA\/EMENT (PCIS)	6,B43	0.157
HAPD SURFACE (NPOIS)	2,083	0.048
L4x DSC PE/PERVIOUS Rr	6,339	0. 80
TUTAL	bU,U L	1. bjd

\\ETLAND BJ**ER AREA	SF	AC
TulAL	102,815	2.360

GRAPHIC SCALE



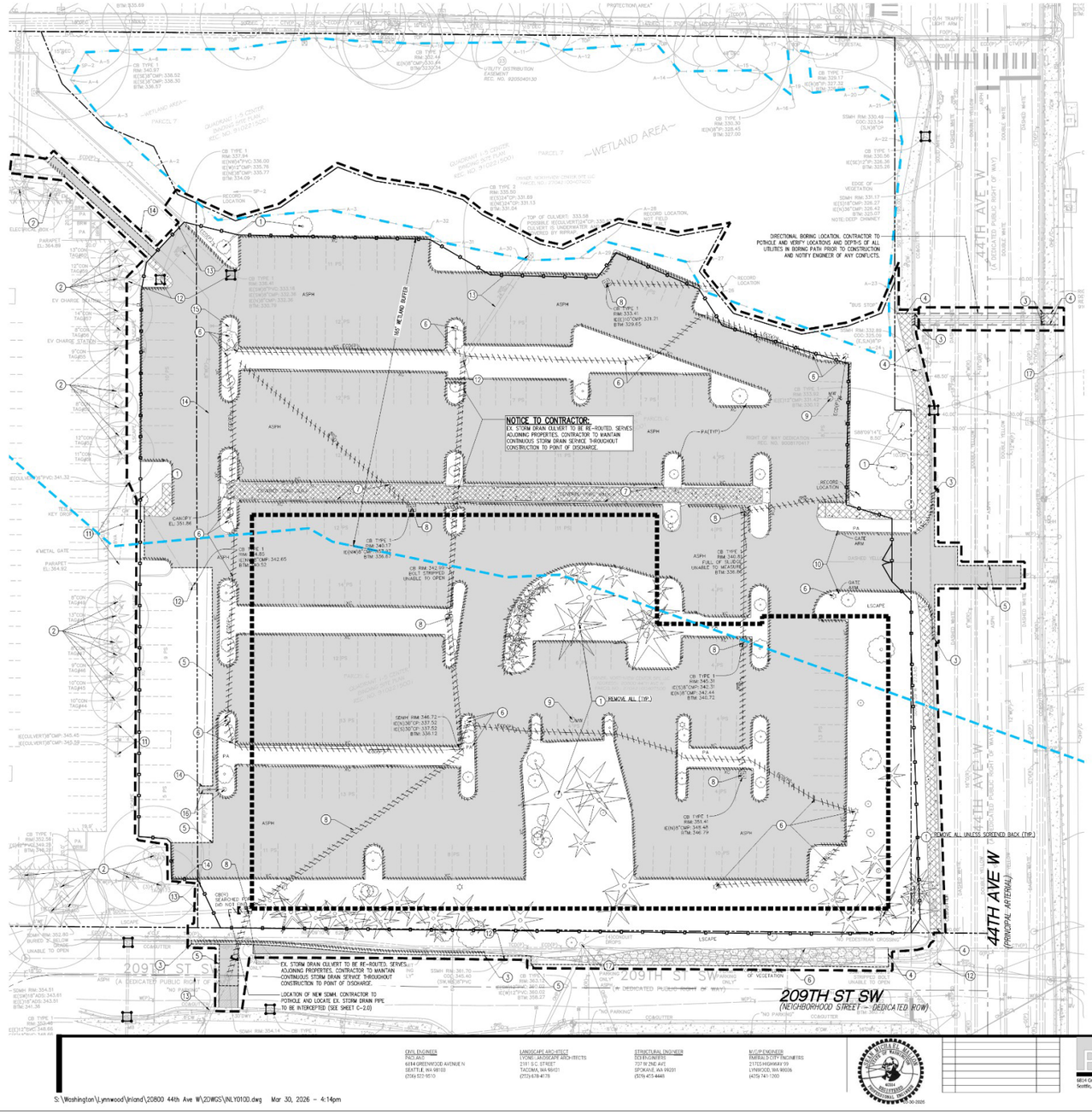
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INLAND POLARIS LYNNWOOD 20800 44TH AVE W, LYNNWOOD, WA	DEVELOPED AREAS	EX—2.0

APPENDIX C –PLANS



DEMOLITION NOTES

SEE SHEET CV-1.2 FOR DEMOLITION NOTES.

LEGEND

- REMOVE ASPHALT PAVEMENT
- REMOVE CONCRETE PAVEMENT
- REMOVE GRAVEL PAVEMENT
- PAVEMENT GRIND AND OVERLAY
- DEMOLISH AND REMOVE EXISTING STRUCTURE
- APPROXIMATE AREA OF DIRECTIONAL UTILITY BORING. SEE PLAN NOTES.
- DEMOLISH EXISTING CONCRETE CURB
- DEMOLISH EXISTING UTILITY
- 5 / D-2.0 HIGH-VISIBILITY CONSTRUCTION FENCE
- 1 / D-2.0 INLET PROTECTION
- APPROXIMATE PROJECT LIMITS (OFFSET FOR CLARITY)
- PROPOSED BUILDING FOOTPRINT
- SAWCUT EX PAVEMENT
- WETLAND BOUNDARY
- 105' WETLAND BUFFER

DEMOLITION KEY NOTES

1. REMOVE EXISTING TREE. ALL TREES WITHIN PROJECT AREA TO BE REMOVED UNLESS NOTED OTHERWISE. SEE LANDSCAPE PLANS FOR TREE REMOVAL PLAN.
2. PROTECT EXISTING TREE TO REMAIN. SEE LANDSCAPE PLANS FOR TREE PROTECTION DETAILS.
3. SAWCUT AND REMOVE EXISTING CONCRETE CURB AND GUTTER TO THE NEAREST JOINT.
4. SAWCUT AND REMOVE EXISTING CONCRETE SIDEWALK TO THE NEAREST JOINT.
5. SAWCUT AND REMOVE EXISTING ASPHALT PAVEMENT.
6. DEMOLISH EXISTING LIGHT POLE AND ASSOCIATED UNDERGROUND CONDUITS.
7. DEMOLISH EXISTING WALKWAY CANOPY.
8. DEMOLISH AND REMOVE EXISTING STORM CATCH BASIN AND ASSOCIATED PIPING (OR CUT, GROUT AND CAP STORM PIPE WHERE SHOWN ON PLAN WITH APPROVAL FROM CITY OF LYNNWOOD PUBLIC WORKS).
9. DECOMMISSION EXISTING MONITORING WELL IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF ECOLOGY, STATE, AND LOCAL REGULATIONS.
10. DEMOLISH EXISTING GATE AND GATE ARMS.
11. EXISTING STORM DRAIN CULVERT TO REMAIN AND BE PROTECTED FROM DAMAGE.
12. EXISTING SEWER/STORM DRAIN STRUCTURE TO REMAIN AND BE PROTECTED FROM DAMAGE. ADJUST TO FINISHED GRADE AS NEEDED.
13. EXISTING STORM DRAIN PIPE TO REMAIN AND BE PROTECTED FROM DAMAGE.
14. EXISTING WATER MAIN TO REMAIN AND BE PROTECTED FROM DAMAGE.
15. EXISTING HYDRANT AND APPURTENANCES TO REMAIN AND BE PROTECTED FROM DAMAGE.
16. EXISTING HYDRANT TO BE REMOVED. CONTRACTOR TO COORDINATE RELOCATION WITH PUBLIC WORKS.
17. EXISTING POWER POLE TO REMAIN PROTECTED IN PLACE.
18. IF NEEDED, IMPLEMENT COMPOST SOCKS IN THE EXISTING SWALE TO PREVENT DOWNSTREAM SEDIMENTATION. LAY COMPOST SOCKS PERPENDICULAR TO THE DIRECTION OF STORMWATER FLOW.

SITE AREA (PARCEL NO. 27042100407500)	
134,170 SF	(3.08 AC)
APPROX. AREA OF IMPROVEMENTS ON NEIGHBORING PROPERTY (PARCEL NO. 27042100407400)	
10,430 SF	(0.24 AC)
SUBTOTAL IMPACTED PROJECT AREA (PRIVATE)	
144,608 SF	(3.32 AC)
APPROX. AREA OF IMPROVEMENTS IN RIGHT-OF-WAY	
10,775 SF	(0.25 AC)
TOTAL PROJECT AREA	
155,383 SF	(3.57 AC)

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CIVIL ENGINEER: PACLAND, 6814 GREENWOOD AVENUE N, SEATTLE, WA 98103, (206) 522-9510

LANDSCAPE ARCHITECT: STONE LANDSCAPE ARCHITECTS, 2111 S.C. STREET, TACOMA, WA 98421, (972) 674-4776

STRUCTURAL ENGINEER: ECHELON ENGINEERS, 707 W 2ND AVE, SPOKANE, WA 99201, (509) 475-4440

M/E/P ENGINEER: EMERALD CITY ENGINEERS, 21705 HIGHWAY 99, LYNNWOOD, WA 98036, (425) 741-1300

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20800 44TH AVE, LYNNWOOD, WA 98036

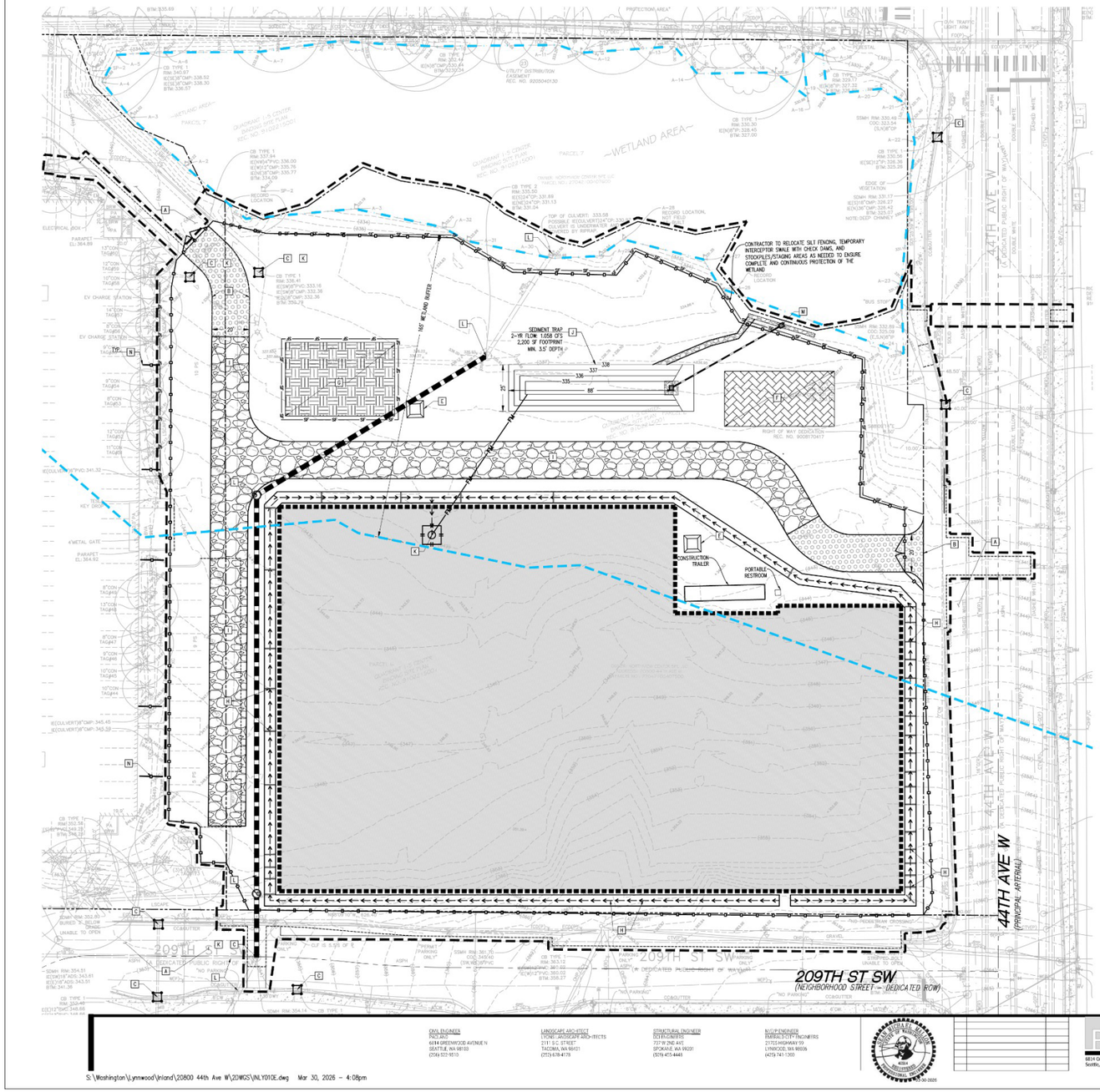
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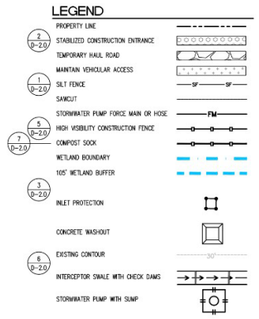
DEMOLITION PLAN

D-1.0

FOR PERMIT SET

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EROSION CONTROL KEY NOTES

A CONTRACTOR TO PROVIDE STREET SWEEPING REGULARLY DURING DEMOLITION AND EARTHWORK ACTIVITIES.
B INSTALL TEMPORARY CONSTRUCTION ENTRANCE.
C CATCH BASIN INLET PROTECTION. COORDINATE PLACEMENT AND TYPE WITH CITY INSPECTOR.
D SILT FENCE.
E CONCRETE WASHOUT (ECO-PAN OR APPROVED EQUAL).
F APPROXIMATE LOCATION OF CONTRACTOR STAGING AND CONSTRUCTION MATERIALS STORAGE AREA.
G SOIL STOCKPILE AREA. PROTECT AREA WITH PLASTIC COVERING AND HELD DOWN WITH SANDBAGS WHEN NOT IN USE
H INTERCEPTOR SWALE WITH CHECK DAMS, SHOWN SCHEMATICALLY. CONTRACTOR TO LOCATE AS NEEDED DURING CONSTRUCTION.
I INSTALL TEMPORARY ACCESS HAUL ROAD – CONTRACTOR TO FIELD LOCATE AS NEEDED (6" QUARRY SPALLS PER WSDOT STD SPEC 9-13.6, 1' DEPTH MIN). UNDERLAY QUARRY SPALLS WITH GEOTEXTILE FABRIC (MIRAFI 180N OR APPROVED EQUIVALENT).
J INSTALL SEDIMENT TRAP WITH GRAVEL CONE RISER AT OUTLET PIPE AND OVERFLOW ROUTE. SEE SEDIMENT TRAP SIZING NOTES FOR ADDITIONAL DETAILS.
K INSTALL SUMP PUMP IN 4'x4'x4' PIT FILLED WITH COBBLES. CONTRACTOR TO FIELD LOCATE AT LOW POINT AND MOV AS NECESSARY TO DEWATER CONSTRUCTION AREA AND PROTECT FOUNDATION SUBGRADE DURING EXCAVATION AND GRADING OPERATIONS. CONVEY STORMWATER VIA PIPE OR HOSE TO SEDIMENT TRAP.
L CONTRACTOR TO MAINTAIN STORMWATER SERVICE TO ADJACENT PROPERTIES. RE-ROUTE DRAINAGE PER APPROVED DRAINAGE PLANS (SEE GRADING AND DRAINAGE PLANS AND DEMOLITION PLANS).
M PIPE DRAINAGE DOWNSTREAM OF SEDIMENT TRAP TO LEVEL SPREADER. SEE GRADING AND DRAINAGE PLANS FOR DETAILS.
N INSTALL COMPOST SOCKS AS NEEDED TO PREVENT SEDIMENTATION THROUGH THE EXISTING SWALE. COMPOST SOCKS ARE TO BE LAID PERPENDICULAR TO THE FLOW OF STORMWATER.

EROSION CONTROL NOTES

SEE SHEET CV-1.1 AND CV-1.2 FOR EROSION CONTROL NOTES.

CONSTRUCTION SEQUENCE

1. PRE-CONSTRUCTION MEETING.
2. FLAG OR FENCE CLEARING LIMITS AND INSTALL TEMPORARY TREE PROTECTION FENCING.
3. POST NOTICE OF CONSTRUCTION ACTIVITY SIGN WITH NAME AND PHONE NUMBER OF ESC SUPERVISOR.
4. INSTALL INLET PROTECTION FOR CATCH BASINS, IF REQUIRED.
5. INSTALL CONSTRUCTION ENTRANCE AND EXIT.
6. INSTALL PERIMETER PROTECTION (SILT FENCE, BRUSH BARRIER, ETC.).
7. GRADE AND STABILIZE CONSTRUCTION ROADS.
8. CONSTRUCT SURFACE WATER CONTROLS (INTERCEPTOR DIKES, PIPE SLOPE DRAINS, ETC.) SIMULTANEOUSLY WITH CLEARING AND GRADING FOR PROJECT DEVELOPMENT.
9. MAINTAIN EROSION CONTROL MEASURES IN ACCORDANCE WITH THE LOCAL JURISDICTION STANDARDS AND MANUFACTURER'S RECOMMENDATIONS.
10. RELOCATE SURFACE WATER CONTROLS AND EROSION CONTROL MEASURES OR INSTALL NEW MEASURES SO THAT AS SITE CONDITIONS CHANGE THE EROSION AND SEDIMENT CONTROL IS ALWAYS IN ACCORDANCE WITH THE LOCAL JURISDICTION EROSION AND SEDIMENT CONTROL STANDARDS.
11. COVER ALL AREAS THAT WILL BE UNWORKED FOR MORE THAN SEVEN DAYS DURING THE DRY SEASON OR TWO DAYS DURING THE WET SEASON WITH STRAW, WOOD FIBER MULCH, COMPOST, PLASTIC SHEETING OR EQUIVALENT.
12. STABILIZE ALL AREAS THAT REACH FINAL GRADE WITHIN SEVEN DAYS.
13. SEED OR SOD ANY AREAS TO REMAIN UNWORKED FOR MORE THAN 30 DAYS.
14. UPON COMPLETION OF THE PROJECT, ALL DISTURBED AREAS MUST BE STABILIZED AND BEST MANAGEMENT PRACTICES REMOVED IF APPROPRIATE.

SEEDING NOTE:

TEMPORARY SEEDING – WITHIN 14 DAYS AFTER CONSTRUCTION ACTIVITY CEASES ON ANY PARTICULAR AREA, ALL DISTURBED GROUND WHERE THERE WILL NOT BE CONSTRUCTION FOR LONGER THAN 21 DAYS MUST BE SEEDED WITH FAST-GERMINATING TEMPORARY SEED AND PROTECTED WITH MULCH.

PERMANENT SEEDING – ALL AREAS AT FINAL GRADE MUST BE SEEDED WITHIN 14 DAYS AFTER COMPLETION OF THE MAJOR CONSTRUCTION ACTIVITY.

SCALE: 1" = 20'
0 10 20 40

SITE AREA	
134,170 SF	(3.08 AC)
TOTAL PROJECT AREA	
415,355 SF	(3.566 AC)

CONSTRUCTION STORMWATER SEDIMENT TRAP/POND SIZING:
PER THE 2019 DOE SWMMWW THE 2-YEAR DESIGN EVENT (PEAK FLOW) HAS BEEN EVALUATED FOR BMP SIZING. CONTINUOUS FLOW MODELING USING THE WESTERN WASHINGTON HYDROLOGY MODEL (WWHM) HAS BEEN UTILIZED TO DETERMINE PEAK FLOWS.

BASED ON THE FULLY DEVELOPED CONDITIONS, THE 2-YEAR PEAK FLOW RATE IS 1.058 CFS.

FOR A TEMPORARY SEDIMENT TRAP OR POND, THE MINIMUM REQUIRED SURFACEA REA IS 2,080 X Q.

2,080 X 1.058 = 2,201 SF

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LYONS LANDSCAPE ARCHITECTS
2111 S.C. STREET
TACOMA, WA 98421
(253) 678-4778

STRUCTURAL ENGINEER
DCW ENGINEERS
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SPOKANE, WA 99201
(509) 475-4445

M/E/P ENGINEER
EMERALD CITY ENGINEERS
21705 HIGHWAY 99
LYNNWOOD, WA 98036
(425) 741-1300

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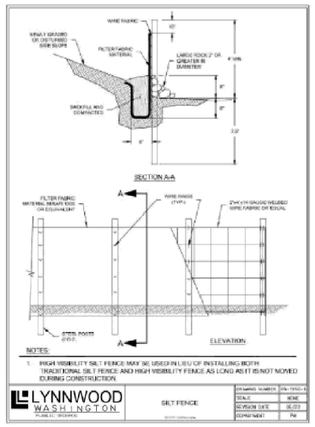
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20800 44TH AVE, LYNNWOOD, WA 98036

PROJ. # 10760.015
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DATE 03/30/26

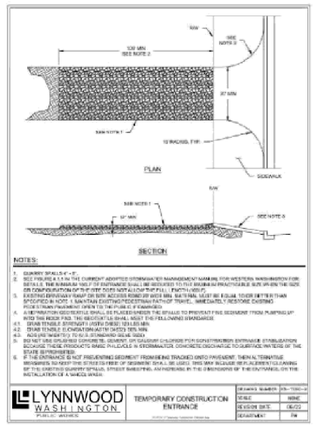
TEMPORARY EROSION CONTROL PLAN

D-1.1

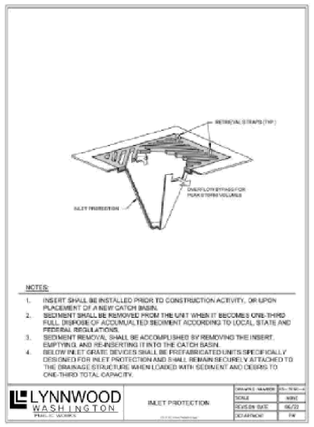
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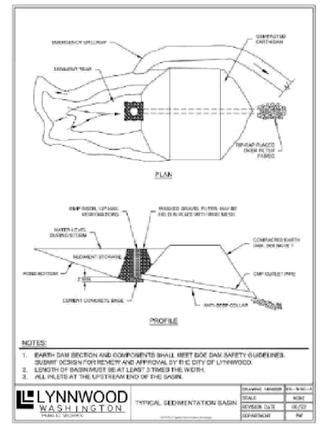
1 SILT FENCE
NTS



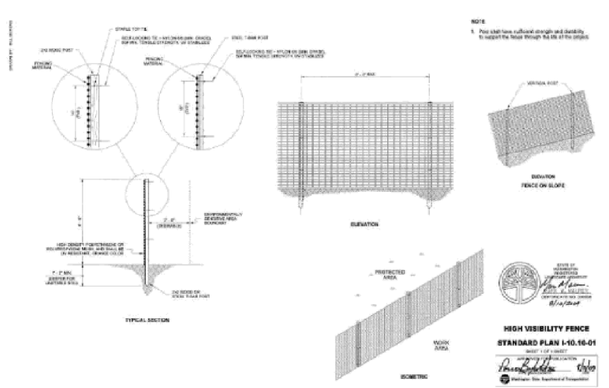
2 TEMPORARY CONSTRUCTION ENTRANCE
NTS



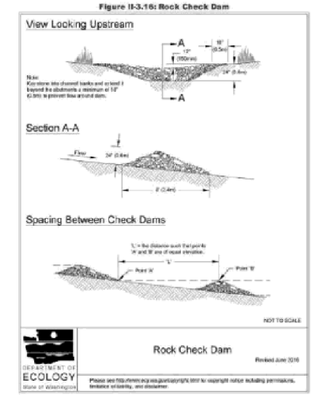
3 CATCH BASIN / IFJLET SEDIMEFJT TRAP
NTS



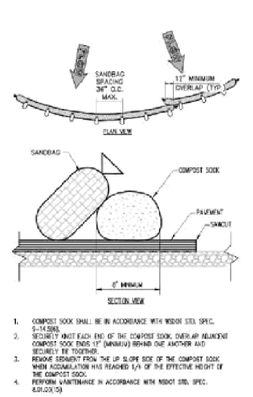
4 PPICfiL SEDil4ENIAJJON BASIN
NTS



5 HIGH VISIBILITY FENCE
NTS



6 CHECK DAMS OX CHANNELS
NTS



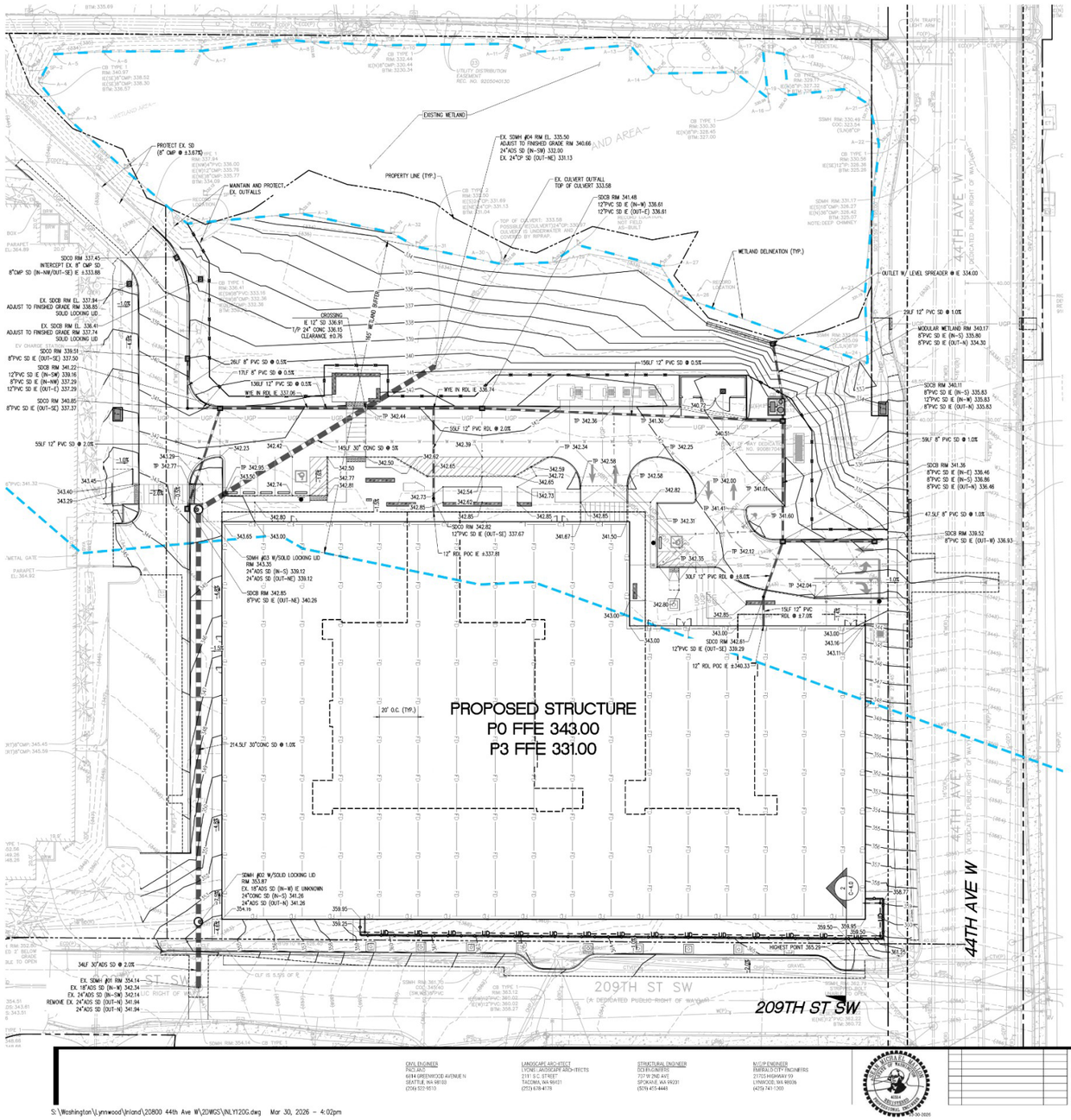
7 COMPOST SOCK
NTS

811 Know what's below. Call before you dig.

POLARIS at LYNNWOOD

D-2.0

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GRADING NOTES

SEE SHEET CV-1.1 AND CV-1.2 FOR GRADING NOTES.

STORM DRAINAGE NOTES

SEE SHEET CV-1.1 AND CV-1.2 FOR STORM DRAINAGE NOTES.

LEGEND

- EXISTING CONTOUR
- PROPOSED CONTOUR
- SPOT ELEVATION (TP UNLESS OTHERWISE NOTED)
- SOLID PVC STORM DRAIN PIPE (SIZE PER PLAN)
- STORM DRAIN CLEANOUT
- WSDOT TYPE 1 CB
- LEVEL FLOW SPREADER
- CONTECH MODULAR WETLAND (4 X 8)
- STORM DRAIN MANHOLE (TYPE 2 CB)
- RETAINING WALL
- INTERIOR PERIMETER FOOTING DRAIN/UNDERSLAB DRAIN
- FRENCH/CURTAIN DRAIN
- WETLAND DELINEATION
- WETLAND BUFFER

STORMWATER CULVERT PROFILE TO BE PROVIDED FOR REVIEW UNDER DEVELOPMENT ENGINEERING PERMIT.

CIVIL ENGINEER
PACLAND
6814 GREENWOOD AVENUE N
SEATTLE, WA 98103
(206) 522-9510

LANDSCAPE ARCHITECT
LYDIG LANDSCAPE ARCHITECTS
2111 S.C. STREET
TACOMA, WA 98431
(253) 678-4178

STRUCTURAL ENGINEER
DCI ENGINEERS
727 W 2ND AVE
SPOKANE, WA 99201
(509) 473-4440

M/E/P ENGINEER
EMERALD CITY ENGINEERS
21705 HIGHWAY 99
LYNNWOOD, WA 98036
(425) 741-1300

PACLAND
6814 Greenwood Ave. N.
Seattle, WA 98103
T (206) 522-9510
www.PacLand.com

POLARIS at LYNNWOOD
20830 44TH AVE, LYNNWOOD, WA 98036

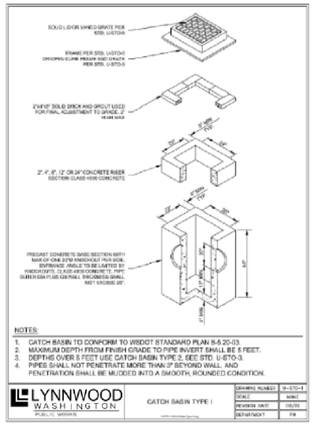
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CHECKED: SMM
DATE: 03/30/26

FOR PERMIT SET

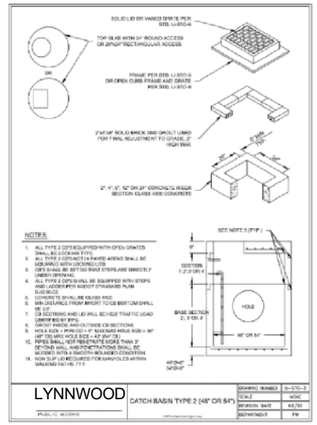
GRADING & DRAINAGE PLAN

C-2.0

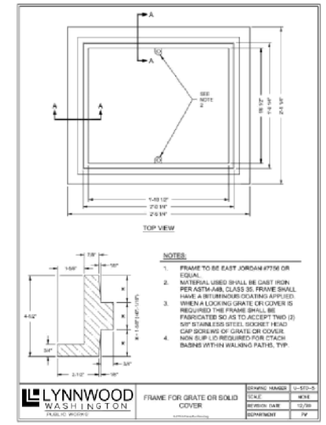
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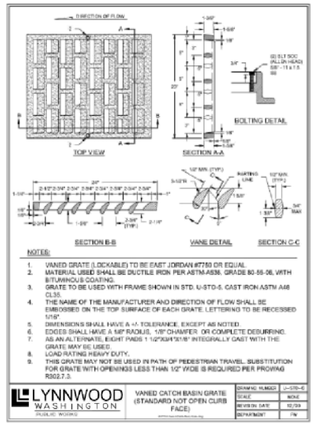
1 CATCH BASIN TYPE \
NTS



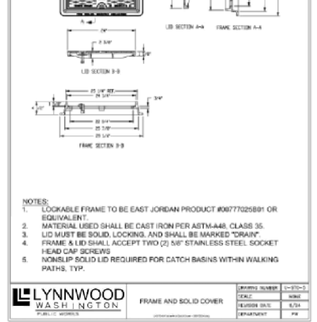
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NTS



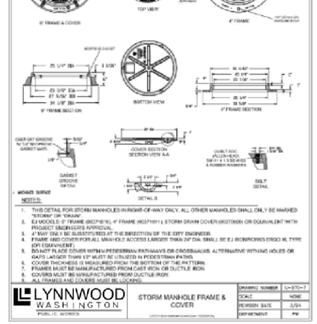
3 FRAME *0R GR/TE 0R SOLID COVER
NTS



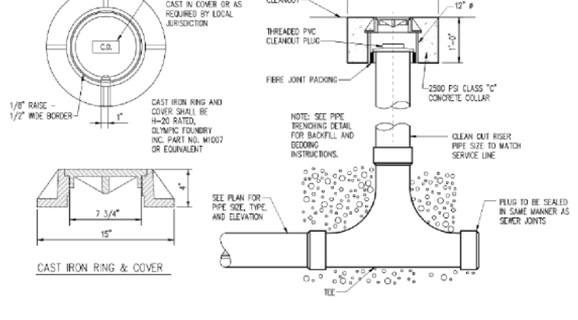
4 VARIED CATCH BASIN WRITE
NTS



5 reAME Ax0 souD coma
NTS



6 STORM MANHOLE FRAME & COVER
NTS



7 STORM DRAIN CLEANOLT
NTS

FOR PERMIT SET

CIVIL ENGINEER
TACE ASE
604 EDMONDS AVENUE N
SEATTLE, WA 98102
(206) 523-9572

LANDSCAPE ARCHITECT
SYDNEY LANDSCAPE ARCHITECTS
2511 D.C. STREET
TACOMA, WA 98421
(253) 428-8736

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DCI ENGINEERS
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(509) 475-4646

M/E/P ENGINEER
ENERGY SAVE TECHNOLOGIES
21715 HIGHWAY 99
LYNNWOOD, WA 98036
(425) 741-1360

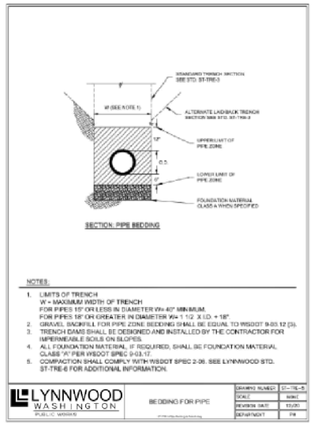
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6824 Oakwood Ave. N.
Seattle, WA 98103
T 425.298.5221
www.PacLand.com

POLARIS at LYNNWOOD
20800 44TH AVE, LYNNWOOD WA 98036

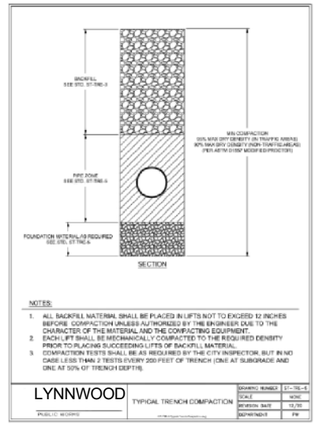
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CHECKED RM
DATE 03/30/26

STORM DRAINAGE DETAILS
C-6.0

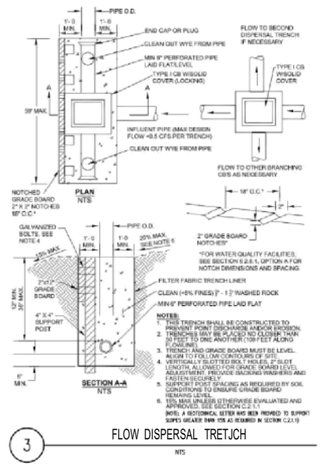
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1 BEDDING FOR PIPE
NTS



2 TYPICAL TRENCH COMPACTION
NTS



3 FLOW DISPERSAL TRETJCH
NTS

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PACLAND
6544 GREENWOOD AVENUE N
SEATTLE, WA 98103
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LANDSCAPE ARCHITECT
SYDNEY ERICKSON ARCHITECTS
2101 S.C. STREET
TACOMA, WA 98405
(253) 838-8139

STRUCTURAL ENGINEER
DCI ENGINEERS
737 W 2ND AVE
SPOKANE, WA 99201
(509) 455-8648

MEP ENGINEER
INTERFACE ENGINEERING
21725 MEADOWAY 20
LYNNWOOD, WA 98036
(425) 641-1960

PACLAND
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Seattle, WA 98103 www.Pacland.com

POLARIS at LYNNWOOD
20000 44TH AVE, LYNNWOOD WA 98036

PROJ. # 10760.018
DRAWN BY SJ
CHECKED BY RM
DATE 03/30/25

FOR PERMIT SET

STORM DRAINAGE DETAILS

C-6.1

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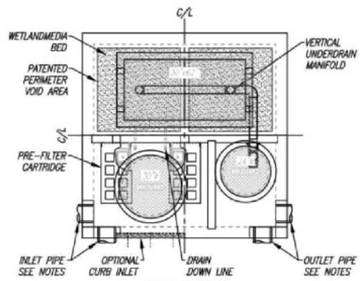
SITE SPECIFIC DATA

PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
TREATMENT FLOW (CFS)			0.202
PRETREATMENT LOADING RATE (GPM/SF)			2.1 GPM/S
WETLAND MEDIA LOADING RATE (GPM/SF)			1.0
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			2.96(CFS
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	335.80		
INLET PIPE 2			
OUTLET PIPE	334.30		
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION	340.17		
SURFACE LOAD	PEDESTRIAN		
NOTES:			

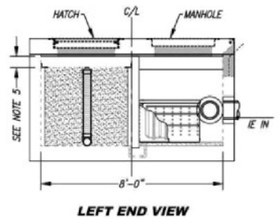
* PRELIMINARY ONLY - NOT FOR CONSTRUCTION

INSTALLATION NOTES

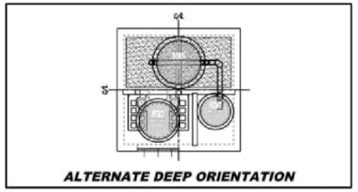
1. LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURER'S SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURER'S CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 8" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE FOR VERIFYING PROJECT ENGINEER'S RECOMMENDED BASE SPECIFICATIONS.
3. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATERTIGHT PER MANUFACTURER'S STANDARD CONNECTION DETAIL.
4. CONTRACTOR RESPONSIBLE FOR CONTACTING CONTECH FOR ACTIVATION OF UNIT. MANUFACTURER'S WARRANTY IS VOID WITHOUT PROPER ACTIVATION BY A CONTECH REPRESENTATIVE.
5. ALTERNATE DEEP FRAME & COVER ORIENTATION USED WHEN CEILING TO MEDIA DISTANCE IS 2.5' OR GREATER.
6. VERTICAL HEIGHT VARIES BASED ON SITE SPECIFIC REQUIREMENTS.



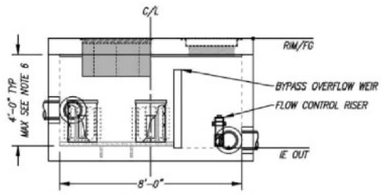
PLAN VIEW



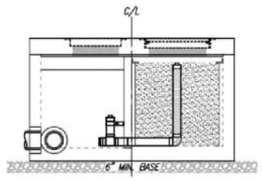
LEFT END VIEW



ALTERNATE DEEP ORIENTATION



ELEVATION VIEW



RIGHT END VIEW

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MODULAR WETLANDS — FOR PATENT INFORMATION, GO TO www.contechES.com/IP

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MWS-L-8-8- V-UG
STOPMWATER BIoFIt TRATION SYSTEM
STANDARD DETAIL

1 MODULAR WETLAND MWS-L-8-8-V-UG
NTS

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STORM DRAINAGE DETAILS
C-6.2

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APPENDIX D –CALCULATIONS

PEAK FLOW CALCULATIONS

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: POLARIS LYNNWOOD PEAK

Site Name:	Polaris Lynnwood
Site Address:	20800 44th Ave W
City:	Lynnwood
Report Date:	3/18/2026
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2024/10/15
Version:	4.3.1

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Flat	1.074
Pervious Total	1.074

Impervious Land Use	acre
ROADS FLAT	2.181
ROOF TOPS FLAT	0.053
SIDEWALKS FLAT	0.014
Impervious Total	2.248
Basin Total	3.322

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Mitigated Land Use

Developed Site

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Flat	0.986
Pervious Total	0.986

Impervious Land Use	acre
ROADS FLAT	0.642
ROOF TOPS FLAT	1.469
SIDEWALKS FLAT	0.223
Impervious Total	2.334
Basin Total	3.32

Element Flow Componants:

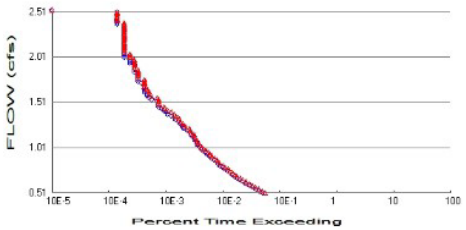
Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

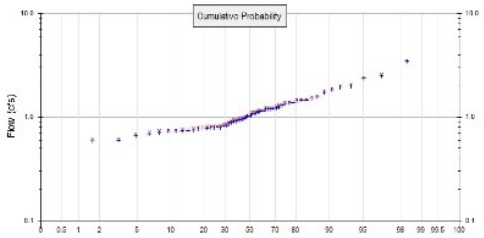
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.074
Total Impervious Area: 2.248

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.986
Total Impervious Area: 2.334

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	1.027603
5 year	1.433152
10 year	1.736733
25 year	2.162208
50 year	2.510912
100 year	2.887976

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	1.058192
5 year	1.470649
10 year	1.778569
25 year	2.209185
50 year	2.561426
100 year	2.941735

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	1.131	1.155
1950	1.300	1.330
1951	1.117	1.160
1952	0.935	0.966
1953	1.254	1.292
1954	1.734	1.767
1955	1.210	1.237
1956	0.531	0.548
1957	1.024	1.043
1958	2.511	2.565

1959	0.912	0.944
1960	0.955	0.978
1961	3.477	3.530
1962	1.090	1.132
1963	1.452	1.481
1964	0.729	0.750
1965	0.780	0.810
1966	0.795	0.824
1967	1.929	2.001
1968	1.081	1.115
1969	2.361	2.398
1970	0.791	0.817
1971	1.197	1.227
1972	1.557	1.593
1973	1.231	1.265
1974	1.511	1.553
1975	1.199	1.229
1976	0.791	0.816
1977	0.773	0.800
1978	0.590	0.609
1979	1.457	1.489
1980	0.736	0.763
1981	0.790	0.816
1982	0.766	0.795
1983	1.138	1.166
1984	0.977	1.010
1985	1.370	1.421
1986	1.440	1.470
1987	1.191	1.227
1988	0.934	0.964
1989	1.043	1.068
1990	0.738	0.762
1991	0.916	0.951
1992	0.963	0.989
1993	0.730	0.753
1994	0.751	0.779
1995	0.707	0.734
1996	1.020	1.058
1997	1.358	1.376
1998	1.362	1.397
1999	0.596	0.615
2000	1.990	2.056
2001	0.690	0.716
2002	0.660	0.685
2003	0.888	0.922
2004	1.831	1.884
2005	0.829	0.857
2006	1.142	1.163
2007	1.086	1.110
2008	0.822	0.844
2009	0.856	0.883

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	3.4772	3.5301
2	2.5114	2.5649
3	2.3615	2.3979

4	1.9899	2.0563
5	1.9295	2.0013
6	1.8307	1.8837
7	1.7337	1.7672
8	1.5569	1.5926
9	1.5105	1.5525
10	1.4571	1.4886
11	1.4523	1.4809
12	1.4396	1.4704
13	1.3703	1.4209
14	1.3621	1.3970
15	1.3578	1.3762
16	1.2999	1.3303
17	1.2537	1.2922
18	1.2313	1.2650
19	1.2100	1.2368
20	1.1990	1.2289
21	1.1972	1.2274
22	1.1913	1.2270
23	1.1419	1.1655
24	1.1376	1.1631
25	1.1306	1.1597
26	1.1170	1.1554
27	1.0902	1.1317
28	1.0856	1.1150
29	1.0812	1.1103
30	1.0430	1.0684
31	1.0236	1.0580
32	1.0200	1.0428
33	0.9770	1.0100
34	0.9627	0.9892
35	0.9554	0.9783
36	0.9349	0.9660
37	0.9335	0.9641
38	0.9162	0.9512
39	0.9120	0.9443
40	0.8880	0.9219
41	0.8563	0.8829
42	0.8295	0.8567
43	0.8221	0.8444
44	0.7950	0.8244
45	0.7913	0.8169
46	0.7907	0.8159
47	0.7897	0.8156
48	0.7801	0.8099
49	0.7730	0.8004
50	0.7660	0.7949
51	0.7508	0.7795
52	0.7384	0.7635
53	0.7358	0.7622
54	0.7298	0.7527
55	0.7293	0.7499
56	0.7069	0.7337
57	0.6898	0.7160
58	0.6602	0.6854
59	0.5959	0.6147
60	0.5901	0.6089
61	0.5312	0.5483

Duration Flows

The Duration Matching Failed

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.5138	1063	1192	112	Fail
0.5340	938	1042	111	Fail
0.5541	813	910	111	Fail
0.5743	719	799	111	Fail
0.5945	631	712	112	Fail
0.6147	548	630	114	Fail
0.6348	486	548	112	Fail
0.6550	428	483	112	Fail
0.6752	377	435	115	Fail
0.6954	348	382	109	Fail
0.7155	309	348	112	Fail
0.7357	288	313	108	Fail
0.7559	259	288	111	Fail
0.7760	230	263	114	Fail
0.7962	208	235	112	Fail
0.8164	188	217	115	Fail
0.8366	176	191	108	Fail
0.8567	168	178	105	Fail
0.8769	150	168	112	Fail
0.8971	136	154	113	Fail
0.9173	124	140	112	Fail
0.9374	114	130	114	Fail
0.9576	106	119	112	Fail
0.9778	96	110	114	Fail
0.9979	90	100	111	Fail
1.0181	83	90	108	Fail
1.0383	79	85	107	Pass
1.0585	76	79	103	Pass
1.0786	75	77	102	Pass
1.0988	69	75	108	Pass
1.1190	67	70	104	Pass
1.1392	62	68	109	Pass
1.1593	59	67	113	Fail
1.1795	57	60	105	Pass
1.1997	51	57	111	Fail
1.2199	44	56	127	Fail
1.2400	42	48	114	Fail
1.2602	41	44	107	Pass
1.2804	38	42	110	Pass
1.3005	36	39	108	Pass
1.3207	32	37	115	Fail
1.3409	32	36	112	Fail
1.3611	27	32	118	Fail
1.3812	23	30	130	Fail
1.4014	22	27	122	Fail
1.4216	20	23	115	Fail
1.4418	18	21	116	Fail
1.4619	16	20	125	Fail
1.4821	16	17	106	Pass
1.5023	16	16	100	Pass
1.5224	15	16	106	Pass
1.5426	12	16	133	Fail
1.5628	11	15	136	Fail
1.5830	10	12	120	Fail

1.6031	10	11	110	Pass
1.6233	9	11	122	Fail
1.6435	9	10	111	Fail
1.6637	9	10	111	Fail
1.6838	9	9	100	Pass
1.7040	9	9	100	Pass
1.7242	8	9	112	Fail
1.7443	7	9	128	Fail
1.7645	7	9	128	Fail
1.7847	7	7	100	Pass
1.8049	7	7	100	Pass
1.8250	7	7	100	Pass
1.8452	6	7	116	Fail
1.8654	6	7	116	Fail
1.8856	6	6	100	Pass
1.9057	6	6	100	Pass
1.9259	6	6	100	Pass
1.9461	5	6	120	Fail
1.9662	5	6	120	Fail
1.9864	5	6	120	Fail
2.0066	4	5	125	Fail
2.0268	4	5	125	Fail
2.0469	4	5	125	Fail
2.0671	4	4	100	Pass
2.0873	4	4	100	Pass
2.1075	4	4	100	Pass
2.1276	4	4	100	Pass
2.1478	4	4	100	Pass
2.1680	4	4	100	Pass
2.1881	4	4	100	Pass
2.2083	4	4	100	Pass
2.2285	4	4	100	Pass
2.2487	4	4	100	Pass
2.2688	4	4	100	Pass
2.2890	4	4	100	Pass
2.3092	4	4	100	Pass
2.3294	4	4	100	Pass
2.3495	4	4	100	Pass
2.3697	3	4	133	Fail
2.3899	3	4	133	Fail
2.4100	3	3	100	Pass
2.4302	3	3	100	Pass
2.4504	3	3	100	Pass
2.4706	3	3	100	Pass
2.4907	3	3	100	Pass
2.5109	3	3	100	Pass

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.257 acre-feet
On-line facility target flow:	0.3566 cfs.
Adjusted for 15 min:	0.3566 cfs.
Off-line facility target flow:	0.2017 cfs.
Adjusted for 15 min:	0.2017 cfs.

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



POLARIS LYNNWOOD PEAK 3/18/2026 12:46:38 PM Page 15

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM         26   POLARIS LYNNWOOD PEAK.wdm
MESSU       25   PrePOLARIS LYNNWOOD PEAK.MES
            27   PrePOLARIS LYNNWOOD PEAK.L61
            28   PrePOLARIS LYNNWOOD PEAK.L62
            30   POCPOLARIS LYNNWOOD PEAK1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND       1
      IMPLND       4
      IMPLND       8
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   16     C, Lawn, Flat           1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   16         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
```

```
  16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
  16         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2          ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  16             0       4.5      0.03       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  16               0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  16           0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS       IFWS       LZS       AGWS      GWVS
  16             0         0         0          0       2.5          1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                 in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    4    1    9
    4         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1
```

```
  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  16                       1.074     COPY   501     12
PERLND  16                       1.074     COPY   501     13
IMPLND   1                       2.181     COPY   501     15
IMPLND   4                       0.053     COPY   501     15
IMPLND   8                       0.014     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
```

```
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM         26   POLARIS LYNNWOOD PEAK.wdm
MESSU       25   MitPOLARIS LYNNWOOD PEAK.MES
            27   MitPOLARIS LYNNWOOD PEAK.L61
            28   MitPOLARIS LYNNWOOD PEAK.L62
            30   POCPOLARIS LYNNWOOD PEAK1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND       1
      IMPLND       4
      IMPLND       8
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Developed Site              MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   16     C, Lawn, Flat           1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   16         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
```

```
  16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
  16         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2          ***
    # -  # ***FOREST      LZSN     INFILT      LSUR     SLSUR     KVARY     AGWRC
  16             0       4.5      0.03       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  16               0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  16           0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS       IFWS       LZS       AGWS      GWVS
  16             0         0         0          0       2.5          1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                 in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    4         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    4    1    9
    4         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    4         0    0    0    0    0
    8         0    0    0    0    0
  END IWAT-PARM1
```

```
  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    4              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Developed Site***
PERLND  16                      0.986     COPY   501     12
PERLND  16                      0.986     COPY   501     13
IMPLND   1                      0.642     COPY   501     15
IMPLND   4                      1.469     COPY   501     15
IMPLND   8                      0.223     COPY   501     15

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
```

```
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
             FG FG FG FG  possible  exit  *** possible  exit      possible  exit
              *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #    #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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WETLAND HYDROPERIOD CALCULATIONS

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: POLARIS-PRELIM-SIMP

Site Name:	Polaris Lynnwood
Site Address:	20800 44th Ave W
City:	Lynnwood
Report Date:	3/30/2026
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2024/10/15
Version:	4.3.1

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

EX. PGIS

Bypass:	No
Impervious Land Use	acre
DRIVEWAYS FLAT	1.029

Element Flow Componant:
Surface
Componant Flows To:
WETLAND BUFFER

EX. NPGIS

Bypass:	No
Impervious Land Use	acre
SIDEWALKS FLAT	0.005

Element Flow Componant:
Surface
Componant Flows To:
WETLAND BUFFER

EX. LANDSCAPE

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	.942

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
WETLAND BUFFER	WETLAND BUFFER	WETLAND BUFFER

WETLAND BUFFER

Bypass:	No	
GroundWater:	No	
Pervious Land Use	acre	
C, Lawn, Mod	2.36	
Element Flow Componants:		
Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	POC 1

Mitigated Land Use

PROPOSED ROOF

Bypass:	No
Impervious Land Use	acre
ROOF TOPS FLAT	1.253
Element Flow Componant:	
Surface	
Componant Flows To:	
WETLAND BUFFER	

PROPOSED PGIS

Bypass:	No
Impervious Land Use	acre
DRIVEWAYS FLAT	0.157

Element Flow Componant:
Surface
Componant Flows To:
WETLAND BUFFER

PROPOSED NPGIS

Bypass:	No
Impervious Land Use	acre
SIDEWALKS FLAT	0.048

Element Flow Componant:
Surface
Componant Flows To:
WETLAND BUFFER

PROPOSED LANDSCAPE

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	.38

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
WETLAND BUFFER	WETLAND BUFFER	WETLAND BUFFER

WETLAND BUFFER

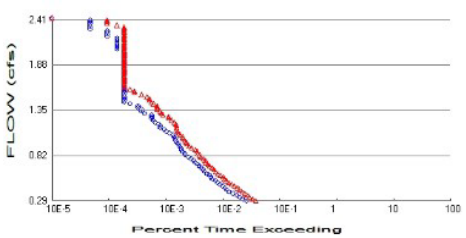
Bypass:	No	
GroundWater:	No	
Pervious Land Use	acre	
C, Lawn, Mod	2.36	
Element Flow Componants:		
Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	POC 1

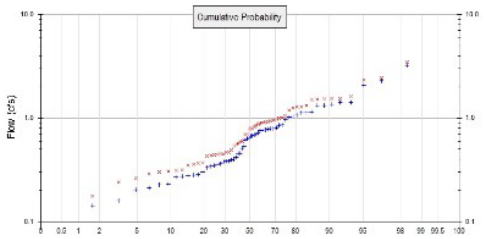
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 3.302
Total Impervious Area: 1.034

Mitigated Landuse Totals for POC #1
Total Pervious Area: 2.74
Total Impervious Area: 1.458

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.570523
5 year	1.02991
10 year	1.402459
25 year	1.949324
50 year	2.411331
100 year	2.919748

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.691673
5 year	1.196055
10 year	1.592503
25 year	2.161046
50 year	2.632158
100 year	3.143052

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.759	0.824
1950	1.134	1.316
1951	0.336	0.373
1952	0.611	0.704
1953	0.699	0.871
1954	1.423	1.603
1955	1.020	1.195
1956	0.278	0.304
1957	0.854	0.947
1958	2.067	2.335

1959	0.420	0.552
1960	0.632	0.700
1961	3.238	3.461
1962	0.684	0.796
1963	1.361	1.535
1964	0.402	0.442
1965	0.143	0.176
1966	0.228	0.263
1967	0.452	0.574
1968	0.673	0.892
1969	2.282	2.432
1970	0.361	0.469
1971	0.797	0.918
1972	1.326	1.522
1973	0.669	0.782
1974	1.062	1.292
1975	0.795	0.921
1976	0.376	0.489
1977	0.204	0.289
1978	0.230	0.303
1979	1.315	1.508
1980	0.395	0.430
1981	0.385	0.467
1982	0.348	0.440
1983	0.757	0.852
1984	0.510	0.583
1985	0.806	0.934
1986	1.134	1.275
1987	0.782	0.977
1988	0.351	0.452
1989	0.765	0.905
1990	0.287	0.357
1991	0.303	0.438
1992	0.535	0.600
1993	0.344	0.446
1994	0.279	0.350
1995	0.269	0.311
1996	0.768	0.901
1997	1.411	1.535
1998	1.044	1.250
1999	0.273	0.370
2000	0.719	0.992
2001	0.115	0.171
2002	0.159	0.240
2003	0.212	0.313
2004	1.140	1.530
2005	0.384	0.538
2006	0.967	1.056
2007	0.858	1.001
2008	0.639	0.787
2009	0.455	0.614

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	3.2375	3.4609
2	2.2824	2.4320
3	2.0668	2.3355

4	1.4234	1.6035
5	1.4112	1.5355
6	1.3606	1.5353
7	1.3259	1.5296
8	1.3149	1.5219
9	1.1397	1.5083
10	1.1341	1.3159
11	1.1337	1.2918
12	1.0623	1.2748
13	1.0444	1.2502
14	1.0196	1.1948
15	0.9668	1.0555
16	0.8582	1.0013
17	0.8544	0.9923
18	0.8064	0.9774
19	0.7969	0.9469
20	0.7950	0.9339
21	0.7823	0.9208
22	0.7678	0.9178
23	0.7654	0.9052
24	0.7587	0.9012
25	0.7566	0.8921
26	0.7189	0.8712
27	0.6995	0.8517
28	0.6844	0.8239
29	0.6725	0.7962
30	0.6694	0.7867
31	0.6389	0.7819
32	0.6320	0.7040
33	0.6110	0.6996
34	0.5346	0.6137
35	0.5098	0.6001
36	0.4547	0.5835
37	0.4525	0.5739
38	0.4198	0.5518
39	0.4017	0.5385
40	0.3947	0.4888
41	0.3854	0.4690
42	0.3837	0.4669
43	0.3761	0.4517
44	0.3614	0.4462
45	0.3510	0.4417
46	0.3484	0.4403
47	0.3439	0.4383
48	0.3356	0.4302
49	0.3030	0.3735
50	0.2867	0.3701
51	0.2795	0.3575
52	0.2778	0.3495
53	0.2725	0.3129
54	0.2691	0.3106
55	0.2300	0.3042
56	0.2279	0.3028
57	0.2117	0.2895
58	0.2042	0.2634
59	0.1586	0.2396
60	0.1426	0.1760
61	0.1147	0.1712

Duration Flows

The Duration Matching Failed

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.2853	559	814	145	Fail
0.3067	478	719	150	Fail
0.3282	421	632	150	Fail
0.3497	377	572	151	Fail
0.3712	323	521	161	Fail
0.3926	277	466	168	Fail
0.4141	255	421	165	Fail
0.4356	236	383	162	Fail
0.4571	212	342	161	Fail
0.4785	193	304	157	Fail
0.5000	174	271	155	Fail
0.5215	163	249	152	Fail
0.5430	142	232	163	Fail
0.5644	134	214	159	Fail
0.5859	125	195	156	Fail
0.6074	112	173	154	Fail
0.6289	104	161	154	Fail
0.6503	96	150	156	Fail
0.6718	89	139	156	Fail
0.6933	82	126	153	Fail
0.7148	78	117	150	Fail
0.7362	70	109	155	Fail
0.7577	66	105	159	Fail
0.7792	59	98	166	Fail
0.8007	53	87	164	Fail
0.8221	47	85	180	Fail
0.8436	46	79	171	Fail
0.8651	41	76	185	Fail
0.8866	40	71	177	Fail
0.9080	39	61	156	Fail
0.9295	37	55	148	Fail
0.9510	35	51	145	Fail
0.9725	33	49	148	Fail
0.9940	32	46	143	Fail
1.0154	32	44	137	Fail
1.0369	30	42	140	Fail
1.0584	29	38	131	Fail
1.0799	25	36	144	Fail
1.1013	22	35	159	Fail
1.1228	20	34	170	Fail
1.1443	17	33	194	Fail
1.1658	17	33	194	Fail
1.1872	16	32	200	Fail
1.2087	14	30	214	Fail
1.2302	13	27	207	Fail
1.2517	12	24	200	Fail
1.2731	12	24	200	Fail
1.2946	12	19	158	Fail
1.3161	9	18	200	Fail
1.3376	8	17	212	Fail
1.3590	8	15	187	Fail
1.3805	7	15	214	Fail
1.4020	7	15	214	Fail
1.4235	5	13	260	Fail

1.4449	4	12	300	Fail
1.4664	4	11	275	Fail
1.4879	4	11	275	Fail
1.5094	4	10	250	Fail
1.5308	4	8	200	Fail
1.5523	4	6	150	Fail
1.5738	4	6	150	Fail
1.5953	4	5	125	Fail
1.6167	4	4	100	Pass
1.6382	4	4	100	Pass
1.6597	4	4	100	Pass
1.6812	4	4	100	Pass
1.7026	4	4	100	Pass
1.7241	4	4	100	Pass
1.7456	4	4	100	Pass
1.7671	4	4	100	Pass
1.7885	4	4	100	Pass
1.8100	4	4	100	Pass
1.8315	4	4	100	Pass
1.8530	4	4	100	Pass
1.8744	4	4	100	Pass
1.8959	4	4	100	Pass
1.9174	4	4	100	Pass
1.9389	4	4	100	Pass
1.9603	4	4	100	Pass
1.9818	4	4	100	Pass
2.0033	4	4	100	Pass
2.0248	4	4	100	Pass
2.0462	4	4	100	Pass
2.0677	3	4	133	Fail
2.0892	3	4	133	Fail
2.1107	3	4	133	Fail
2.1322	3	4	133	Fail
2.1536	3	4	133	Fail
2.1751	3	4	133	Fail
2.1966	3	4	133	Fail
2.2181	2	4	200	Fail
2.2395	2	4	200	Fail
2.2610	2	4	200	Fail
2.2825	2	4	200	Fail
2.3040	1	4	400	Fail
2.3254	1	4	400	Fail
2.3469	1	3	300	Fail
2.3684	1	2	200	Fail
2.3899	1	2	200	Fail
2.4113	1	2	200	Fail

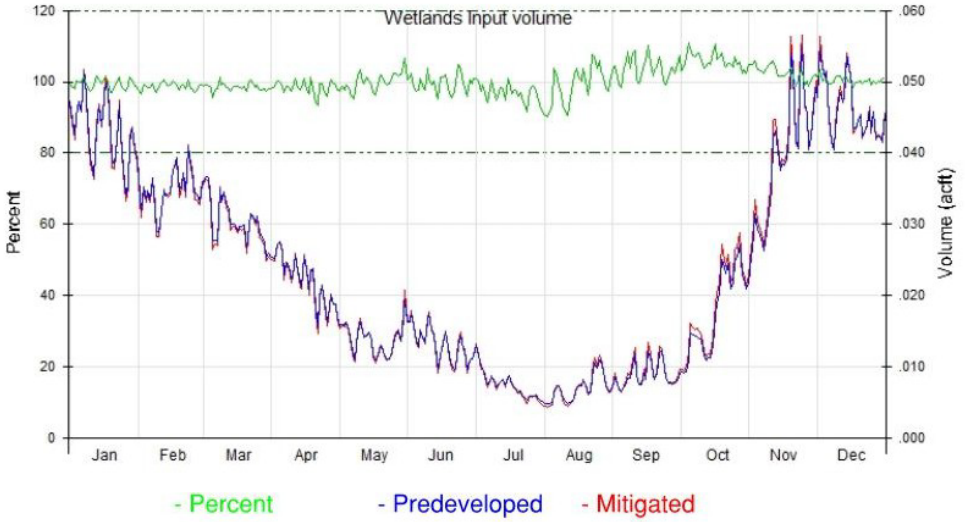
The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

Wetland Input Volumes



Wetlands Input Volume for POC 1
Average Annual Volume (acft)
Series 1: 501 POC 1 Predeveloped flow
Series 2: 801 POC 1 Mitigated flow

Month	Series 1	Series 2	Percent	Pass/Fail
Jan	1.3427	1.3361	99.5	Pass
Feb	0.9931	0.9805	98.7	Pass
Mar	0.9517	0.9379	98.5	Pass
Apr	0.6689	0.6592	98.6	Pass
May	0.4308	0.4310	100.0	Pass
Jun	0.3981	0.3974	99.8	Pass
Jul	0.2389	0.2332	97.6	Pass
Aug	0.2132	0.2130	99.9	Pass
Sep	0.2630	0.2733	103.9	Pass
Oct	0.5300	0.5609	105.8	Pass
Nov	1.1495	1.1777	102.5	Pass
Dec	1.4306	1.4371	100.5	Pass

Day	Predevel	Mitigated	Percent	Pass/Fail
Jan1	0.0472	0.0470	99.6	Pass
2	0.0448	0.0441	98.5	Pass
3	0.0426	0.0418	98.2	Pass
4	0.0453	0.0453	100.1	Pass
5	0.0472	0.0471	99.8	Pass
6	0.0458	0.0459	100.0	Pass
7	0.0511	0.0517	101.3	Pass
8	0.0506	0.0507	100.0	Pass
9	0.0449	0.0442	98.3	Pass
10	0.0394	0.0385	97.5	Pass
11	0.0379	0.0372	98.1	Pass
12	0.0368	0.0363	98.7	Pass
13	0.0432	0.0439	101.6	Pass
14	0.0466	0.0469	100.7	Pass

15	0.0439	0.0437	99.5	Pass
16	0.0456	0.0455	99.9	Pass
17	0.0498	0.0506	101.6	Pass
18	0.0488	0.0487	99.8	Pass
19	0.0433	0.0420	97.2	Pass
20	0.0391	0.0380	97.1	Pass
21	0.0384	0.0378	98.4	Pass
22	0.0418	0.0419	100.1	Pass
23	0.0468	0.0474	101.4	Pass
24	0.0430	0.0426	99.1	Pass
25	0.0379	0.0372	98.1	Pass
26	0.0342	0.0333	97.4	Pass
27	0.0354	0.0351	99.0	Pass
28	0.0416	0.0422	101.4	Pass
29	0.0434	0.0436	100.4	Pass
30	0.0408	0.0402	98.6	Pass
31	0.0394	0.0389	98.6	Pass
Feb1	0.0367	0.0359	97.7	Pass
2	0.0319	0.0309	96.7	Pass
3	0.0352	0.0349	99.3	Pass
4	0.0335	0.0331	98.9	Pass
5	0.0347	0.0341	98.4	Pass
6	0.0335	0.0330	98.5	Pass
7	0.0364	0.0363	99.6	Pass
8	0.0330	0.0321	97.3	Pass
9	0.0291	0.0282	97.2	Pass
10	0.0288	0.0284	98.4	Pass
11	0.0319	0.0318	99.9	Pass
12	0.0347	0.0349	100.4	Pass
13	0.0341	0.0341	99.8	Pass
14	0.0341	0.0337	98.9	Pass
15	0.0345	0.0343	99.2	Pass
16	0.0378	0.0378	100.1	Pass
17	0.0380	0.0379	99.9	Pass
18	0.0393	0.0390	99.2	Pass
19	0.0347	0.0338	97.5	Pass
20	0.0355	0.0351	99.0	Pass
21	0.0372	0.0369	99.2	Pass
22	0.0345	0.0338	97.9	Pass
23	0.0408	0.0411	100.7	Pass
24	0.0386	0.0378	98.1	Pass
25	0.0380	0.0373	98.2	Pass
26	0.0344	0.0334	97.1	Pass
27	0.0341	0.0333	97.7	Pass
28	0.0330	0.0327	99.1	Pass
29	0.0359	0.0355	99.1	Pass
Mar1	0.0360	0.0356	98.8	Pass
2	0.0367	0.0363	99.0	Pass
3	0.0365	0.0360	98.7	Pass
4	0.0329	0.0324	98.4	Pass
5	0.0277	0.0265	95.4	Pass
6	0.0278	0.0271	97.6	Pass
7	0.0275	0.0270	98.1	Pass
8	0.0348	0.0353	101.3	Pass
9	0.0334	0.0331	99.1	Pass
10	0.0345	0.0343	99.5	Pass
11	0.0329	0.0324	98.4	Pass
12	0.0321	0.0315	98.1	Pass

13	0.0299	0.0291	97.4	Pass
14	0.0301	0.0296	98.5	Pass
15	0.0299	0.0295	98.7	Pass
16	0.0291	0.0287	98.6	Pass
17	0.0297	0.0293	98.6	Pass
18	0.0298	0.0292	98.2	Pass
19	0.0299	0.0295	98.7	Pass
20	0.0267	0.0260	97.2	Pass
21	0.0282	0.0280	99.2	Pass
22	0.0314	0.0316	100.4	Pass
23	0.0312	0.0310	99.4	Pass
24	0.0303	0.0299	98.4	Pass
25	0.0311	0.0309	99.3	Pass
26	0.0287	0.0281	97.7	Pass
27	0.0282	0.0276	97.9	Pass
28	0.0273	0.0268	98.2	Pass
29	0.0255	0.0248	97.4	Pass
30	0.0259	0.0253	97.9	Pass
31	0.0255	0.0250	98.0	Pass
Apr1	0.0253	0.0249	98.5	Pass
2	0.0251	0.0249	98.9	Pass
3	0.0272	0.0272	100.2	Pass
4	0.0276	0.0276	99.8	Pass
5	0.0263	0.0260	98.7	Pass
6	0.0229	0.0222	97.1	Pass
7	0.0246	0.0243	98.7	Pass
8	0.0241	0.0237	98.5	Pass
9	0.0224	0.0218	97.3	Pass
10	0.0230	0.0226	98.4	Pass
11	0.0256	0.0259	100.9	Pass
12	0.0235	0.0232	98.6	Pass
13	0.0218	0.0213	97.9	Pass
14	0.0213	0.0210	98.5	Pass
15	0.0255	0.0257	101.0	Pass
16	0.0239	0.0234	98.2	Pass
17	0.0208	0.0201	96.7	Pass
18	0.0233	0.0236	101.3	Pass
19	0.0238	0.0234	98.5	Pass
20	0.0183	0.0173	94.3	Pass
21	0.0156	0.0146	93.4	Pass
22	0.0198	0.0197	99.4	Pass
23	0.0214	0.0213	99.4	Pass
24	0.0193	0.0187	97.1	Pass
25	0.0164	0.0158	95.9	Pass
26	0.0170	0.0166	97.8	Pass
27	0.0200	0.0202	100.7	Pass
28	0.0188	0.0187	99.4	Pass
29	0.0188	0.0186	99.0	Pass
30	0.0170	0.0166	97.6	Pass
May1	0.0158	0.0154	97.3	Pass
2	0.0159	0.0157	98.8	Pass
3	0.0159	0.0156	97.8	Pass
4	0.0163	0.0161	99.0	Pass
5	0.0153	0.0150	98.4	Pass
6	0.0132	0.0126	95.8	Pass
7	0.0114	0.0108	95.0	Pass
8	0.0110	0.0108	97.8	Pass
9	0.0147	0.0149	101.6	Pass

10	0.0163	0.0168	103.3	Pass
11	0.0150	0.0150	100.0	Pass
12	0.0141	0.0141	99.5	Pass
13	0.0142	0.0144	101.4	Pass
14	0.0148	0.0148	100.2	Pass
15	0.0138	0.0137	99.3	Pass
16	0.0119	0.0115	96.9	Pass
17	0.0110	0.0106	96.3	Pass
18	0.0117	0.0116	99.1	Pass
19	0.0129	0.0131	102.1	Pass
20	0.0127	0.0129	101.6	Pass
21	0.0117	0.0117	99.9	Pass
22	0.0110	0.0109	99.0	Pass
23	0.0111	0.0111	99.4	Pass
24	0.0120	0.0122	101.3	Pass
25	0.0130	0.0134	102.5	Pass
26	0.0144	0.0148	102.5	Pass
27	0.0150	0.0152	101.7	Pass
28	0.0135	0.0138	101.9	Pass
29	0.0146	0.0151	103.1	Pass
30	0.0195	0.0208	106.6	Pass
31	0.0162	0.0163	100.5	Pass
Jun1	0.0163	0.0165	101.2	Pass
2	0.0175	0.0179	102.4	Pass
3	0.0159	0.0156	98.5	Pass
4	0.0137	0.0133	97.2	Pass
5	0.0129	0.0127	97.8	Pass
6	0.0150	0.0151	101.1	Pass
7	0.0144	0.0142	99.0	Pass
8	0.0134	0.0131	97.9	Pass
9	0.0162	0.0169	103.9	Pass
10	0.0175	0.0176	100.9	Pass
11	0.0153	0.0152	99.3	Pass
12	0.0144	0.0144	100.1	Pass
13	0.0113	0.0110	96.6	Pass
14	0.0095	0.0090	95.4	Pass
15	0.0115	0.0117	101.3	Pass
16	0.0133	0.0135	101.2	Pass
17	0.0148	0.0151	101.9	Pass
18	0.0140	0.0140	100.2	Pass
19	0.0116	0.0112	96.7	Pass
20	0.0101	0.0097	95.4	Pass
21	0.0096	0.0093	97.0	Pass
22	0.0099	0.0099	99.7	Pass
23	0.0129	0.0136	104.9	Pass
24	0.0143	0.0148	103.7	Pass
25	0.0125	0.0124	99.3	Pass
26	0.0125	0.0123	98.5	Pass
27	0.0095	0.0091	95.9	Pass
28	0.0109	0.0110	100.4	Pass
29	0.0111	0.0110	99.3	Pass
30	0.0115	0.0116	100.9	Pass
Jul1	0.0131	0.0132	100.8	Pass
2	0.0116	0.0116	100.2	Pass
3	0.0099	0.0097	97.2	Pass
4	0.0099	0.0098	99.2	Pass
5	0.0089	0.0087	97.2	Pass
6	0.0075	0.0071	94.3	Pass

7	0.0079	0.0078	98.1	Pass
8	0.0087	0.0087	100.6	Pass
9	0.0082	0.0080	97.5	Pass
10	0.0072	0.0068	94.9	Pass
11	0.0077	0.0075	96.9	Pass
12	0.0079	0.0078	98.4	Pass
13	0.0083	0.0081	98.2	Pass
14	0.0075	0.0071	94.9	Pass
15	0.0084	0.0085	101.0	Pass
16	0.0088	0.0088	100.3	Pass
17	0.0077	0.0074	96.5	Pass
18	0.0071	0.0070	97.7	Pass
19	0.0067	0.0066	97.4	Pass
20	0.0065	0.0062	95.8	Pass
21	0.0065	0.0063	97.0	Pass
22	0.0059	0.0056	94.5	Pass
23	0.0055	0.0051	92.7	Pass
24	0.0053	0.0048	91.7	Pass
25	0.0059	0.0058	97.8	Pass
26	0.0059	0.0058	98.6	Pass
27	0.0059	0.0058	98.3	Pass
28	0.0061	0.0059	97.5	Pass
29	0.0055	0.0053	94.8	Pass
30	0.0052	0.0048	92.4	Pass
31	0.0050	0.0045	91.2	Pass
Aug1	0.0048	0.0044	90.6	Pass
2	0.0048	0.0043	90.3	Pass
3	0.0048	0.0044	91.8	Pass
4	0.0049	0.0046	93.6	Pass
5	0.0063	0.0065	103.8	Pass
6	0.0072	0.0074	102.3	Pass
7	0.0073	0.0072	98.9	Pass
8	0.0064	0.0062	96.5	Pass
9	0.0056	0.0053	93.5	Pass
10	0.0051	0.0047	91.5	Pass
11	0.0048	0.0044	90.6	Pass
12	0.0049	0.0047	95.7	Pass
13	0.0052	0.0051	99.7	Pass
14	0.0057	0.0058	102.1	Pass
15	0.0069	0.0071	103.6	Pass
16	0.0074	0.0075	101.0	Pass
17	0.0073	0.0073	100.3	Pass
18	0.0080	0.0083	103.7	Pass
19	0.0075	0.0076	100.1	Pass
20	0.0063	0.0060	96.2	Pass
21	0.0064	0.0065	102.0	Pass
22	0.0085	0.0091	107.7	Pass
23	0.0105	0.0112	106.9	Pass
24	0.0098	0.0102	103.9	Pass
25	0.0110	0.0116	106.0	Pass
26	0.0109	0.0112	103.2	Pass
27	0.0093	0.0095	101.2	Pass
28	0.0075	0.0074	97.9	Pass
29	0.0066	0.0064	97.3	Pass
30	0.0065	0.0065	99.9	Pass
31	0.0069	0.0072	103.2	Pass
Sep1	0.0086	0.0090	104.4	Pass
2	0.0076	0.0077	101.6	Pass

3	0.0069	0.0068	99.2	Pass
4	0.0065	0.0064	98.2	Pass
5	0.0071	0.0073	103.9	Pass
6	0.0077	0.0082	106.0	Pass
7	0.0084	0.0091	108.5	Pass
8	0.0084	0.0088	103.9	Pass
9	0.0102	0.0110	108.2	Pass
10	0.0117	0.0128	108.8	Pass
11	0.0088	0.0089	100.7	Pass
12	0.0076	0.0075	99.5	Pass
13	0.0075	0.0077	101.8	Pass
14	0.0092	0.0096	104.9	Pass
15	0.0082	0.0087	105.4	Pass
16	0.0122	0.0135	110.2	Pass
17	0.0114	0.0120	105.1	Pass
18	0.0089	0.0090	101.5	Pass
19	0.0082	0.0084	103.5	Pass
20	0.0088	0.0092	104.1	Pass
21	0.0121	0.0129	107.1	Pass
22	0.0121	0.0125	103.3	Pass
23	0.0110	0.0110	100.4	Pass
24	0.0085	0.0084	99.0	Pass
25	0.0077	0.0078	101.1	Pass
26	0.0076	0.0079	103.3	Pass
27	0.0074	0.0077	104.2	Pass
28	0.0077	0.0079	102.3	Pass
29	0.0080	0.0083	104.7	Pass
30	0.0091	0.0097	107.3	Pass
Oct1	0.0093	0.0096	102.9	Pass
2	0.0092	0.0095	104.0	Pass
3	0.0093	0.0099	106.7	Pass
4	0.0108	0.0119	111.0	Pass
5	0.0147	0.0162	109.6	Pass
6	0.0145	0.0155	107.2	Pass
7	0.0143	0.0153	107.1	Pass
8	0.0142	0.0154	108.2	Pass
9	0.0139	0.0151	108.0	Pass
10	0.0137	0.0145	105.9	Pass
11	0.0117	0.0121	103.7	Pass
12	0.0109	0.0114	104.6	Pass
13	0.0112	0.0118	105.3	Pass
14	0.0112	0.0118	104.8	Pass
15	0.0130	0.0141	108.4	Pass
16	0.0171	0.0189	110.5	Pass
17	0.0189	0.0202	106.5	Pass
18	0.0202	0.0217	107.1	Pass
19	0.0251	0.0271	108.2	Pass
20	0.0239	0.0251	104.8	Pass
21	0.0231	0.0241	104.3	Pass
22	0.0244	0.0257	105.2	Pass
23	0.0209	0.0219	104.8	Pass
24	0.0219	0.0228	104.1	Pass
25	0.0247	0.0265	107.0	Pass
26	0.0254	0.0267	105.0	Pass
27	0.0273	0.0288	105.7	Pass
28	0.0227	0.0232	102.3	Pass
29	0.0225	0.0232	103.3	Pass
30	0.0209	0.0214	102.2	Pass

31	0.0217	0.0228	104.8	Pass
Nov1	0.0256	0.0269	105.0	Pass
2	0.0263	0.0276	104.9	Pass
3	0.0316	0.0334	105.9	Pass
4	0.0294	0.0304	103.6	Pass
5	0.0285	0.0294	103.0	Pass
6	0.0274	0.0281	102.7	Pass
7	0.0264	0.0270	102.4	Pass
8	0.0287	0.0298	103.9	Pass
9	0.0317	0.0333	105.0	Pass
10	0.0350	0.0368	105.1	Pass
11	0.0421	0.0446	105.8	Pass
12	0.0431	0.0448	104.0	Pass
13	0.0405	0.0412	101.8	Pass
14	0.0376	0.0381	101.5	Pass
15	0.0385	0.0392	101.6	Pass
16	0.0382	0.0388	101.6	Pass
17	0.0390	0.0398	102.3	Pass
18	0.0436	0.0449	103.0	Pass
19	0.0541	0.0564	104.2	Pass
20	0.0513	0.0521	101.6	Pass
21	0.0418	0.0413	98.9	Pass
22	0.0407	0.0409	100.7	Pass
23	0.0501	0.0515	102.8	Pass
24	0.0550	0.0565	102.8	Pass
25	0.0470	0.0465	99.0	Pass
26	0.0457	0.0458	100.3	Pass
27	0.0409	0.0404	99.0	Pass
28	0.0420	0.0422	100.5	Pass
29	0.0463	0.0471	101.7	Pass
30	0.0491	0.0500	101.8	Pass
Dec1	0.0478	0.0484	101.2	Pass
2	0.0545	0.0564	103.5	Pass
3	0.0521	0.0522	100.2	Pass
4	0.0507	0.0510	100.7	Pass
5	0.0514	0.0516	100.4	Pass
6	0.0451	0.0448	99.3	Pass
7	0.0417	0.0415	99.5	Pass
8	0.0404	0.0405	100.0	Pass
9	0.0433	0.0439	101.3	Pass
10	0.0467	0.0475	101.7	Pass
11	0.0485	0.0494	101.8	Pass
12	0.0472	0.0471	99.9	Pass
13	0.0477	0.0483	101.4	Pass
14	0.0534	0.0541	101.2	Pass
15	0.0520	0.0520	100.0	Pass
16	0.0495	0.0492	99.5	Pass
17	0.0434	0.0428	98.6	Pass
18	0.0435	0.0434	99.8	Pass
19	0.0446	0.0446	100.0	Pass
20	0.0453	0.0455	100.4	Pass
21	0.0423	0.0421	99.4	Pass
22	0.0430	0.0430	100.1	Pass
23	0.0439	0.0440	100.3	Pass
24	0.0461	0.0465	101.0	Pass
25	0.0431	0.0428	99.2	Pass
26	0.0458	0.0459	100.1	Pass
27	0.0421	0.0419	99.5	Pass

28	0.0424	0.0425	100.3	Pass
29	0.0425	0.0424	100.0	Pass
30	0.0415	0.0419	100.8	Pass
31	0.0454	0.0458	100.9	Pass

Model Default Modifications

Total of 0 changes have been made.

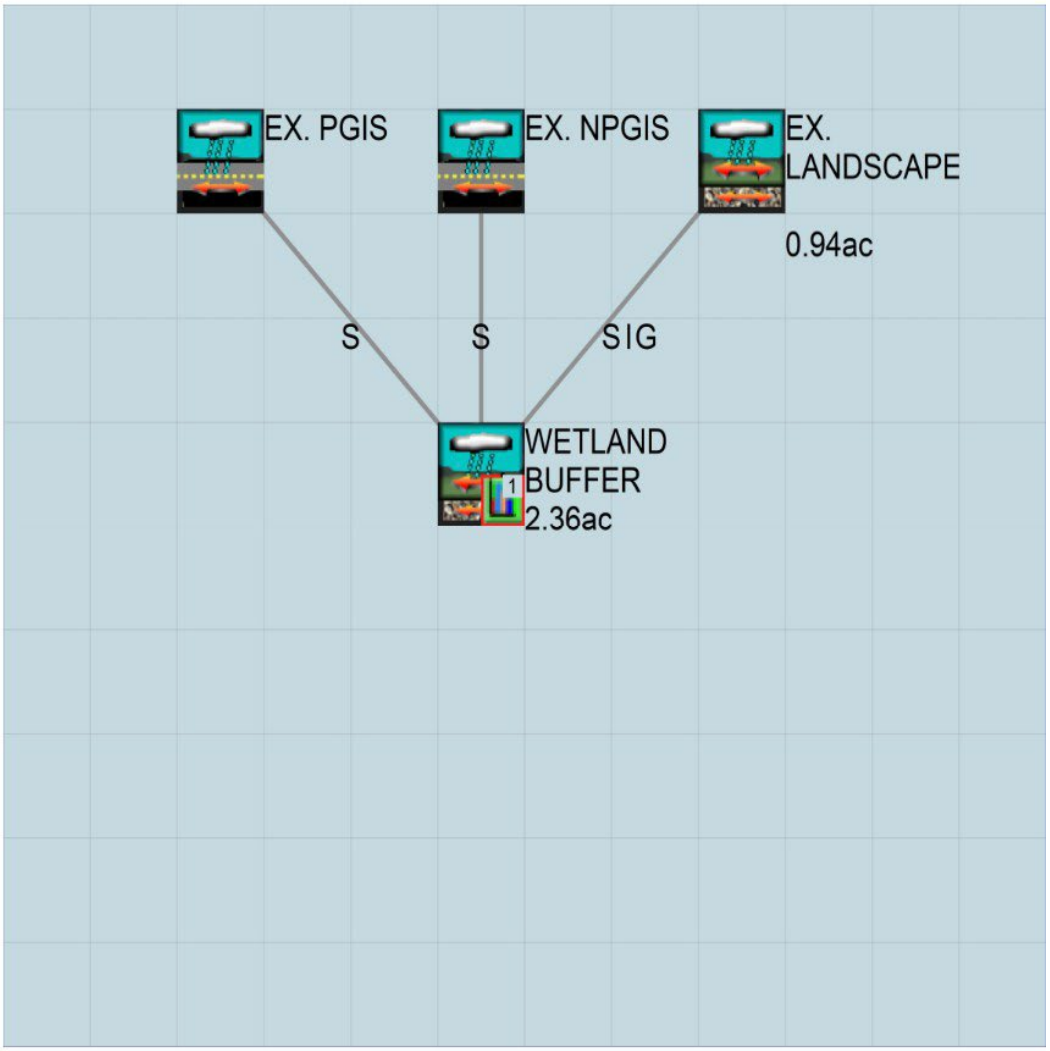
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

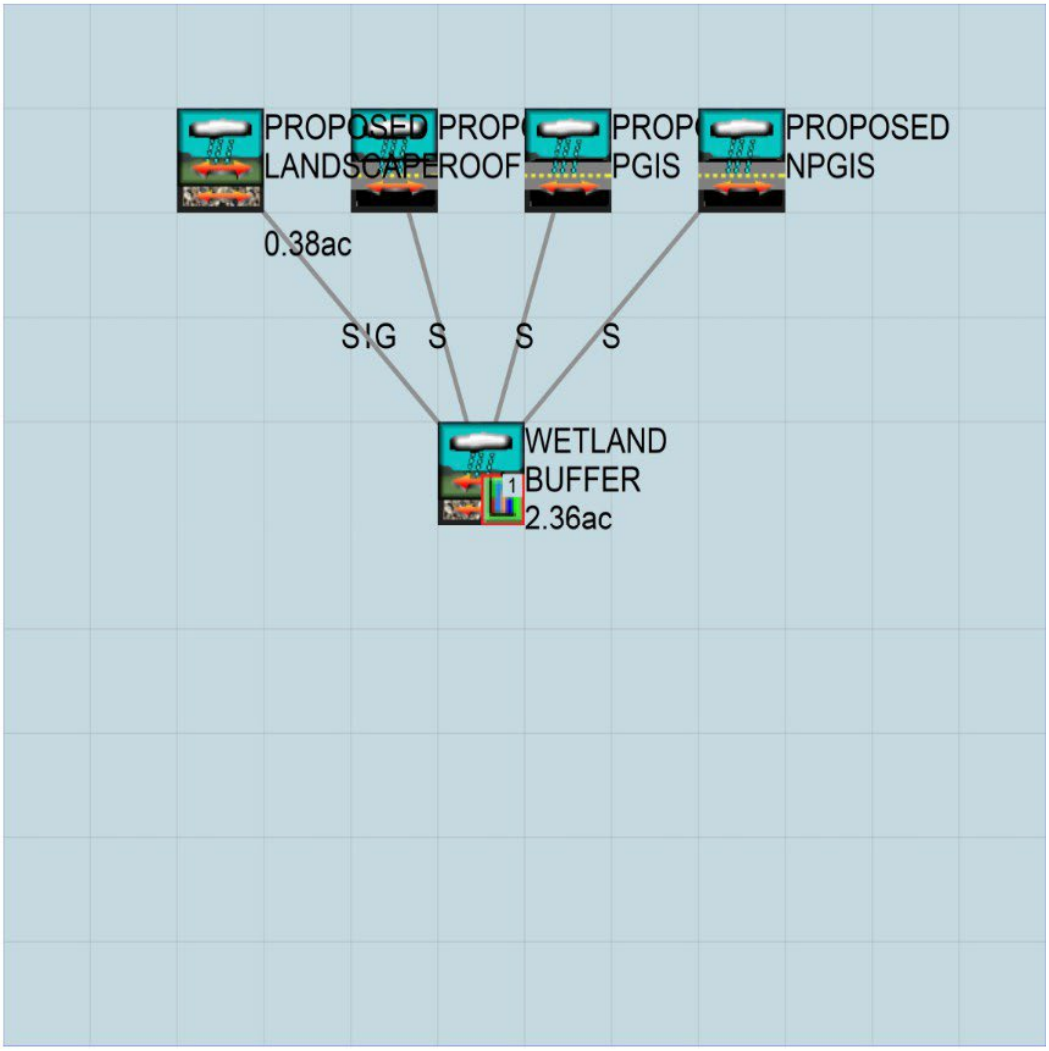
No IMPLND changes have been made.

Appendix
Predeveloped Schematic



POLARIS-PRELIM-SIMP 3/30/2026 3:50:00 PM Page 30

Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   POLARIS-PRELIM-SIMP.wdm
MESSU       25   PrePOLARIS-PRELIM-SIMP.MES
            27   PrePOLARIS-PRELIM-SIMP.L61
            28   PrePOLARIS-PRELIM-SIMP.L62
            30   POCPOLARIS-PRELIM-SIMP1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       20
      IMPLND       21
      PERLND       39
      PERLND       40
      COPY        501
      COPY          1
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        WETLAND BUFFER              MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                         User  t-series Engl Metr ***
                                          in  out            ***
   39     C, Lawn, Flat           1    1    1    1   27    0
   40     C, Lawn, Mod            1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   39         0    0    1    0    0    0    0    0    0    0    0    0
   40         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   39         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   40         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   39         0    0    0    0    0    0    0    0    0    0    0
   40         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN     INFILT      LSUR     SLSUR     KVARY     AGWRC
   39              0       4.5      0.03       400      0.05       0.5     0.996
   40              0       4.5      0.03       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   39              0         0         2         2         0         0         0
   40              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   39            0.1      0.25      0.25         6       0.5      0.25
   40            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS       IFWS       LZS       AGWS      GWVS
   39              0         0         0         0       2.5          1         0
   40              0         0         0         0       2.5          1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                  in  out           ***
   20      DRIVEWAYS/FLAT         1    1    1   27    0
   21      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   20         0    0    1    0    0    0
   21         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   20         0    0    4    0    0    0    1    9
   21         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
```

```
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
   20         0    0    0    0    0
   21         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
   20            400      0.01       0.1       0.1
   21            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   20              0         0
   21              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   20              0         0
   21              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
EX. PGIS***
IMPLND  20                      0.436     PERLND  40     50
EX. LANDSCAPE***
PERLND  39                     0.3992     PERLND  40     30
PERLND  39                     0.3992     PERLND  40     34
PERLND  39                     0.3992     PERLND  40     38
EX. NPGIS***
IMPLND  21                     0.0021     PERLND  40     50
WETLAND BUFFER***
PERLND  40                       2.36     COPY   501     12
PERLND  40                       2.36     COPY   501     13
PERLND  40                       2.36     COPY   501     14

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY
```

```
  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                    ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit      possible  exit
            *  *  *  *    *  *  *  *  *       *  *  *  *  *         ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                       ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #    #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       14
PERLND     PWATER AGWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   14

  MASS-LINK       30
PERLND     PWATER SURO                     PERLND         EXTNL  SURLI
  END MASS-LINK   30

  MASS-LINK       34
PERLND     PWATER IFWO                     PERLND         EXTNL  IFWLI
  END MASS-LINK   34

  MASS-LINK       38
```

```
PERLND     PWATER AGWO                    PERLND         EXTNL  AGWLI
  END MASS-LINK   38

  MASS-LINK       50
IMPLND     IWATER SURO                    PERLND         EXTNL  SURLI
  END MASS-LINK   50


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   POLARIS-PRELIM-SIMP.wdm
MESSU       25   MitPOLARIS-PRELIM-SIMP.MES
            27   MitPOLARIS-PRELIM-SIMP.L61
            28   MitPOLARIS-PRELIM-SIMP.L62
            30   POCPOLARIS-PRELIM-SIMP1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       25
      IMPLND       26
      IMPLND       27
      PERLND       41
      PERLND       42
      COPY        501
      COPY          1
      DISPLY        1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        WETLAND BUFFER              MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   41     C, Lawn, Flat           1    1    1    1   27    0
   42     C, Lawn, Mod            1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   41         0    0    1    0    0    0    0    0    0    0    0    0
   42         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   41         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   42         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   41         0    0    0    0    0    0    0    0    0    0    0
   42         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN     INFILT      LSUR     SLSUR     KVARY     AGWRC
   41              0       4.5       0.03       400      0.05       0.5     0.996
   42              0       4.5       0.03       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   41              0         0         2         2         0         0         0
   42              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   41            0.1      0.25      0.25         6       0.5      0.25
   42            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   41              0         0         0         0       2.5         1         0
   42              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
   25      ROOF TOPS/FLAT         1    1    1   27    0
   26      DRIVEWAYS/FLAT         1    1    1   27    0
   27      SIDEWALKS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
   25         0    0    1    0    0    0
   26         0    0    1    0    0    0
   27         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
   25         0    0    4    0    0    0    1    9
   26         0    0    4    0    0    0    1    9
   27         0    0    4    0    0    0    1    9
```

```
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
   25         0    0    0    0    0
   26         0    0    0    0    0
   27         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
   25            400      0.01       0.1       0.1
   26            400      0.01       0.1       0.1
   27            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
   25              0         0
   26              0         0
   27              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
   25             0         0
   26             0         0
   27             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
PROPOSED ROOF***
IMPLND  25                      0.5309     PERLND  42     50
PROPOSED LANDSCAPE***
PERLND  41                       0.161     PERLND  42     30
PERLND  41                       0.161     PERLND  42     34
PERLND  41                       0.161     PERLND  42     38
PROPOSED PGIS***
IMPLND  26                      0.0665     PERLND  42     50
PROPOSED NPGIS***
IMPLND  27                      0.0203     PERLND  42     50
WETLAND BUFFER***
PERLND  42                        2.36     COPY   501     12
PERLND  42                        2.36     COPY   501     13
PERLND  42                        2.36     COPY   501     14

******Routing******
IMPLND  25                       1.253     COPY     1     15
IMPLND  26                       0.157     COPY     1     15
IMPLND  27                       0.048     COPY     1     15
PERLND  41                        0.38     COPY     1     12
PERLND  41                        0.38     COPY     1     13
PERLND  41                        0.38     COPY     1     14
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1


POLARIS-PRELIM-SIMP          3/30/2026 3:50:03 PM          Page 39
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                       in  out                               ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                      ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12
```

```
  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       14
PERLND     PWATER AGWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   14

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       30
PERLND     PWATER SURO                     PERLND         EXTNL  SURLI
  END MASS-LINK   30

  MASS-LINK       34
PERLND     PWATER IFWO                     PERLND         EXTNL  IFWLI
  END MASS-LINK   34

  MASS-LINK       38
PERLND     PWATER AGWO                     PERLND         EXTNL  AGWLI
  END MASS-LINK   38

  MASS-LINK       50
IMPLND     IWATER SURO                     PERLND         EXTNL  SURLI
  END MASS-LINK   50


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

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APPENDIX E –OPERATIONS AND MAINTENANCE

To be provided under Development Engineering Review.

APPENDIX F –GEOTECHNICAL ENGINEERING STUDY


Geotechnical Engineering Services
Preliminary Report
20800 44th Avenue West
Lynnwood, Washington
for
Nitze-Stagen & Company, Inc.
March 28, 2023
GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services
Preliminary Report

20800 44th Avenue West
Lynnwood, Washington

for
Nitze-Stagen & Company, Inc.

March 28, 2023

GeoEngineers

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Geotechnical Engineering Services
Preliminary Report

20800 44th Avenue West
Lynnwood, Washington

File No. 06407-016-00

March 28, 2023

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GeoEngineers

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1.0 INTRODUCTION

This report presents the results of GeoEngineers' geotechnical engineering due diligence services for the 20800 44th Avenue West project located in Lynnwood, Washington. The subject property is bounded by 20800 Block to the north, 44th Avenue West to the east, 209th Street SW to the south, and private property to the west (20818 44th Avenue West). The site is shown relative to surrounding physical features on the Vicinity Map (Figure 1) and the Site Plan (Figure 2).

The purpose of this report is to provide preliminary geotechnical engineering conclusions and recommendations for the site. The approximately 6.81-acre site consists of three Snohomish County Parcels (27042100407400, 27042100407600, and 27042100407500). We understand that the north/northeast parcel is mapped as a wetland and that there may be setback restrictions for new developments. GeoEngineers' geotechnical engineering services have been completed in general accordance with our work order executed February 13, 2023. Our scope of services includes:

- Reviewing existing subsurface information available for the site and surrounding area;
- Completing explorations at the site to further characterize subsurface soil and groundwater conditions;
- Providing recommendations for seismic design in accordance with the 2018 International Building Code (IBC);
- Providing recommendations for earthwork;
- Providing foundation, temporary shoring, slab-on-grade and permanent below-grade wall recommendations;
- Providing recommendations for temporary dewatering and groundwater seepage estimates; and
- Preparing this report.

2.0 PROJECT DESCRIPTION

We understand that Nitze-Stagen Company, Inc. is interested in redeveloping the project site. Currently there are no proposed development options, but we understand that planned buildings may be supported at grade or include a below-grade level. Temporary shoring consisting of soldier pile and tiebacks or soil nail shoring will be required where excavations extend below existing site grades and/or where temporary cut slopes may not be feasible. Active temporary dewatering may be necessary depending on the presence of below-grade levels and the location of the building(s) located relative to measured groundwater. Competent soil conditions are present in the northwestern, central and southern portion of the project site and can be supported on shallow foundations. Mixed bearing soils are present near existing site grades in the northern portion of the project site and can consist of shallow foundations bearing on improved ground and/or deep foundations.

3.0 FIELD EXPLORATIONS AND LABORATORY TESTING

3.1. Field Explorations

The subsurface conditions at the site were evaluated by drilling six borings (GEI-1 through GEI-6), to depth of approximately 25½ to 36½ feet below existing site grades. The approximate locations of the explorations are shown in Figure 2. Descriptions of the field exploration program and the boring logs are presented in Appendix A, Field Explorations.

3.2. Laboratory Testing

Soil samples were obtained during drilling and were taken to GeoEngineers' laboratory for further evaluation. Selected samples were tested for the determination of moisture content, fines content (material passing the U.S. No. 200 sieve), and sieve analysis (grain size distribution). A description of the laboratory testing and the test results are presented in Appendix B, Laboratory Testing, and the boring logs included in Appendix A.

4.0 PREVIOUS SITE EVALUATIONS

In addition to the explorations completed as part of this evaluation, the logs of selected explorations from previous studies in the project vicinity were reviewed. The logs of explorations from previous projects referenced for this study are presented in Appendix C, Test Pit Logs from Previous Studies.

5.0 SITE CONDITIONS

5.1. Surface Conditions

An existing wetland is present in the northeast corner of the project boundary and an existing two-story parking structure is present in the southwest corner of the site. The remaining portions of the site include surface parking. Site grades gently slope to the north and east across the site from approximate Elevation 357 feet in the southeast corner and Elevation 353 feet in the northwest corner to Elevation 335 feet near the northeast corner between the at grade parking and the wetland.

Numerous buried utilities are anticipated to be located within and near the project site and within the public right-of-way along the adjacent streets. These utilities include, but are not limited to, electrical, telecommunication, gas, power, water, power, and combined sanitary sewer and storm drain.

5.2. Subsurface Conditions

The subsurface conditions at the site have been evaluated by completing six geotechnical borings for the current study and reviewing logs of test pits completed by others at the project site. The approximate locations of the current borings, and the previous test pits, are shown in Figure 2. Subsurface conditions encountered three soil units; fill, recent deposits, and glacially consolidated soils.

The borings encountered approximately 1 to 2 inches of asphalt concrete pavement and 3 to 5 inches of ¾-inch minus crushed rock. The asphalt and crushed rock was underlain by fill, where encountered, and recent deposits. Fill was encountered in boring GEI-5 below the asphalt and crushed rock and extended

approximately 2 feet below existing site grades. The fill material consisted of loose to medium dense silty sand with gravel and occasional brick debris.

Recent deposits were encountered below the asphalt and crushed rock in each of the borings except GEI-5. The recent deposits generally consisted of very loose to medium dense sand with variable silt and gravel content and extended up to 14½ feet below existing site grades (GEI-3).

Glacially consolidated soils were encountered below the fill or recent deposits and extended to the depths explored. The glacially consolidated soils generally consisted of dense to very dense silty sand with variable gravel content.

5.3. Groundwater Conditions

The depth to groundwater was measured in the monitoring wells installed in boring GEI-3 and GEI-5. An automatic data-logger was installed in the monitoring wells to observe the variability in groundwater levels seasonally and after significant rainfall events.

Table 1 provides a summary of the monitoring well and recent groundwater measurements at the site.

TABLE 1. MONITORING WELLS SUMMARY

Well ID	Ground Surface Elevation (feet)	Top of Casing Elevation (feet)	Well Screen Elevation (feet)	Measured Groundwater Elevation (feet)
GEI-3	340	339.7	324.7 to 334.7	334.2 (03/24/23)
GEI-5	350	349.7	314.7 to 324.7	337.9 (03/28/23)

Notes:
Additional groundwater readings should be taken for GEI-3 and GEI-5 during the design phase.

The groundwater observed in monitoring well GEI-3 is likely perched and influenced by the wetlands present directly north of the monitoring well and located in the northeastern portion of the project site. The groundwater observed in monitoring well GEI-5 is likely perched and located above the glacially consolidated soils and located in the south-central portion of the project site.

Groundwater levels are anticipated to vary as a function of location, precipitation, season, and other factors. Additional groundwater measurements will be taken to assess seasonal variations in groundwater elevations.

6.0 ENVIRONMENTALLY CRITICAL AREAS

GeoEngineers has reviewed the environmentally critical area (ECA) maps available online. Based on our review of the maps, the site (three parcels that make up the project site) are located within a mapped potential erosion hazards area (southwest corner), wetland (northeast corner), stream (runs from northeast corner to midpoint of the south project boundary), and critical aquifer recharge area (northeast corner). We understand that a wetlands and stream review is being completed for the project by another consultant. Restrictions relative to critical aquifer recharge area should also be reviewed during design. We do not anticipate that the potential erosions hazards area would require additional consideration, as the construction of a building or other improvements would likely satisfy design review for this critical area.

7.0 CONCLUSIONS AND RECOMMENDATIONS

A summary of the primary geotechnical considerations is provided below. The summary is presented for introductory purposes only and should be used in conjunction with the complete recommendations presented in this report.

- The site is designated as Soil Profile Type C or D per the 2018 IBC. Site Class should be reviewed during design for the structure.
- Groundwater was measured in monitoring well GEI-3 located within 5 to 6 feet of existing site grades and is consistent with explorations completed near the wetlands (GEI-2 also observed groundwater at a depth of 7½ feet) in the northeastern portion of the site. Water bearing soils were typically not observed in explorations outside of GEI-2 and GEI-3. Perched groundwater was observed in monitoring well GEI-5 and is likely not a significant design concern.
- If the excavation extends below the groundwater table in the vicinity of borings GEI-2 and GEI-3, localized temporary dewatering may be necessary. Depending on the location and depth of the planned excavation, casual dewatering through the use of sumps and pumps or shallow wells can be implemented for temporary dewatering.
- Excavation support for below-grade structures can be completed using soldier pile and tieback shoring, soil nailing, or through the use of temporary cut slopes for portions of the below-grade structure that is located sufficiently offset from property boundaries. If ground anchors will extend into the public right-of-way, these elements will be required to be temporary. Permanent below-grade building walls will be required to resist the permanent lateral earth pressures. Ground anchors extending into the public right-of-way should be assumed to be required to be de-stressed once the temporary shoring is no longer required. If soldier pile and tieback shoring is used, the below-grade building walls should be designed and constructed to facilitate de-stressing of temporary tieback anchors, if required.
- For shallow foundations bearing on glacially consolidated soils, we recommend the foundations be designed using an allowable bearing pressure of 12 kips per square foot (ksf).
- For shallow foundations bearing on existing fill or recent deposits, ground improvement consisting of rigid inclusions, stone columns, or rammed aggregate piers (RAPs) can be used. For this condition, we recommend that an allowable bearing pressure of 6 ksf be used.
- Deep foundations consisting of pin piles may be used to support foundations where bearing on existing fill or recent deposits. The pin piles would likely consist of 4- or 6-inch-diameter piles. The pin piles would likely be driven to competent glacially consolidates soils.
- Conventional slabs-on-grade are appropriate for this site where bearing on glacially consolidated soils and should be underlain by a 6-inch-thick layer of clean crushed rock (for example, City of Seattle Mineral Aggregate Type 22). The underslab drainage system is anticipated to consist of a combination of perimeter and interior foundation drains.

Our specific geotechnical recommendations are presented in the following sections of this report.

7.1. Earthquake Engineering

7.1.1. Liquefaction

Liquefaction refers to the condition by which vibration or shaking of the ground, usually from earthquake forces, results in the development of excess pore pressures in saturated soils with subsequent loss of strength. In general, soils that are susceptible to liquefaction include very loose to medium dense, clean to silty sands, and some silts that are below the water table.

The results of our analyses indicate that borings GEI-1, GEI-2, and GEI-4 through GEI-6 have a low risk of liquefaction and boring GEI-3 has a moderate potential for liquefaction during the design earthquake event.

The evaluation of liquefaction potential is a complex procedure and is dependent on numerous site parameters, including soil grain size, soil density, site geometry, static stress, and the design ground acceleration. Typically, the liquefaction potential of a site is evaluated by comparing the cyclic stress ratio (CSR), which is the ratio of the cyclic shear stress induced by an earthquake to the initial effective overburden stress, to the cyclic resistance ratio (CRR), which is the soils resistance to liquefaction. We evaluated the liquefaction triggering potential (Youd et al. 2001; Idriss and Boulanger 2014) and liquefaction-induced settlement (Tokimatsu and Seed 1987; Ishihara and Yoshimine 1992; Idriss and Boulanger 2014) for soil conditions in each of the borings we completed at the site. These methods predict the potential for up to about 3 inches of free-field liquefaction-induced settlement across the site for the design earthquake event. The liquefiable soils are primarily present at depths ranging from about 5 to 15 feet. Mitigation of the potentially liquefiable soils may be required through the use of ground improvement or removal and replacement of the potentially liquefiable soils, or a combination of the two, depending on the proximity of the development to the potentially liquefiable soils encountered in boring GEI-3.

7.1.2. Other Seismic Hazards

Due to the location of the site and the site's topography, the risk of adverse impacts resulting from seismically induced slope instability, differential settlement, or surface displacement due to faulting is low.

7.1.3. 2018 IBC Seismic Design Information

We recommend the use of the following 2018 IBC parameters for soil profile type, short period spectral response acceleration (S_S), 1-second period spectral response acceleration (S_1) and seismic coefficients (F_A and F_V) for the project site as summarized in Table 2 below.

TABLE 2. 2018 IBC SEISMIC PARAMETERS

2018 IBC Parameter	Recommended Value	
Soil Profile Type	C	D
Short Period Spectral Response Acceleration, S_S (percent g)	129.3	129.3
1-Second Period Spectral Response Acceleration, S_1 (percent g)	45.6	45.6
Seismic Coefficient, F_A	1.2	1.0
Seismic Coefficient, F_V	1.5	1.84

Notes:
Parameters developed based on latitude 47.8097813 and longitude -122.2945425 using the Applied Technology Council (ATC) Hazards online tool (https://hazards.atcouncil.org/).

The site class estimated from the borings completed for this study varied between Site Class C and D. The Site Class should be reviewed during design of the structure to determine the appropriate seismic design parameters. It should be noted that the recommended Site Class (Site Class C or D) will require that the development be located where potentially liquefiable soils are not present, or that the potentially liquefiable soils be mitigated through the use of ground improvement or the completion of removal and replacement.

7.2. Temporary Dewatering

The soils encountered in the borings at the site generally consist of low permeability soils. Where excavations extend below the groundwater table, temporary dewatering through the use of sumps and pumps is anticipated to be effective where the groundwater table is to be lowered by less than about 5 to 6 feet below current levels. GeoEngineers can provide more information on temporary dewatering after the design of the building(s) becomes more defined.

7.3. Excavation Support

The subsurface conditions present away from the north and northeast corner of the site support the use of soldier pile and tiebacks or soil nail shoring for temporary excavation support. Temporary cut slopes can also be utilized provided the excavation is located offset from property boundaries sufficient distances.

The shoring walls should be designed to limit lateral deflections to 1 inch or less in order to reduce the risk of damage to nearby existing improvements.

Ground anchors should be designed to maintain an acceptable clearance from buried utilities in the right-of-way. The ground anchors are recommended to be temporary and the basement walls be designed to resist the lateral earth pressures on a permanent basis.

Temporary cut slopes may also be utilized for excavation support provided the building is sufficiently offset from the property line. In areas where adjacent buildings or structures are located near the planned cut slope, a minimum 5-foot offset should be established before transitioning to the temporary cut slope. Depending on the depth of excavation, a larger offset or shoring may be required near adjacent buildings. See “Temporary Cut Slopes” section below for recommendations.

Temporary easements from adjacent property owners will also be required for ground anchors extending onto adjacent parcels.

We provide geotechnical design and construction recommendations for conventional soldier pile and tieback walls, soil nail walls and temporary cut slopes below.

7.3.1. Excavation Considerations

The site soils may be excavated with conventional excavation equipment, such as trackhoes or dozers. The site might also contain surficial fill and foundation elements and/or utilities from previous site development, debris, rubble and/or cobbles and boulders. We recommend that procedures be identified in the project specifications for measurement and payment of work associated with obstructions.

7.3.2. Soldier Pile and Tieback Walls

Soldier pile walls consist of steel beams that are concreted into drilled vertical holes located along the wall alignment, typically about 8 feet on center. After excavation to specified elevations, tiebacks are installed, if necessary. Once the tiebacks are installed, the pullout capacity of each tieback is tested, and the tieback is locked off to the soldier pile at or near the design tieback load. Tiebacks typically consist of steel strands that are installed into pre-drilled holes and then either tremie or pressure grouted. Timber lagging is typically installed behind the flanges of the steel beams to retain the soil located between the soldier piles. Geotechnical design recommendations for each of these components of the soldier pile and tieback wall system are presented in the following sections.

7.3.2.1. Soldier Piles

We recommend that soldier pile walls be designed using the earth pressure diagram presented in Figure 3. The earth pressures presented in Figure 3 are for full-height cantilever soldier pile walls and soldier pile walls with single or multiple levels of tiebacks, and the pressures represent the estimated loads that will be applied to the wall system for various wall heights. The earth pressures presented on Figure 3 are for areas where limited thicknesses of fill and recent deposits are encountered and the shoring system is typically constructed in glacially consolidated soils. If shoring walls will be constructed in areas of fill and recent deposits, GeoEngineers should review and provide revised design earth pressures.

The earth pressures presented in Figure 3 include the loading from traffic surcharge. Recommended surcharge pressures for shoring wall design are presented in Figure 4, Recommended Surcharge Pressure. Other surcharge loads, such as cranes, construction equipment or construction staging areas, should be considered by GeoEngineers on a case-by-case basis. No seismic pressures have been included in Figure 3 because it is assumed that the shoring will be temporary.

We recommend that the embedded portion of the soldier piles be at least 2 feet in diameter and extend a minimum distance of 10 feet below the base of the excavation to resist "kick-out." The axial capacity of the soldier piles must resist the downward component of the anchor loads and other vertical loads, as appropriate. We recommend using an allowable end bearing value of 40 ksf for piles supported on the glacially consolidated soils. The allowable end bearing value should be applied to the base area of the drilled hole into which the soldier pile is concreted. This value includes a factor of safety of about 2.5. The allowable end bearing value assumes that the shaft bottom is cleaned out immediately prior to concrete placement. If necessary, an allowable pile skin friction of 2.0 ksf may be used on the embedded portion of the soldier piles to resist the vertical loads.

7.3.2.2. Lagging

Table 3 below presents recommend lagging thicknesses (roughcut) as a function of soldier pile clear span and depth.

TABLE 3. TIMBER LAGGING RECOMMENDATIONS

	Recommended Lagging Thickness (roughcut) for clear spans of:					
Depth (feet)	**5 feet**	**6 feet**	**7 feet**	**8 feet**	**9 feet**	**10 feet**
0 to 25	2 inches	3 inches	3 inches	3 inches	4 inches	4 inches
25 to 50	3 inches	3 inches	3 inches	4 inches	4 inches	5 inches

Lagging should be installed promptly after excavation, especially in areas where perched groundwater is present or where clean sand and gravel soils are present and caving soils conditions are likely. The workmanship associated with lagging installation is important for maintaining the integrity of the excavation.

The space behind the lagging should be filled with soil as soon as practicable. We recommend that voids be backfilled immediately or within a single shift, depending on the selected method of backfill. Placement of this material will help reduce the risk of voids developing behind the wall and damage to existing improvements located behind the wall.

Material used as backfill in voids located behind the lagging should not cause buildup of hydrostatic pressure behind the wall. Lean concrete is a suitable option for the use of backfill behind the walls. Lean concrete will reduce the volume of voids present behind the wall. Alternatively, lean concrete may be used for backfill behind the upper 15 to 20 feet of the excavation to limit caving and sloughing of the upper soils, with on-site soils used to backfill the voids for the remainder of the excavation. Based on our experience, the voids between each lean concrete lift are sufficient for preventing the buildup of hydrostatic pressure behind the wall.

7.3.2.3. Tiebacks

Tieback anchors can be used for wall heights where cantilever soldier pile walls are not cost-effective. Tieback anchors should extend far enough behind the wall to develop anchorage beyond the "no-load" zone and within a stable soil mass. The anchors are typically inclined downward at 15 to 25 degrees below the horizontal. Corrosion protection will not be required for the temporary tiebacks.

Centralizers should be used to keep the tieback in the center of the hole during grouting. Structural grout or concrete should be used to fill the bond zone of the tiebacks. A bond breaker, such as plastic sheathing, should be placed around the portion of the tieback located within the no-load zone.

Loose soil and slough should be removed from the holes drilled for tieback anchors prior to installing the tieback. The contractor should take necessary precautions to minimize loss of ground and prevent disturbance to previously installed anchors and existing improvements in the site vicinity. Holes drilled for tiebacks should be grouted/filled promptly to reduce the potential for loss of ground.

Tieback anchors should develop anchorage in the glacially consolidated soils. We recommend that spacing between tiebacks be at least three times the diameter of the anchor hole to minimize group interaction. We recommend a design load transfer value between the anchor and soil of 4 kips per foot for glacially consolidated soils.

The tieback anchors should be verification- and proof-tested to confirm that the tiebacks have adequate pullout capacity. The pullout resistance of tiebacks should be designed using a factor of safety of 2. The pullout resistance should be verified by completing at least two successful verification tests in each soil type and a minimum of four total tests for the project. Each tieback should be proof-tested to 133 percent of the design load. Verification and proof tests should be completed as described in Appendix D, Ground Anchor Load Tests and Shoring Monitoring Program.

The tieback layout and inclination should be checked to confirm that the tiebacks do not interfere with adjacent buried utilities. Minimum clearances between ground anchors and existing utilities should be maintained.

7.3.2.4. Drainage

Drainage for soldier pile and lagging walls is achieved through seepage through the timber lagging. Seepage flows at the bottom of the excavation should be contained and controlled in order to prevent loss of soil from behind the lagging. Drainage should be provided for permanent below-grade walls as described below in the "Below-Grade Walls" section of this report.

7.3.3. Soil Nail Walls

The soil nail wall system consists of drilling and grouting rows of steel bars or "nails" behind the excavation face as it is excavated and then covering the face with reinforced shotcrete. The placement of soil nails reinforces the soils located behind the excavation face and increases the soil's ability to resist a mass of soil from sliding into the excavation.

Soil nail walls are typically constructed using the following sequence:

1. Excavate the soil at the wall face to between 1 and 3 feet below the row of soil nails to be installed. Depending upon the soil conditions at the wall face, the excavation may be completed with a vertical cut or with berms (native or fill).
2. Drill, install and grout soil nails.
3. Excavate berm, if present, located within about 3 feet below the elevation of the soil nail.
4. Place drainage strips, steel wire mesh and/or reinforcing bars in front of excavated soil.
5. Install shotcrete and place steel plates and nuts over soil nails.
6. Complete nail pullout capacity testing on approximately one out of every 20 nails in an installed row.
7. Repeat steps 3 through 6 for each row of nails located below the completed row.

Vertical elements provide face stability and deflection control, as well as to provide for utility clearance. These are not anticipated to be required for design based on the limited thickness of fill/recent deposits encountered in the borings. The need for vertical elements should be re-evaluated during design once the depth and location of the planned excavation has been determined.

Soil nails typically consist of #8 (1-inch-diameter) to #10 (1¼-inch-diameter) threaded steel bars. The steel bars are placed in 6- to 8-inch-diameter holes drilled at angles typically ranging from 10 to 25 degrees below horizontal. Centralizers are used to center the steel bars in the holes. Once the steel bars are installed, the holes are tremie grouted using cement grout or concrete.

The soils typically are required to have an adequate standup time (to allow placement of the steel wire mesh and/or reinforcing bars to be installed and the shotcrete to be placed). Soils that have short standup times are problematic for soil nailing.

7.3.3.1. Design Recommendations

We recommend the following for design purposes:

- A soil nail grid pattern of about 6 feet by 6 feet. A tighter grid pattern may be necessary where construction-related surcharges are anticipated.
- A soil nail length ranging up to the wall height (but not less than 10 feet), inclined at approximately 15 to 20 degrees from the horizontal.
- An allowable load transfer value of 1.5 kip per foot for fill and recent deposits and 4 kips per foot for the glacially consolidated soils for 6-inch-diameter holes.
- Strips of drainage material installed behind the shotcrete to relieve hydrostatic pressures. Additional drainage provisions may be necessary if significant groundwater is encountered during the excavation.

The fill associated with utilities located behind the walls will affect the soil nail design. Typically, the soil nail spacing is tighter or the soil nails are longer, or both, where fill or looser native soils are present compared to where stiff to hard silt and clay or dense to very dense sand and gravel soils are present.

Difficulties associated with face stability and standup time may be experienced during construction in the site soils. Fill soils are often loose to medium dense and, as a result, may have a shorter standup time. Spalling and raveling of the cut face may occur at these locations during soil nail wall installation. Construction techniques used to mitigate spalling and raveling include the following:

- Excavating leaving a 1H:1V (horizontal to vertical) earth berm in front of the wall. The soil nails are installed by drilling through the soil berm. The native soil berm is then removed to allow for installation of the drainage material and reinforcing steel and shotcrete.
- Excavating to the planned back of shotcrete facing and then placing a 1H:1V fill berm in front of the wall. The fill berm is then removed just before placement of drainage material, reinforcement, and shotcrete.
- Shortening the length of wall drilled and shotcreted using a staggered excavation approach.

Contractors experienced in the soil nailing method should be able to mitigate significant spalling and raveling conditions. Contractors should also be prepared to use techniques to address problems that occur because of caving soils. The contractor should be made responsible for the safety of the shoring system.

7.3.3.2. Soil Properties

Based on the information obtained from the subsurface explorations completed on, and adjacent to, the project site and our experience with similar projects, we recommend the soil parameters for design of the soil nail temporary shoring as summarized in Table 4 below.

TABLE 4. SOIL NAIL DESIGN PARAMETERS

Soil Type	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)	Allowable Load Transfer (klf)
Fill/Recent Deposits	120	30	0	1.5
Glacially Consolidated Soils	135	40	200	4

Notes:
pcf = pounds per cubic foot
psf = pounds per square foot
klf = kips per lineal foot

The elevation for the glacially consolidated soils should be estimated from the boring logs.

7.3.3.3. Soil Nail Wall Performance

A soil nail wall is a passive shoring system that requires deflections for load to be applied to the soil nails. We recommend that the soil nail wall be designed such that average wall deflections are limited to 1 inch and ground surface settlements behind the wall are less than about 1 inch. Where existing structures are located behind the face of the shoring wall within a distance equal to or less than the planned height of the shoring wall, the soil nail wall should be designed to limit deflections of the structure to less than ½ inch.

The deflections and settlements are usually highest at the excavation face and decrease to negligible amounts beyond a distance behind the wall equal to the excavation height. Wall deflections can be reduced by post-tensioning the upper row or rows of soil nails. Localized deflections may exceed the above estimates and may reflect local variations in soil conditions (such as around abandoned side sewers) or may be the result of the techniques and quality used in constructing the wall.

Monitoring of the shoring system should be completed as described in Appendix D.

7.3.3.4. Drainage

A suitable drainage system should be installed to prevent the buildup of hydrostatic groundwater pressures behind the soil nail walls. Drainage behind soil nail walls typically consists of prefabricated geocomposite drainage strips, such as Mirafi G100™, installed vertically between the soil nails. The drainage strips are typically a minimum of 16 inches wide and extend the entire height of the wall. We recommend that drainage strips be connected to weep pipes at the base of excavation to allow groundwater to pass through the shotcrete facing.

7.3.4. Construction Considerations

Shoring construction shall be completed by a qualified shoring contractor. A shoring contractor is qualified if they have successfully completed at least 10 projects of similar size and complexity in the Puget Sound area during the previous 5 years. Interested shoring contractors should prepare a submittal documenting their qualifications unless this requirement is waived by GeoEngineers. The shoring contractor's superintendent shall have a minimum of 3 years' experience supervising soldier pile and tieback shoring construction and the drill operators and on-site supervisors shall have a minimum of 3 years' experience installing soldier piles and tiebacks. The personnel experience shall be included in the qualifications submittal.

Temporary casing or drilling fluid will be required to install the soldier piles and casing will be necessary for tiebacks/soil nails where:

- Loose fill is present;
- The native soils do not have adequate cementation or cohesion to prevent caving or raveling; and/or
- Perched groundwater is present.

GeoEngineers should be retained to observe and document the installation and testing of the shoring to verify conformance with design assumptions and recommendations.

7.3.5. Temporary Cut Slopes

The stability of open-cut slopes is a function of soil type, groundwater seepage, slope inclination, slope height and nearby surface loads. The use of inadequately designed open cuts could impact the stability of adjacent work areas, could affect existing utilities and could endanger personnel.

The contractor performing the work has the primary responsibility for protection of workers and adjacent improvements. In our opinion, the contractor will be in the best position to observe subsurface conditions continuously throughout the construction process and to respond to variable soil and groundwater conditions. Therefore, the contractor should have the primary responsibility for deciding whether to use open-cut slopes for much of the excavations rather than some form of temporary excavation support, and for establishing the safe inclination of the cut slope. Acceptable slope inclinations for utilities and ancillary excavations should be determined during construction. Because of the diversity of construction techniques and available shoring systems, the design of temporary cut slopes is most appropriately left to the contractor proposing to complete the installation. Temporary cut slopes and shoring must comply with the provisions of Chapter 296-155 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring."

For planning and layout purposes temporary unsupported cut slopes can be assumed to be inclined at 1.5H:1V maximum steepness within fill or recent deposit soils and no steeper than 1H:1V in the glacially consolidated soils. Ultimately the contractor and the contractor's designated competent person is responsible for establishing and maintaining safe temporary slopes. For open cuts at the site, we recommend that:

- No traffic, construction equipment, stockpiles or building supplies be allowed at the top of the cut slopes within a distance of at least 5 feet from the top of the cut;
- The cut slopes should be planned such that they do not encroach on a 1H:1V influence line projected down from the edges of nearby or planned foundation elements.
- Exposed soil along the slope be protected from surface erosion by using waterproof tarps or plastic sheeting;
- Construction activities be scheduled so that the length of time the temporary cut is left open is reduced to the extent practicable;
- Erosion control measures be implemented as appropriate such that runoff from the site is reduced to the extent practicable;

- Surface water be diverted away from the slope; and
- The general condition of the slopes be observed periodically by the geotechnical engineer to confirm adequate stability.

Water that enters the excavation must be collected and routed away from prepared subgrade areas. We expect that this may be accomplished by installing a system of drainage ditches and sumps along the toe of the cut slopes. Some sloughing and raveling of the cut slopes should be expected. Temporary covering, such as heavy plastic sheeting with appropriate ballast, should be used to protect these slopes during periods of wet weather. Surface water runoff from above cut slopes should be prevented from flowing over the slope face by using berms, drainage ditches, swales or other appropriate methods.

7.3.6. Shoring Wall Performance

Temporary shoring walls typically move on the order of 0.1 to 0.2 percent of the height of the wall and can be designed to limit lateral movement to 1 inch. Deflections and settlements are usually highest at the excavation face and decrease to negligible amounts beyond a distance behind the wall equal to the height of the excavation. Deflections of the shoring system can be affected by local variations in soil conditions (such as around side sewers) or may be the result of the techniques and quality used in the construction for the shoring wall (completed by the shoring contractor). Given that some movement is expected, existing improvements located adjacent to the temporary shoring system will also experience movement. The deformations discussed above are not likely to cause structural damage to structurally sound existing improvements; however, cosmetic damage is possible (for instance, cracks in drywall finishes; widening of existing cracks; minor cracking of slabs-on-grade/hardscapes; cracking of sidewalks, curbs/gutter, and pavements/ pavement panels; etc.). For this reason, it is important to complete pre-construction survey and photo or video documentation of existing buildings and nearby improvements prior to shoring construction. Refer to Appendix D for more detailed recommendations for shoring monitoring and preconstruction surveying.

7.4. Shallow Foundations

Three general soil units are present at the site: fill, recent deposits, and glacially consolidated soils. The fill and recent deposits are not suitable for shallow foundation support due to anticipated foundation settlement under typical foundation loads. The glacially consolidated soils can provide competent bearing for shallow foundations. Shallow foundations are the preferred foundation support option where bearing on glacially consolidated soils and should be assumed for design. Foundation support recommendations can be provided for competent recent deposits, if necessary, should planned foundations not extend to the glacially consolidated soils. The elevation and settlement criteria would need to be reviewed during design for this foundation support option.

7.4.1. Allowable Bearing Pressure

For foundations constructed as recommended in this report, we recommend using an allowable bearing pressure of 12 ksf for spread, perimeter, and mat foundations bearing on the glacially consolidated soils.

For shallow foundations bearing on existing fill or recent deposits, ground improvement consisting of rigid inclusions, stone columns, or RAPs can be used. For this condition, we recommend that an allowable bearing pressure of 6 ksf be used.

The allowable bearing pressure applies to the total of dead and long-term live loads and may be increased by up to one-third for wind or seismic loads. The allowable bearing pressures are net values.

7.4.2. Settlement

Provided that all loose soil is removed and that the subgrade is prepared as recommended under "Construction Considerations" below, we estimate that the total settlement of shallow foundations will be about 1 inch or less. The settlements will occur rapidly, essentially as loads are applied. Differential settlements between footings could be half of the total settlement. Note that smaller settlements will result from lower applied loads.

7.4.3. Lateral Resistance

Lateral foundation loads may be resisted by passive resistance on the sides of footings and by friction on the base of the shallow foundations. For shallow foundations supported on glacially consolidated soils, the allowable frictional resistance may be computed using a coefficient of friction of 0.4 applied to vertical dead-load forces.

The allowable passive resistance may be computed using an equivalent fluid density of 400 pounds per cubic foot (pcf) (triangular distribution). These values are appropriate for foundation elements that are poured directly against undisturbed glacially consolidated soils or surrounded by structural fill.

The above coefficient of friction and passive equivalent fluid density values incorporate a factor of safety of about 1.5.

7.4.4. Construction Considerations

We recommend that the condition of all subgrade areas be observed by GeoEngineers to evaluate whether the work is completed in accordance with our recommendations and whether the subsurface conditions are as anticipated.

If foundation construction is completed during periods of wet weather, foundation subgrades are recommended to be protected with a "rat slab" or "mud mat" consisting of 2 to 4 inches of lean or structural concrete.

If soft areas are present at the footing subgrade elevation, the soft areas should be removed and replaced with structural fill, lean concrete or controlled density fill (CDF) at the direction of GeoEngineers.

We recommend that the contractor consider leaving the subgrade for the foundations as much as 6 to 12 inches high, depending on soil and weather conditions, until excavation to final subgrade is required for foundation reinforcement. Leaving subgrade high will help reduce damage to the subgrade resulting from construction traffic for other activities.

The foundation recommendations provided in this report are intended for design and construction of building foundations. These recommendations may not be appropriate for temporary construction elements such as tower cranes, mobile cranes, worklifts, or other equipment. A qualified geotechnical engineer should be consulted to provide foundation support recommendations for tower cranes, mobile cranes, manlifts or other temporary construction equipment, as necessary.

7.4.1. Existing Parking Structure

The existing two-story parking structure located in the western portion of the site was constructed in the early 1990's. We understand that the foundations were constructed using an allowable bearing pressure of 6 ksf for foundations bearing on dense glacial till (western half of structure) and 3 ksf for foundations bearing on structural fill or medium dense silty sands (eastern half of structure).

We understand that the planned improvements may include the addition of one or two parking levels added to the existing structure. Based on the explorations completed adjacent to the parking structure the allowable bearing pressures used for design may be increased for future planned improvements. We recommend that the allowable bearing pressure for the dense glacial till be increased to 10 ksf and the structural fil or medium dense silty sand be increased to 7 ksf. We recommend that the project team meet to review the existing structural plans and the revised allowable bearing pressures for the structure.

7.5. Ground Improvement

Due to the presence of compressible fill and recent deposit soils in the northern portion of the site, the use of spread foundations with ground improvement may be necessary to meet static settlement and/or seismic induced settlement tolerances. General recommendations are provided below for ground improvement using rigid inclusions, stone columns, or RAPs. During the design phase of the project, foundation support options should be reviewed with the project team to determine the preferred foundation support alternative. Overexcavation and replacement may also be an option when foundation are located within a few feet of bearing soils.

The purpose of ground improvement is to mitigate potential static and/or seismic induced settlement resulting from settlement of the near surface fill and/or the recent deposits. The benefits of ground improvement for this site include the following:

- Ground improvement will allow for conventional shallow foundations and slabs-on-grade both of which are anticipated to result in more efficient and more cost effective construction.
- Ground improvement will mitigate the potential static and seismic settlement resulting from settlement of the near surface soils under the building loads.

Where ground improvement is used, an allowable bearing pressure of 6 ksf is recommended for preliminary design. This allowable bearing pressure should be reviewed during design after the preferred foundation support methodology has been selected. The following sections provide a general description of ground improvement methodologies.

7.5.1. Rigid Inclusions

Rigid inclusions consist of unreinforced lean concrete columns installed to the bearing soil below the building foundation elements on a variable grid pattern. The design concept with the use of rigid inclusions is similar to that of stone columns or RAPs—to densify and reinforce the compressible soils. The purpose of the rigid inclusions placed in a grid pattern is to provide a significantly higher strength material capable of dissipating building loads in a less concentrated manner and to provide a 'block' of a composite soil and lean concrete material that will reduce the potential for differential settlement.

Advantages with the use of rigid inclusions include: (1) lean concrete columns are more economical than augercast piles (shorter length, no reinforcement, and allows for the use of conventional spread footings/slabs-on-grade), (2) there is minimal disturbance of adjacent structures during installation, and (3) because there is a lower level of construction noise (i.e. no pile driving), there will be lesser impacts to nearby businesses/residences/buried utilities during construction.

Rigid inclusions are constructed using similar techniques for installing drilled shafts or augercast piles. Where augercast methods are used, the first step in the rigid inclusion casting process consists of drilling the auger into the ground to the specified tip elevation of the column. Grout is then pumped into the hole using a tremie pipe. For drilled shaft installation methodology, the shaft is drilled to the specified tip elevation, the bottom of the shaft is then cleaned out, and lean concrete is placed into the drilled shaft. Measures to maintain shaft stability, such as the use of a water head, polymer slurry, or temporary casing may be required depending on the ground conditions. Where water is present in the drilled shaft, the concrete should be placed using a tremie pipe.

The layout/design of the rigid inclusions will be completed once the building design has been finalized. GeoEngineers can assist the project team with preparation of the ground improvement plan and specifications once the foundation layout and building loads have been finalized.

7.5.2. Stone Columns and Rammed Aggregate Piers

Stone columns and RAPs are considered to be appropriate ground improvement techniques for this site. The intent of these ground improvement techniques is to improve the near surface soils sufficiently to control static and seismic induced settlement to within tolerable levels.

RAPs consist of columns of crushed aggregate that are compacted in-place in thin lifts using a hydraulic ram. The RAPs are completed on a grid pattern under foundations. The depth and spacing of the RAPs depends on the foundation loads, soil conditions, and settlement tolerances.

The stone column technique uses a large vibrator to advance a probe to the design depth. Crushed aggregate is injected at the tip of the vibrator as it is removed. Compaction is achieved using vibration, and working the vibrator up and down as it is removed, to create a column of densely compacted crushed aggregate. Stone columns are installed on a grid pattern below foundations. The depth and spacing of the stone columns depends on the foundation loads, soil conditions, and settlement tolerances.

These ground improvement techniques will result in a composite soil mass that has improved strength, and reduced compressibility under building loads. We recommend that the RAPs or stone columns extend into bearing soils located below the base of the excavation.

Both of these methods would likely create some vibration to the surrounding area, but less than that which would result from driven piles. These vibrations are not expected to adversely affect nearby off-site structures. However, it is likely that the vibrations will be noticed within a limited area in and adjacent to the site.

We recommend that the RAPs or stone columns be installed in a grid pattern below the shallow foundations. The stone columns or RAPs would support moderate foundation loads and reduce post construction settlement to an acceptable amount.

Rock replacement ratio, spacing and diameter should be determined by the ground improvement contractor who should develop a performance-based design that will meet the support and settlement criteria specified by the structural engineer. We recommend that we be retained to review the proposed ground improvement program and observe the installation of the selected ground improvement method.

7.6. Deep Foundations

Deep foundations may be appropriate for foundation support, in lieu of shallow foundations bearing on improved ground. Pin piles may be appropriate depending on the load for the structure. Augercast piles may also be suitable if larger loads than anticipated are present. The need for deep foundations should be reviewed during design for the planned structure.

7.6.1. Pin Piles

Small-diameter pipe piles are suitable for support of compressive foundation loads that exceed the allowable bearing pressure provided above. We recommend an allowable design load for 4- and 6-inch-diameter pipe piles driven to refusal criteria as shown in Table 5.

TABLE 5. PIN PILE DESIGN CRITERIA

Pile Diameter[1]	Seconds per Inch	Allowable Axial Compression (kips)
4-inch	10	20
6-inch	20	30

Notes:
[1] Installed with an 1,100-pound hydraulic hammer

We recommend that the piles be installed using a excavator-mounted pneumatic jackhammer with a hammer weight of at least 1,100 pounds. Piles should be driven to refusal criteria summarized in Table 5. The capacities apply to single piles. If piles are spaced at least 2 feet on center, as recommended, no reduction of the axial capacity for group action is needed. We estimate pile settlements on the order of ½ inch, occurring rapidly following load application.

Pile tip depths are estimated to extend between 5 and 10 feet into glacially consolidated soils. However, actual pile penetration may vary significantly. Steel pipe piles have a risk of corrosion and are typically galvanized as a corrosion protection measure. Refusal criteria and pile capacities will need to be confirmed by completing a load test for each pile type used.

We recommend that for each proposed pile type and selected hammer, a load test pile be driven to assess the ability to meet the driving criteria recommended above. The test piles should be loaded to at least 200 percent of the allowable design load. The pile load tests should be observed by a geotechnical engineer from our firm. Pin pile load tests are typically accomplished by jacking against a large piece of construction equipment or a load frame. The equipment is centered over the top of the pile and a hydraulic jack equipped with a hydraulic pump and a pressure gauge is placed between the excavator/load frame and pile. The load is applied in increments and downward deflection measurements are recorded at each load. The load vs. deflection is plotted to determine the pile capacity and factor of safety.

Allowable axial compression loads summarized in Table 4 are provided for Allowable Stress Design (ASD), and the allowable capacities are for combined dead plus long-term live loads. Given that the pin piles will

be driven within glacially consolidated soils, a one-third increase can be used for seismic or wind loading. The allowable capacities are based on the strength of the supporting soils for the depths below the existing ground surface and include a factor of safety of 2.

If lateral capacities of the pin piles are needed, GeoEngineers can provide during design.

7.7. Slab-on-Grade Floors

Slabs-on-grade with below-slab drainage may be used across the building footprint where lowest finished floor elevation are located within the glacially consolidated soils. They may also be appropriate where located within fill or recent deposits, however settlement of the slabs-on-grade would need to be reviewed for this condition. The following sections provide design recommendations for subgrade preparation, slab-on-grade design parameters, and below-slab drainage.

7.7.1. Subgrade Preparation

The exposed subgrade should be evaluated after site grading is complete. Probing should be used to evaluate the subgrade. The exposed subgrade should be firm and unyielding, and without significant groundwater. Disturbed areas should be recompacted if possible or removed and replaced with compacted structural fill.

The site should be rough graded to approximately 1-foot above-slab subgrade elevation prior to foundation construction in order to protect the slab subgrade from deterioration from wet weather or construction traffic. After the foundations and below slab drainage system have been constructed, the remaining soils can be removed to final subgrade elevation followed by immediate placement of the capillary break material.

7.7.2. Design Parameters

Conventional slabs may be supported on-grade, provided the subgrade soils are prepared as recommended in the "Subgrade Preparation" section above. We recommend that the slab be founded on either undisturbed glacially consolidated soils or structural fill placed over the undisturbed glacially consolidated soils. For slabs designed as a beam on an elastic foundation, a modulus of subgrade reaction of 150 pounds per cubic inch (pci) may be used for subgrade soils prepared as recommended.

We recommend that the slab-on-grade floors be underlain by a 6-inch-thick capillary break consisting of material meeting the requirements of Mineral Aggregate Type 22 (¾-inch crushed gravel), City of Seattle Standard Specification 9-03.14.

Provided that loose soil is removed and the subgrade is prepared as recommended, we estimate that slabs-on-grade will not settle appreciably.

7.7.3. Below-Slab Drainage

We expect the static groundwater level to be located below the slab-on-grade level for the proposed building, and perched groundwater may be present above the slab subgrade elevation. We recommend installing an underslab drainage system to remove water from below the slab-on-grade. The underslab drainage system should include an interior perimeter drain. The drains should consist of perforated Schedule 40 polyvinyl chloride (PVC) pipes with a minimum diameter of 4 inches placed in a trench at least

12 inches deep. The top of the underslab drainage system trenches should coincide with the base of the capillary break layer. The underslab drainage system pipes should have adequate slope to allow positive drainage to the sump/gravity drain.

The drainage pipe should be perforated. Perforated pipe should have two rows of ½-inch holes spaced 120 degrees apart and at 4 inches on center. If the perimeter underslab drain will also be used to collect weep pipes from the below-grade walls, it is recommended that the holes of the perforated pipe be oriented up. The underslab drainage system trenches should be backfilled with Mineral Aggregate Type 22 or Type 5 (1-inch washed gravel), City of Seattle Standard Specification 9-03.14, or an alternative approved by GeoEngineers. The Type 22 or Type 5 material should be wrapped with a geotextile filter fabric meeting the requirements of construction geotextile for underground drainage, Washington State Department of Transportation (WSDOT) Standard Specification 9-33. The underslab drainage system pipes should be connected to a header pipe and routed to a sump or gravity drain. Appropriate cleanouts for drainpipe maintenance should be installed. The flow rate for the planned excavation in the below slab drainage and below-grade wall drainage systems is anticipated to be less than 5 gallons per minute (gpm).

If no special waterproofing measures are taken, leaks and/or seepage may occur in localized areas of the below-grade portion of the building, even if the recommended wall drainage and below-slab drainage provisions are constructed. If leaks or seepage is undesirable, below-grade waterproofing should be specified. A vapor barrier should be used below slab-on-grade floors located in occupied portions of the building. Specification of the vapor barrier requires consideration of the performance expectations of the occupied space, the type of flooring planned and other factors, and is typically completed by other members of the project team.

Although, the regional groundwater table may be located below the base of excavation when bearing within the glacially consolidated soils, perched groundwater may be present at higher elevations and should be anticipated below the elevation where foundation drainage is provided for the building. Structural elements (such as vaults, elevator pits, stairwells, etc.) that extend below the foundation drainage elevation should be designed for hydrostatic pressures up to the adjacent foundation drainage elevation.

7.8. Below-Grade Walls

7.8.1. Permanent Below-Grade Walls

Permanent below-grade walls should be designed for the pressures presented in Figure 5, Earth Pressure Diagram – Permanent Below Grade Walls. Surcharge loads, such as cranes, construction equipment or construction staging areas, should be evaluated using Figure 4.

The soil pressures recommended above assume that wall drains will be installed to prevent the buildup of hydrostatic pressure behind the walls, as described above in the "Excavation Support" section of this report, and tied to permanent drains to remove water to suitable discharge points.

7.8.2. Other Cast-in-Place Walls

Conventional cast-in-place walls may be necessary for small retaining structures located on-site. The lateral soil pressures acting on conventional cast-in-place subsurface walls will depend on the nature, density and configuration of the soil behind the wall and the amount of lateral wall movement that can occur as backfill is placed.

For walls that are free to yield at the top at least 0.1 percent of the height of the wall, soil pressures will be less than if movement is limited by such factors as wall stiffness or bracing. Assuming that the walls are backfilled and drainage is provided as outlined in the following paragraphs, we recommend that yielding walls supporting horizontal backfill be designed using an equivalent fluid density of 35 pcf (triangular distribution), while non-yielding walls supporting horizontal backfill be designed using an equivalent fluid density of 55 pcf (triangular distribution). For seismic loading conditions, a rectangular earth pressure equal to 7H pounds per square foot (psf) (where H is the height of the wall in feet) should be added to the active/at-rest pressures. Other surcharge loading should be applied as appropriate.

Lateral resistance for conventional cast-in-place walls can be provided by frictional resistance along the base of the wall and passive resistance in front of the wall. For walls founded on native glacially consolidated soils, the allowable frictional resistance may be computed using a coefficient of friction of 0.4 applied to vertical dead-load forces. The allowable passive resistance may be computed using an equivalent fluid density of 400 pcf (triangular distribution). The above coefficient of friction and passive equivalent fluid density values incorporate a factor of safety of about 1.5.

The above soil pressures assume that wall drains will be installed to prevent the buildup of hydrostatic pressure behind the walls, as discussed below.

7.8.3. Drainage

Drainage behind the permanent below-grade walls is typically provided using prefabricated drainage board attached to the temporary shoring walls. Weep pipes that extend through the permanent below-grade wall should be installed around the perimeter of the building at the footing elevation. The weep pipes should have a minimum diameter of 4 inches. The weep pipes through the permanent below-grade wall should be spaced no more than 20 feet on center and should be hydraulically connected to the sump. These weep pipes may be designed for a hard connection to the perimeter drains discussed above in the "Below-Slab Drainage" section of this report.

The earth pressures for permanent below-grade walls assume that adequate drainage is provided behind the wall. Prefabricated geocomposite drainage material, such as Aquadrain 15X, should be installed vertically to the face of the lagging/shotcrete. The Aquadrain 15X drainage material should terminate at the base of the shoring wall. The weep pipes that penetrate the basement wall should connect to the geocomposite drainage material by means of a prefabricated drainage grate. For soldier pile or soil nail shoring walls, the drainage material should be installed on the excavation side of the lagging/shotcrete facing, with the fabric adjacent to the lagging/shotcrete facing.

Full wall face coverage is recommended to minimize seepage and/or wet areas at the face of the permanent wall. Full wall face coverage should extend from the weep pipe elevation up to about 3 to 5 feet below the top of the wall to reduce the potential for surface water to enter the wall drainage system. Although the use of full wall face coverage will reduce the likelihood of seepage and/or wet areas at the face of the permanent wall, the potential still exists for these conditions to occur. If this is a concern, waterproofing should be specified.

Positive drainage should be provided behind cast-in-place retaining walls by placing a minimum 2-foot-wide zone of Mineral Aggregate Type 17 (bank run gravel), City of Seattle Standard Specification 9-03.14, with the exception that the percent passing the U.S. No. 200 sieve is to be less than 3 percent. A perforated

drainpipe should be placed near the base of the retaining wall to provide drainage. The drainpipe should be surrounded by a minimum of 6 inches of Mineral Aggregate Type 22 (¾-inch crushed gravel) or Type 5 (1-inch washed gravel), City of Seattle Standard Specification 9-03.14, or an alternative approved by GeoEngineers. The Type 22 or Type 5 material should be wrapped with a geotextile filter fabric meeting the requirements of construction geotextile for underground drainage, WSDOT Standard Specification 9-33. The wall drainpipe should be connected to a header pipe and routed to a sump or gravity drain. Appropriate cleanouts for drainpipe maintenance should be installed. A larger-diameter pipe will allow for easier maintenance of drainage systems.

As noted above, the flow rate for the planned excavation in the below slab drainage and below-grade wall drainage systems is anticipated to be less than 5 gpm.

7.9. Earthwork

7.9.1. Subgrade Preparation

The exposed subgrade in structure and hardscape areas should be evaluated after site excavation is complete. Disturbed areas below slabs should be recompacted if the subgrade soil consists of granular material. If the subgrade soils consist of disturbed soils, it will likely be necessary to remove and replace the disturbed soil with structural fill unless the soil can be adequately moisture-conditioned and compacted.

7.9.2. Structural Fill

Fill placed to support structures, placed behind retaining structures, and placed below pavements and sidewalks will need to be specified as structural fill as described below:

- If structural fill is necessary beneath building foundations bearing on glacially consolidated soils, the fill should consist of lean concrete or CDF, where bearing on glacially consolidated soils).
- If structural fill is necessary beneath building foundations bearing on improved ground, the fill should meet the requirements of Mineral Aggregate Type 2 or Type 17 (1¼-inch minus crushed rock or bank run gravel), City of Seattle Standard Specification 9-03.14.
- If structural fill is necessary beneath building slabs or around foundations, the fill should meet the requirements of Mineral Aggregate Type 2 or Type 17 (1¼-inch minus crushed rock or bank run gravel), City of Seattle Standard Specification 9-03.14.
- Structural fill placed behind retaining walls should meet the requirements of Mineral Aggregate Type 17 (bank run gravel), City of Seattle Standard Specification 9-03.14.
- Structural fill placed within utility trenches and below pavement and sidewalk areas should consist of CDF, or fill meeting the requirements of Mineral Aggregate Type 17 (bank run gravel), City of Seattle Standard Specification 9-03.14.
- Structural fill placed around perimeter footing drains, underslab drains and cast-in-place wall drains should meet the requirements of Mineral Aggregate Type 5 (1-inch washed gravel) or Type 22 (¾-inch crushed gravel), City of Seattle Standard Specification 9-03.14, with the exception that the percent fines be less than 3 percent.
- Structural fill placed as capillary break material should meet the requirements of Type 22 (¾-inch crushed gravel), City of Seattle Standard Specification 9-03.14.

- Structural fill placed as crushed surfacing base course below pavements and sidewalks should meet the requirements of Mineral Aggregate Type 2 (1¼-inch minus crushed rock), City of Seattle Standard Specification 9-03.14.

7.9.2.1. On-site Soils

The on-site soils are moisture-sensitive and may have natural moisture contents higher than the anticipated optimum moisture content for compaction. As a result, the on-site soils may require moisture conditioning in order to meet the required compaction criteria during dry weather conditions and will not be suitable for reuse during wet weather. Furthermore, most of the anticipated fill soils required for this project have specific gradation requirements, and the on-site soils do not meet these gradation requirements. For budget and planning purposes, we recommend that the project team assume importing structural fill, where needed. If the contractor wants to use on-site soils for structural fill, GeoEngineers can evaluate the on-site soils for suitability as structural fill, as required.

7.9.2.2. Fill Placement and Compaction Criteria

Structural fill should be mechanically compacted to a firm, non-yielding condition. Structural fill should be placed in loose lifts approximately 6 to 8 inches thick (small vibratory equipment) or 10 to 12 inches thick (large vibratory equipment). Each lift should be conditioned to the proper moisture content and compacted to the specified density before placing subsequent lifts. Structural fill should be compacted to the following criteria:

- Structural fill placed in building areas (surrounding foundations or supporting slab-on-grade floors) and in pavement and sidewalk areas (including utility trench backfill) should be compacted to at least 95 percent of the maximum dry density (MDD) estimated in general accordance with ASTM D 1557.
- Structural fill placed against subgrade walls should be compacted to between 90 and 92 percent. Care should be taken when compacting fill against subsurface walls to avoid over-compaction and, hence overstressing the walls.

We recommend that GeoEngineers be present during probing of the exposed subgrade soils in building and pavement areas, and during placement of structural fill. We will evaluate the adequacy of the subgrade soils and identify areas needing further work, perform in-place moisture-density tests in the fill to verify compliance with the compaction specifications, and advise on any modifications to the procedures that may be appropriate for the prevailing conditions.

7.9.2.3. Weather Considerations

The on-site soils contain a sufficient percentage of fines (silt and clay) to be moisture-sensitive. When the moisture content of these soils is more than a few percent above the optimum moisture content, these soils become muddy and unstable, and operation of equipment on these soils is difficult. The on-site glacially consolidated soils may soften when exposed to rainfall and construction traffic. Additionally, disturbance of near-surface soils should be expected if earthwork is completed during periods of wet weather. During wet weather, we recommend the following:

- The ground surface in and around the work area should be sloped so that surface water is directed away from the work area. The ground surface should be graded such that areas of ponded water do not develop. The contractor should take measures to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.

- Slopes with exposed soils should be covered with plastic sheeting or similar means.
- The site soils should not be left uncompacted and exposed to moisture. Sealing the surficial soils by rolling with a smooth-drum roller prior to periods of precipitation will reduce the extent to which these soils become wet or unstable.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practicable.

7.10. Recommended Additional Geotechnical Services

GeoEngineers will complete a design-level geotechnical engineering evaluation for the project, which is anticipated to confirm or modify, as appropriate, the preliminary design recommendations presented in this report. We recommend that additional explorations be completed near the north end of the project site to delineate the elevation for the bearing soils contact adjacent to the wetland and a boring located at the southeast corner of the existing parking structure. GeoEngineers should be retained to review the project plans and specifications when complete to confirm that our design recommendations have been implemented as intended.

During construction, GeoEngineers should observe the installation of the shoring system, review/collect shoring monitoring data, evaluate the suitability of the foundation subgrades, observe installation of subsurface drainage measures, evaluate structural backfill, observe the condition of temporary cut slopes, and provide a summary letter of our construction observation services. The purposes of GeoEngineers construction phase services are to confirm that the subsurface conditions are consistent with those observed in the explorations and other reasons described in Appendix E, Report Limitations and Guidelines for Use.

8.0 LIMITATIONS

We have prepared this report for the exclusive use of Nitze-Stagen & Company, Inc. and their authorized agents for the 20800 44th Avenue West project in Lynnwood, Washington.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments are only a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please refer to Appendix E for additional information pertaining to use of this report.

9.0 REFERENCES

City of Seattle, 2020, "Standard Specifications for Road, Bridge and Municipal Construction."

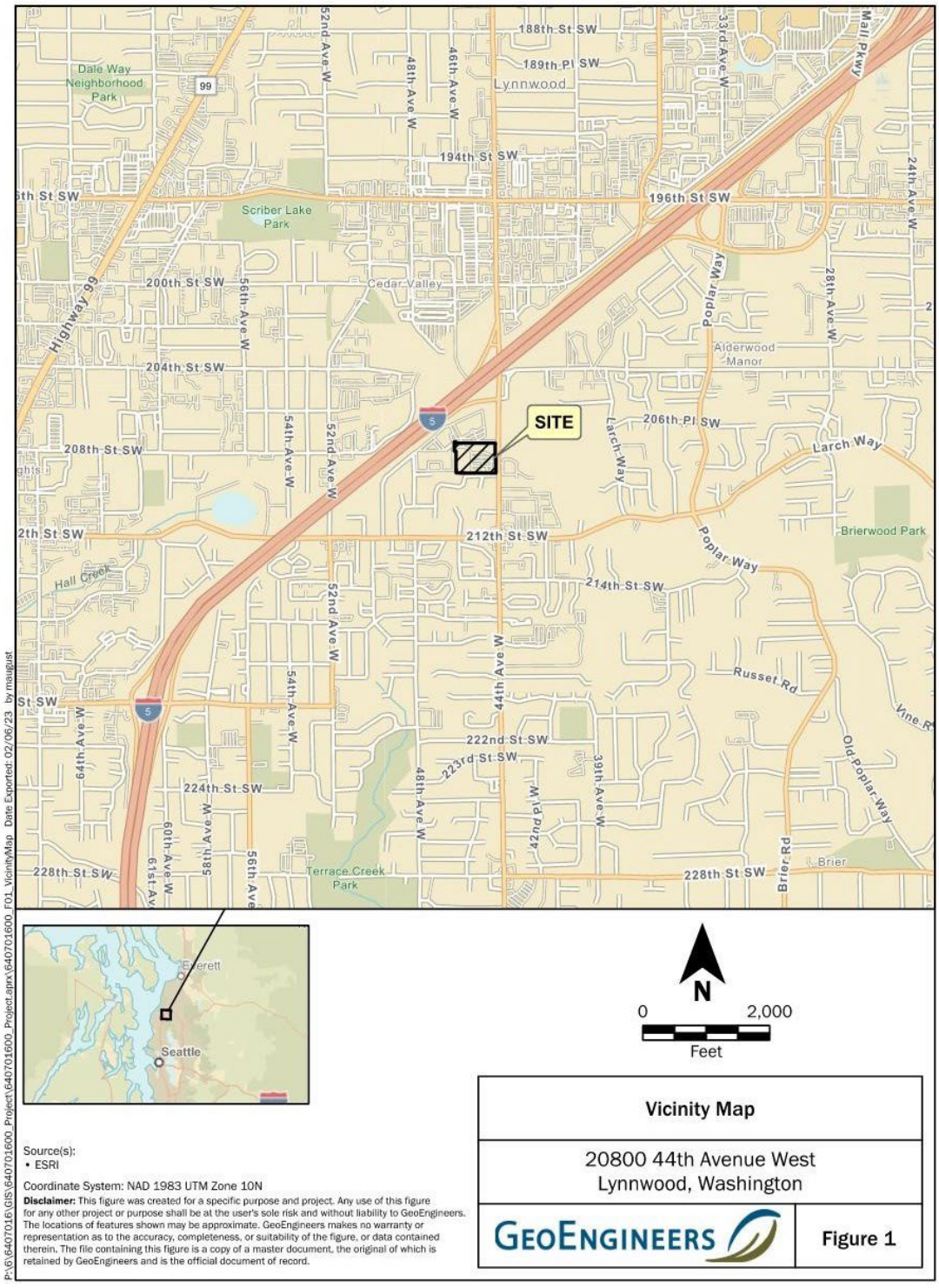
Geotech Consultants, 1990, "Geotechnical Engineering Study, Quadrant I-5 Center/Phase II Parking Garage, Southeast of I-5 and 44th Ave. West, Lynnwood, Washington."

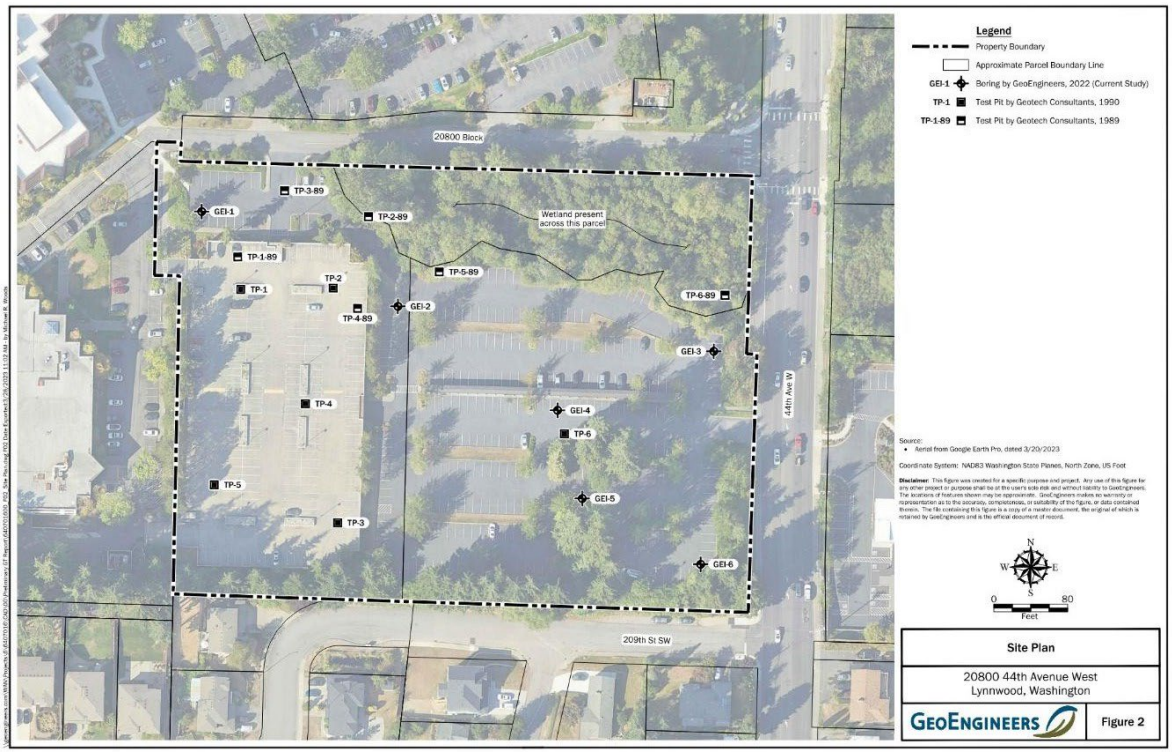
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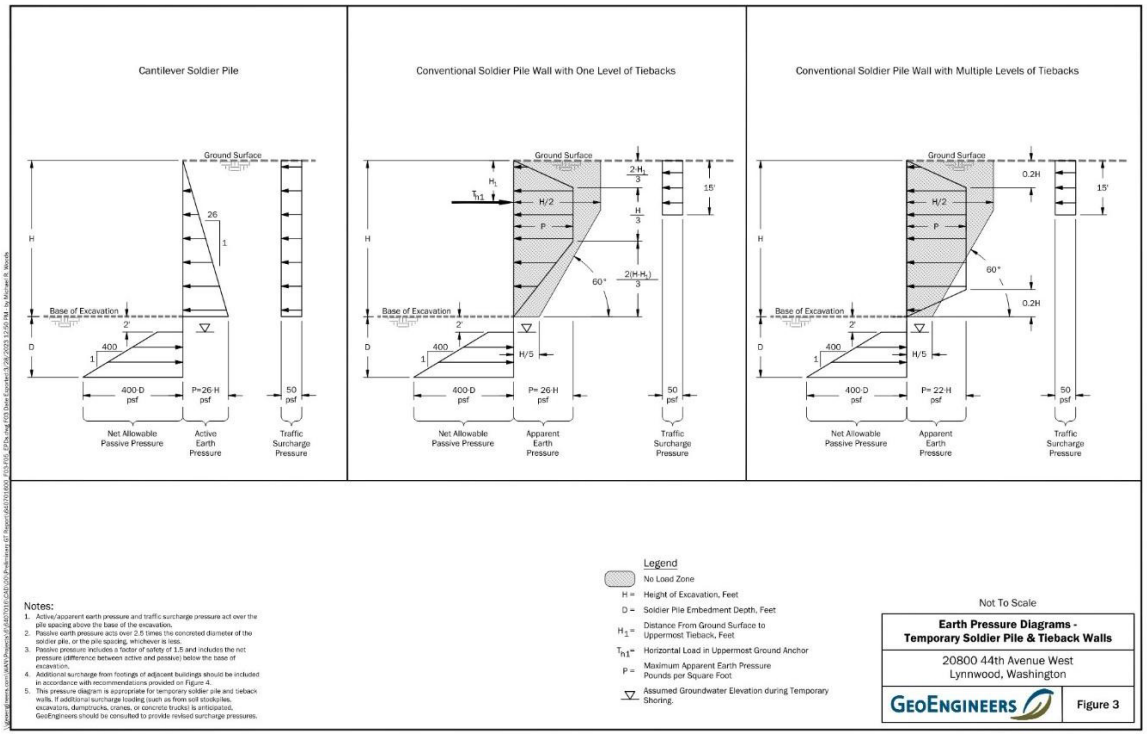
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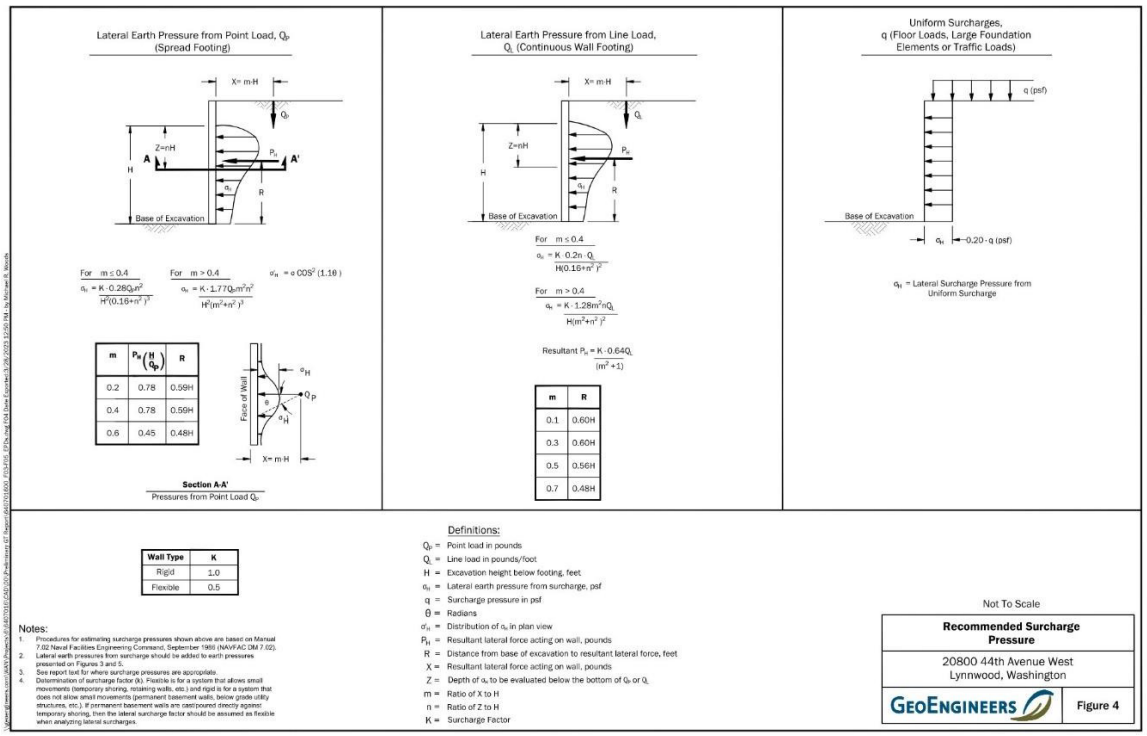
FIGURES

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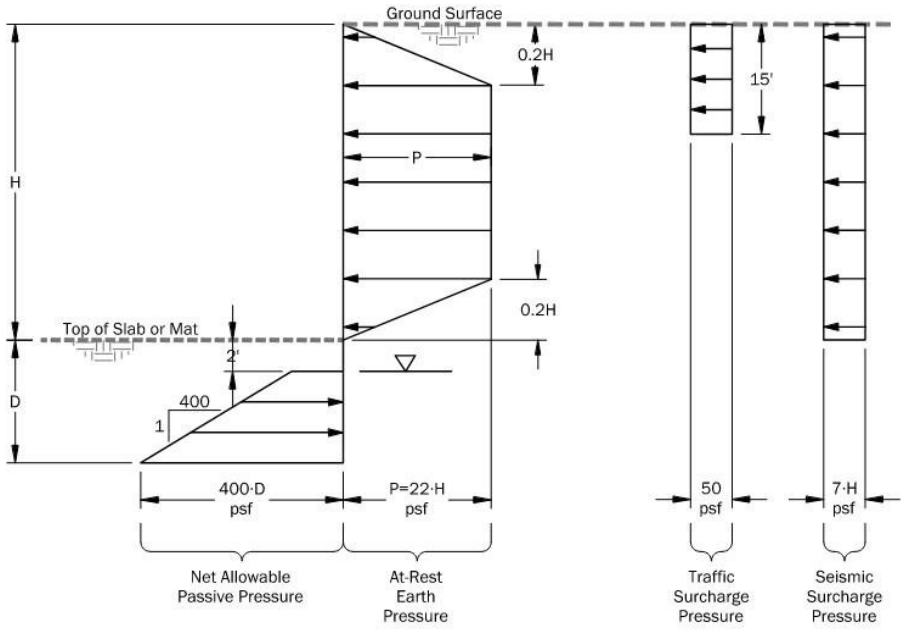

SITE
188th St SW
189th Pl SW
Lynnwood
194th St SW
196th St SW
200th St SW
204th St SW
206th Pl SW
208th St SW
212th St SW
214th St SW
222nd St SW
223rd St SW
224th St SW
228th St SW
Dale Way Neighborhood Park
Scriber Lake Park
Cedar Valley
Alderwood Manor
Brierwood Park
Terrace Creek Park
Brier
Highway 99
Poplar Way
Larch Way
Russet Rd
Old Poplar Way
Hall Creek
52nd Ave W
48th Ave W
46th Ave W
44th Ave W
42nd Pl W
39th Ave W
56th Ave W
54th Ave W
64th Ave W
60th Ave W
61st Ave W
58th Ave W
33rd Ave W
28th Ave W
24th Ave W
Mall Pkwy
Brier Rd
Vine R
Everett
Seattle
N
0
2,000
Feet
Source(s):
• ESRI
Coordinate System: NAD 1983 UTM Zone 10N
Disclaimer: This figure was created for a specific purpose and project. Any use of this figure for any other project or purpose shall be at the user's sole risk and without liability to GeoEngineers. The locations of features shown may be approximate. GeoEngineers makes no warranty or representation as to the accuracy, completeness, or suitability of the figure, or data contained therein. The file containing this figure is a copy of a master document, the original of which is retained by GeoEngineers and is the official document of record.
Vicinity Map
20800 44th Avenue West
Lynnwood, Washington
GeoEngineers
Figure 1
P:\6\6407016\GIS\6407016_Project\6407016_Project.aprx\6407016_F01_VicinityMap Date Exported: 02/06/23 by maugust


Legend
Property Boundary
Approximate Parcel Boundary Line
GEI-1 Boring by GeoEngineers, 2022 (Current Study)
TP-1 Test Pit by Geotech Consultants, 1990
TP-1-89 Test Pit by Geotech Consultants, 1989
20800 Block
TP-3-89
GEI-1
TP-2-89
Wetland present across this parcel
TP-1-89
TP-5-89
TP-1
TP-2
TP-4-89
GEI-2
TP-6-89
GEI-3
TP-4
GEI-4
TP-6
TP-5
GEI-5
TP-3
GEI-6
44th Ave W
209th St SW
Source:
Aerial from Google Earth Pro, dated 3/20/2023
Coordinate System: NAD83 Washington State Planes, North Zone, US Foot
N
W
E
S
0
80
Feet
Site Plan
20800 44th Avenue West
Lynnwood, Washington
GeoEngineers
Figure 2


Cantilever Soldier Pile
Conventional Soldier Pile Wall with One Level of Tiebacks
Conventional Soldier Pile Wall with Multiple Levels of Tiebacks
Ground Surface
Base of Excavation
H
D
26
1
400
2'
400·D psf
P=26·H psf
50 psf
Net Allowable Passive Pressure
Active Earth Pressure
Traffic Surcharge Pressure
H1
T h1
H/2
P
2·H1/3
H/3
2(H-H1)/3
15'
60°
H/5
Apparent Earth Pressure
0.2H
P= 22·H psf
Notes:
1. Active/apparent earth pressure and traffic surcharge pressure act over the pile spacing above the base of the excavation.
2. Passive earth pressure acts over 2.5 times the concreted diameter of the soldier pile, or the pile spacing, whichever is less.
3. Passive pressure includes a factor of safety of 1.5 and includes the net pressure (difference between active and passive) below the base of excavation.
4. Additional surcharge from footings of adjacent buildings should be included in accordance with recommendations provided on Figure 4.
5. This pressure diagram is appropriate for temporary soldier pile and tieback walls. If additional surcharge loading (such as from soil stockpiles, excavators, dumptrucks, cranes, or concrete trucks) is anticipated, GeoEngineers should be consulted to provide revised surcharge pressures.
Legend
No Load Zone
H = Height of Excavation, Feet
D = Soldier Pile Embedment Depth, Feet
H1 = Distance From Ground Surface to Uppermost Tieback, Feet
Th1 = Horizontal Load in Uppermost Ground Anchor
P = Maximum Apparent Earth Pressure Pounds per Square Foot
Assumed Groundwater Elevation during Temporary Shoring.
Not To Scale
Earth Pressure Diagrams - Temporary Soldier Pile & Tieback Walls
20800 44th Avenue West
Lynnwood, Washington
GeoEngineers
Figure 3


Lateral Earth Pressure from Point Load, Q_P (Spread Footing)
X= m·H
Z=nH
H
A
A'
R
Base of Excavation
For m ≤ 0.4
$\sigma_h = K \cdot 0.28 Q_P n^2 / H^2(0.16+n^2)^3$
For m > 0.4
$\sigma_h = K \cdot 1.77 Q_P m^2 n^2 / H^2(m^2+n^2)^3$
$\sigma'_H = \sigma \cos^2(1.1\theta)$
m | P_H/Q_P | R
0.2 | 0.78 | 0.59H
0.4 | 0.78 | 0.59H
0.6 | 0.45 | 0.48H
Face of Wall
σ_H
Q_P
θ
X= m·H
Section A-A'
Pressures from Point Load Q_P
Lateral Earth Pressure from Line Load, Q_L (Continuous Wall Footing)
X= m·H
Q_L
Z=nH
H
P_H
R
Base of Excavation
For m ≤ 0.4
$\sigma_h = K \cdot 0.2n \cdot Q_L / H(0.16+n^2)^2$
For m > 0.4
$\sigma_h = K \cdot 1.28 m^2 n Q_L / H(m^2+n^2)^2$
Resultant $P_H = K \cdot 0.64 Q_L / (m^2+1)$
m | R
0.1 | 0.60H
0.3 | 0.60H
0.5 | 0.56H
0.7 | 0.48H
Uniform Surcharges, q (Floor Loads, Large Foundation Elements or Traffic Loads)
q (psf)
Base of Excavation
σ_h
0.20 · q (psf)
σ_h = Lateral Surcharge Pressure from Uniform Surcharge
Wall Type | K
Rigid | 1.0
Flexible | 0.5
Notes:
1. Procedures for estimating surcharge pressures shown above are based on Manual 7.02 Naval Facilities Engineering Command, September 1986 (NAVFAC DM 7.02).
2. Lateral earth pressures from surcharge should be added to earth pressures presented on Figures 3 and 5.
3. See report text for where surcharge pressures are appropriate.
4. Determination of surcharge factor (K): Flexible is for a system that allows small movements (temporary shoring, retaining walls, etc.) and rigid is for a system that does not allow small movements (permanent basement walls, below grade utility structures, etc.). If permanent basement walls are cast/poured directly against temporary shoring, then the lateral surcharge factor should be assumed as flexible when analyzing lateral surcharges.
Definitions:
Q_P = Point load in pounds
Q_L = Line load in pounds/foot
H = Excavation height below footing, feet
σ_h = Lateral earth pressure from surcharge, psf
q = Surcharge pressure in psf
θ = Radians
σ'_H = Distribution of σ_h in plan view
P_H = Resultant lateral force acting on wall, pounds
R = Distance from base of excavation to resultant lateral force, feet
X = Resultant lateral force acting on wall, pounds
Z = Depth of σ_h to be evaluated below the bottom of Q_P or Q_L
m = Ratio of X to H
n = Ratio of Z to H
K = Surcharge Factor
Not To Scale
Recommended Surcharge Pressure
20800 44th Avenue West
Lynnwood, Washington
GeoEngineers
Figure 4

Permanent Basement Wall Against Temporary Shoring



Legend

H = Height of Basement Wall, Feet

D = Foundation Embedment Depth, Feet

P = Maximum At-Rest Earth Pressure, Pounds per Square Foot

▽ Design Groundwater Elevation for Drained Walls/Passive Resistance Design

Not To Scale

Notes:

1. Passive earth pressure includes a factor of safety of 1.5.
2. Additional surcharge(s) from footings of adjacent buildings should be included in accordance with recommendations provided on Figure 4.
3. This pressure diagram is appropriate for permanent basement walls constructed in front of temporary shoring walls with tieback or soil nail anchors. If additional surcharge loading (such as from soil stockpiles, excavators, dumptrucks, cranes, or concrete trucks) is anticipated, GeoEngineers should be consulted to provide revised surcharge pressures.
4. The at-rest earth pressure does not include a factor of safety and represents the actual anticipated static earth pressure.

Earth Pressure Diagram - Permanent Below Grade Walls

20800 44th Avenue West
Lynnwood, Washington

GeoEngineers

Figure 5

\\geoengineers.com\WAN\Projects\6\6407016\CAD\00\Preliminary GT Report\6407016_F03-F05_EPDs.dwg F05 Date Exported:3/28/2023 12:50 PM - by Michael R. Woods


APPENDICES
GeoEngineers

APPENDIX A
Field Explorations

APPENDIX A
FIELD EXPLORATIONS

Field Explorations

Subsurface conditions were explored at the site by drilling six borings (GEI-1 through GEI-6). The borings were completed to depths of approximately 25½ and 36½ feet below existing ground surface. The borings were completed by Advance Drill Technologies, Inc. on February 27 and 28, 2023.

The locations of the explorations were estimated by taping/pacing from existing site features. The approximate exploration locations are shown on the Site Plan, Figure 2.

Borings

The borings were completed using track-mounted, continuous-flight, hollow-stem auger drilling equipment. The borings were continuously monitored by a geotechnical engineer or geologist from our firm who examined and classified the soils encountered, obtained representative soil samples, observed groundwater conditions and prepared a detailed log of each exploration.

The soils encountered in the borings were generally sampled at 2½- and 5-foot vertical intervals with a 2-inch outside-diameter split-barrel standard penetration test (SPT) sampler. The disturbed samples were obtained by driving the sampler 18 inches into the soil with a 140-pound automatic hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration was recorded. The blow count ("N-value") of the soil was calculated as the number of blows required for the final 12 inches of penetration. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. Where very dense soil conditions precluded driving the full 18 inches, the penetration resistance for the partial penetration was entered on the logs. The blow counts are shown on the boring logs at the respective sample depths.

Soils encountered in the borings were visually classified in general accordance with the classification system described in Figure A-1. A key to the boring log symbols is also presented in Figure A-1. The logs of the borings are presented in Figures A-2 through A-7. The boring logs are based on our interpretation of the field and laboratory data and indicate the various types of soils and groundwater conditions encountered. The logs also indicate the depths at which these soils or their characteristics change, although the change may actually be gradual. If the change occurred between samples, it was interpreted. The densities noted on the boring logs are based on the blow count data obtained in the borings and judgment based on the conditions encountered.

Observations of groundwater conditions were made during drilling. The groundwater conditions encountered during drilling are presented on the boring logs. Groundwater conditions observed during drilling represent a short-term condition and may or may not be representative of the long-term groundwater conditions at the site. Groundwater conditions observed during drilling should be considered approximate.

Monitoring Wells

A representative of GeoEngineers observed the installation of a monitoring well in borings GEI-3 and GEI-5. The monitoring wells were constructed using 2-inch-diameter polyvinyl chloride (PVC) casing. The depth to which the casing was installed was selected based on our understanding of subsurface soil and

groundwater conditions in the project area. The lower portion of the casing was slotted to allow entry of water into the casing. Medium sand was placed in the borehole annulus surrounding the slotted portion of the casing. A bentonite seal was placed above and below the slotted portion of the casing. The monitoring wells were protected by installing flush-mount steel monuments set in concrete. Completion details for the monitoring wells are shown on the logs presented in Figures A-4 and A-6.

The monitoring wells will require decommissioning by a licensed well driller prior to excavation for the planned development. The decommissioning of the wells includes backfilling the monitoring wells and providing documentation of the decommissioning to the Washington State Department of Ecology (Ecology). The well installation log and Ecology registry information required for decommissioning and documentation is included on the boring logs.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% RETAINED ON NO. 200 SIEVE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel / Dames & Moore (D&M)
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

- Measured groundwater level in exploration, well, or piezometer
- Measured free product in well or piezometer

Graphic Log Contact

- Distinct contact between soil strata
- Approximate contact between soil strata

Material Description Contact

- Contact between geologic units
- Contact between soil of the same geologic unit

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

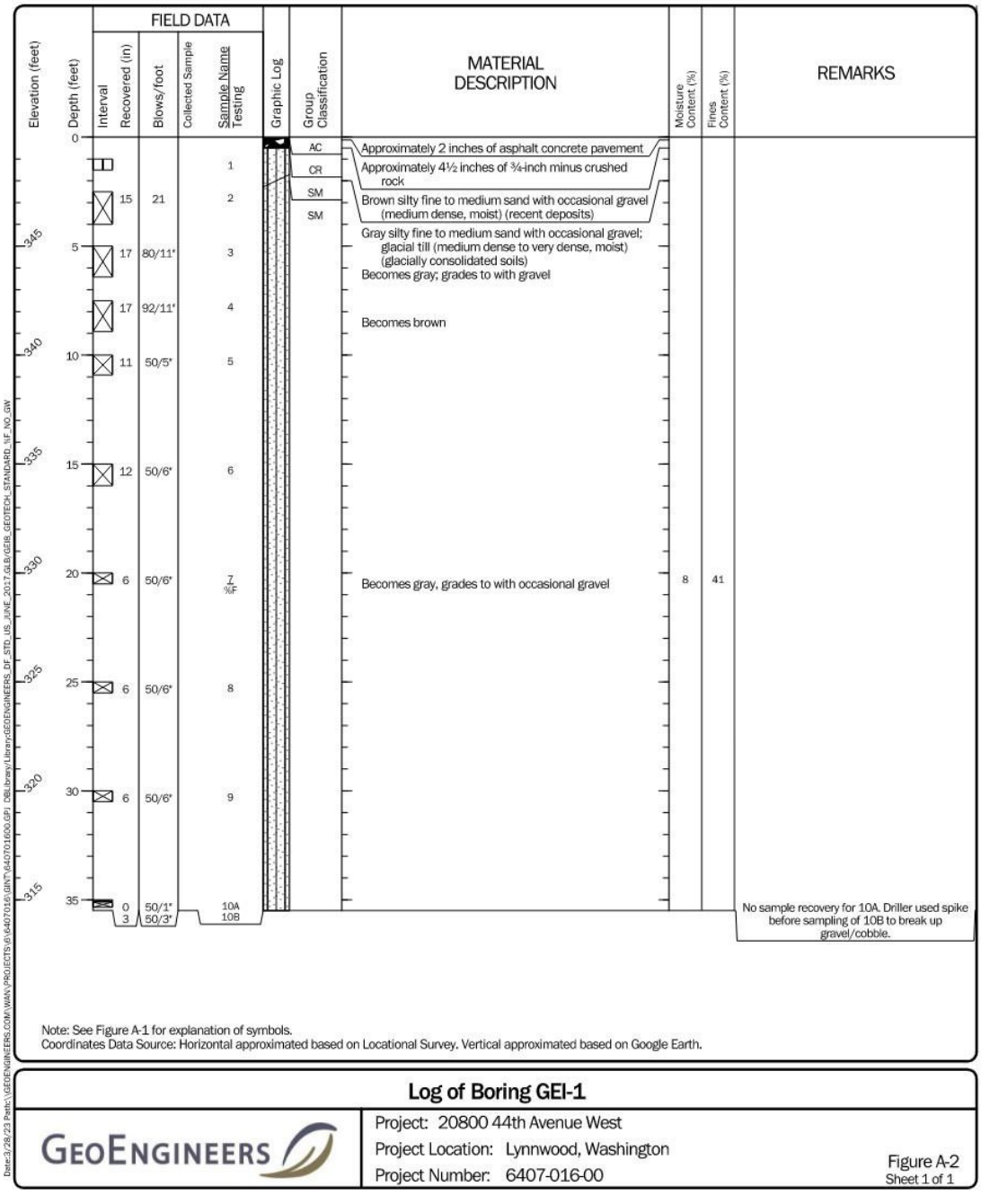
Key to Exploration Logs

GeoEngineers

Figure A-1

Rev 01/2022

Drilled: Start 2/27/2023 End 2/27/2023	Total Depth (ft): 35.5	Logged By: JBA Checked By: VRY	Driller: Advance Drill Technologies, Inc.	Drilling Method: Hollow-stem Auger	
Surface Elevation (ft): 350 Vertical Datum: NAVD88		Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment: Diedrich D-50 Turbo	
Latitude: 47.810397 Longitude: -122.294951		System Datum: WA State Plane North NAD83 (feet)		Groundwater not observed at time of exploration	
Notes:					



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Locational Survey. Vertical approximated based on Google Earth.

Log of Boring GEI-1

GeoEngineers

Project: 20800 44th Avenue West
Project Location: Lynnwood, Washington
Project Number: 6407-016-00

Figure A-2
Sheet 1 of 1

Drilled: Start 2/27/2023 End 2/27/2023	Total Depth (ft): 25.5	Logged By: JBA Checked By: VRY	Driller: Advance Drill Technologies, Inc.	Drilling Method: Hollow-stem Auger	
Surface Elevation (ft): 340 Vertical Datum: NAVD88		Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment: Diedrich D-50 Turbo	
Latitude: 47.810127 Longitude: -122.294077		System Datum: WA State Plane North NAD83 (feet)		See "Remarks" section for groundwater observed	
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0					1		AC	Approximately 2 inches of asphalt concrete pavement			
								CR	Approximately 4 inches of ¾-inch minus crushed rock			
		18	3			2		SM	Brown silty fine to medium sand with occasional gravel (very loose, moist) (recent deposits) Grades to with occasional gravel and trace organic matter			
335	5	18	11			3 %F		SP-SM	Brown fine to medium sand with silt and occasional gravel (medium dense, moist)	21	10	
		18	25			4 %F			Becomes wet	19	8	Groundwater observed at 8 feet below ground surface during drilling
330	10	18	34			5 %F		SM	Brown silty fine to medium sand with occasional gravel; weathered glacial till (dense, wet) (glacially consolidated soils)	16	15	
325	15	18	71			6			Glacial till			
320	20	12	50/6"			7						
315	25	3	50/3"			8						

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Locational Survey. Vertical approximated based on Google Earth.

Date:2/27/23 Path:\\GEOENGINEERS.COM\WAS\PROJECTS\6\6407016\GINT\6407016GO.GPJ DBLibrary\Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI6_GEOTECH_STANDARD_NF_NO_GW

Log of Boring GEI-2

GeoEngineers

Project: 20800 44th Avenue West
Project Location: Lynnwood, Washington
Project Number: 6407-016-00

Figure A-3
Sheet 1 of 1

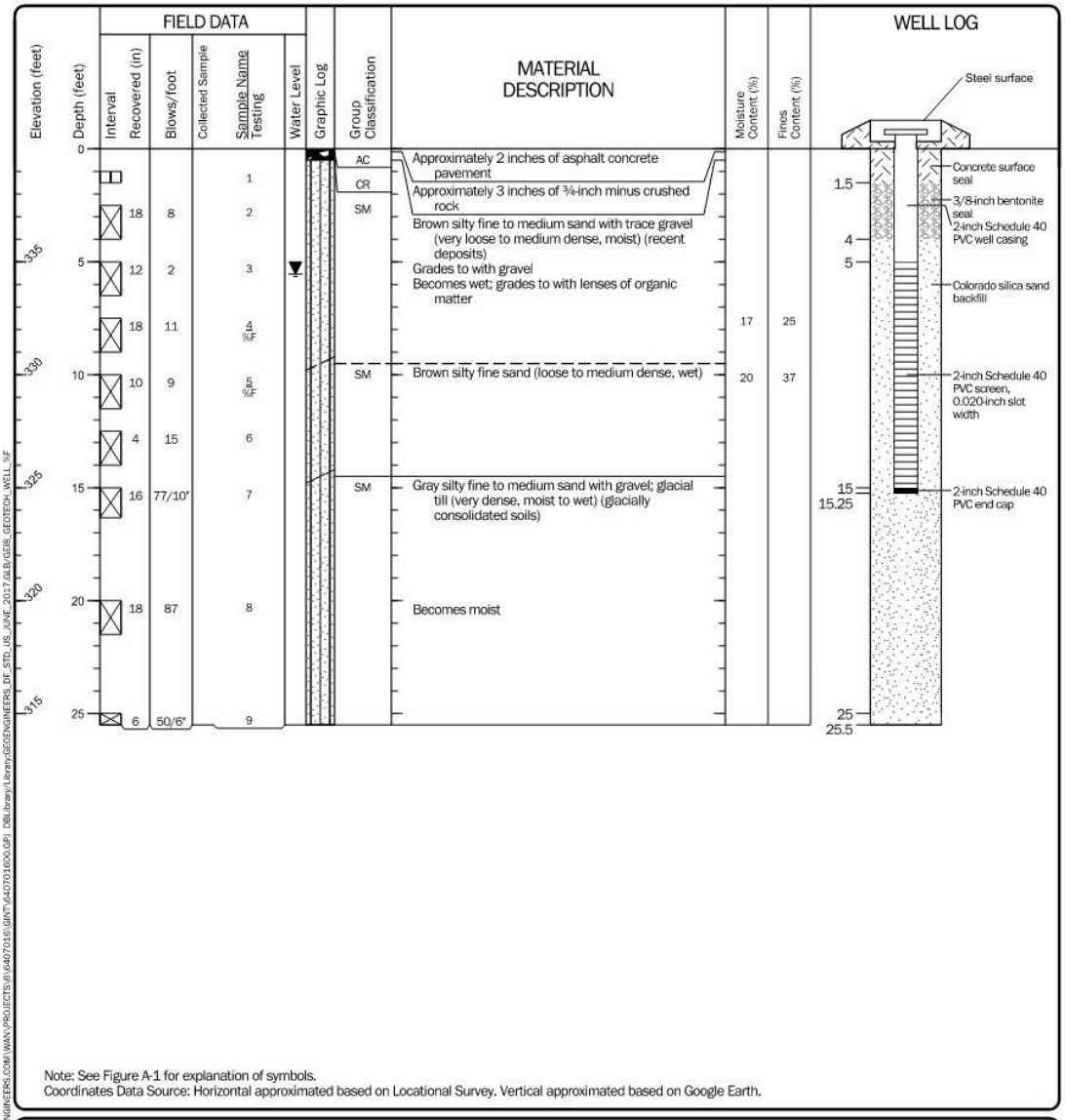
Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	2/28/2023	2/28/2023	25.5	JBA	VRY	Advance Drill Technologies, Inc.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D-50 Turbo
Surface Elevation (ft) Vertical Datum	340 NAVD88	Top of Casing Elevation (ft)	339.70
Latitude Longitude	47.810012 -122.292678	Horizontal Datum	WA State Plane North NAD83 (feet)

DOE Well I.D.: BPQ 226
A 2-in well was installed on 2/28/2023 to a depth of 25.5 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
3/24/2023	5.54	334.16

Notes:



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Locational Survey. Vertical approximated based on Google Earth.

Log of Boring with Monitoring Well GEI-3

GeoEngineers

Project: 20800 44th Avenue West
Project Location: Lynnwood, Washington
Project Number: 6407-016-00

Figure A-4
Sheet 1 of 1

Drilled: Start 2/27/2023 End 2/27/2023	Total Depth (ft): 26	Logged By: JBA Checked By: VRY	Driller: Advance Drill Technologies, Inc.	Drilling Method: Hollow-stem Auger	
Surface Elevation (ft) Vertical Datum: 340 NAVD88		Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment: Diedrich D-50 Turbo	
Latitude: 47.809829 Longitude: -122.293363		System Datum: WA State Plane North NAD83 (feet)		Groundwater not observed at time of exploration	
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0					1		AC	Approximately 1 inches of asphalt concrete pavement			
								CR	Approximately 5 inches of ¾-inch minus crushed rock			
		18	13			2		SM	Gray silty fine to medium sand with occasional gravel (loose to medium dense, moist) (recent deposits) Grades to with organic matter and occasional gravel			
335	5	12	5			3			Becomes moist to wet; grades to with occasional gravel			
		18	14			4		SM	Gray silty fine sand with gravel; weathered glacial till (medium dense, wet) (glacially consilidated soils)			
330	10	18	58			5		SM	Brown silty fine to medium sand with occasional gravel; glacial till (very dense, moist)			
325	15	18	81			6			Becomes gray; grades to with gravel			
320	20	11	50/5"			7						
315	25	11	50/5"			8						

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Locational Survey. Vertical approximated based on Google Earth.

Date:2/27/23 Path:\\GEOENGINEERS.COM\WAS\PROJECTS\6\6407016\GINT\6407016GO.GPJ DBLibrary\Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI6_GEOTECH_STANDARD_NF_NO_GW

Log of Boring GEI-4

GeoEngineers

Project: 20800 44th Avenue West
Project Location: Lynnwood, Washington
Project Number: 6407-016-00

Figure A-5
Sheet 1 of 1

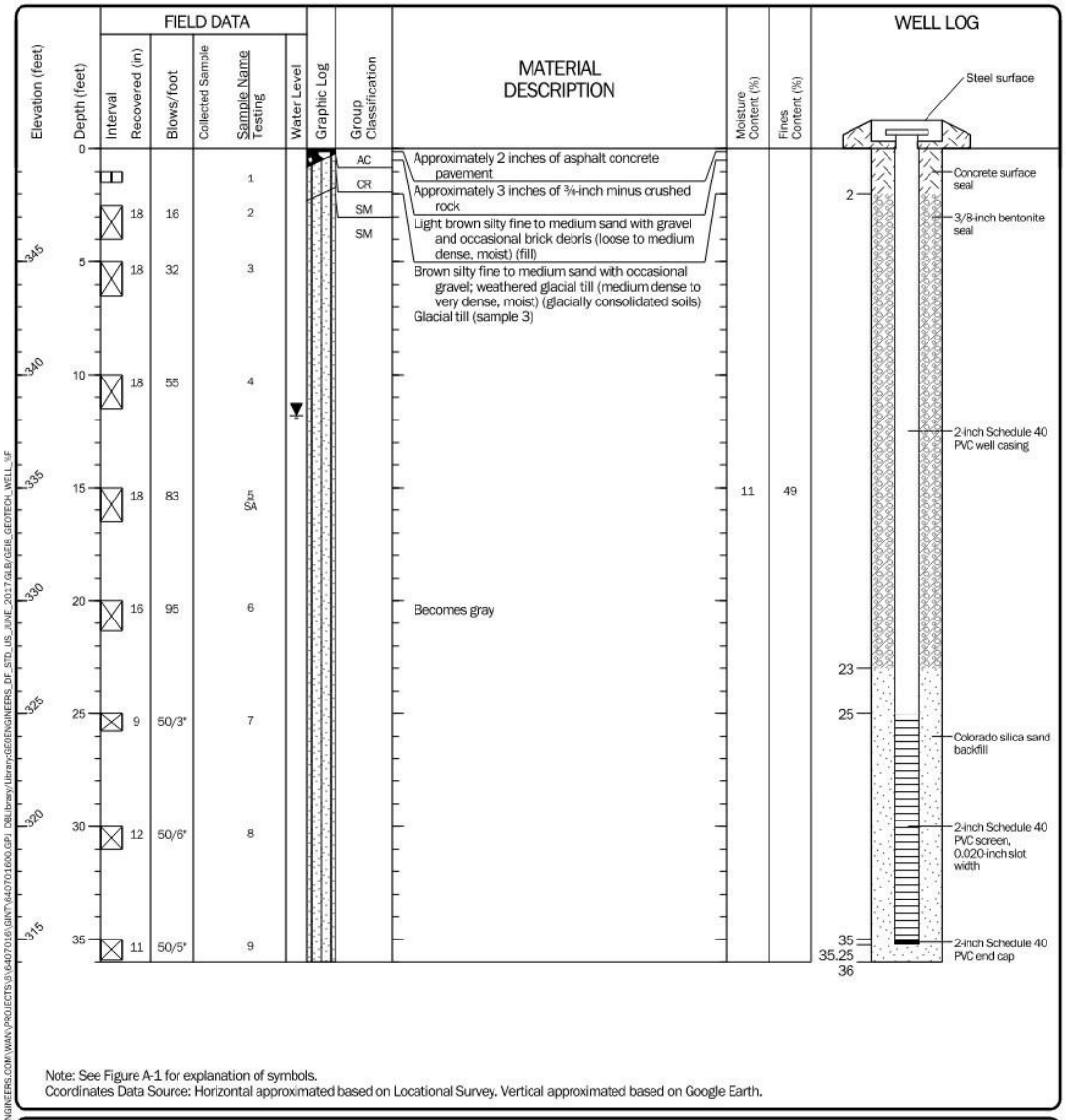
Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	2/28/2023	2/28/2023	36	JBA	VRY	Advance Drill Technologies, Inc.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D-50 Turbo
Surface Elevation (ft) Vertical Datum	350 NAVD88	Top of Casing Elevation (ft)	349.70
Latitude Longitude	47.809569 -122.293247	Horizontal Datum	WA State Plane North NAD83 (feet)

DOE Well I.D.: BPQ 225
A 2-in well was installed on 2/28/2023 to a depth of 36 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
3/28/2023	11.80	337.90

Notes:



Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Locational Survey. Vertical approximated based on Google Earth.

Log of Boring with Monitoring Well GEI-5

GeoEngineers

Project: 20800 44th Avenue West
Project Location: Lynnwood, Washington
Project Number: 6407-016-00

Figure A-6
Sheet 1 of 1

Date:3/28/23 Path:\\GEOENGINEERS.COM\WAS\PROJECTS\6\6407016\GINT\6407016GO.GPJ DBLibrary\Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI6_GEOTECH_WELL %F

Drilled: Start 2/27/2023 End 2/27/2023	Total Depth (ft): 36.5	Logged By: JBA Checked By: VRY	Driller: Advance Drill Technologies, Inc.	Drilling Method: Hollow-stem Auger	
Surface Elevation (ft) Vertical Datum: 350 NAVD88		Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop		Drilling Equipment: Diedrich D-50 Turbo	
Latitude: 47.809381 Longitude: -122.292719		System Datum: WA State Plane North NAD83 (feet)		Groundwater not observed at time of exploration	
Notes:					

Elevation (feet)	Depth (feet)	FIELD DATA: Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0					1		AC	Approximately 2 inches of asphalt concrete pavement			
								CR	Approximately 4 inches of ¾-inch minus crushed rock			
			18	25		2		SM	Brown silty fine sand (medium dense to very dense, wet) (recent deposits)			
345	5		18	32		3		SM	Brown silty fine to medium sand with gravel; weathered glacial till (medium dense to very dense, moist) (glacially consolidated soils) Glacial till			
			18	50		4			Grades to with occasional gravel			
340	10		18	67		5						
335	15		12	50/6"		6			Becomes gray			
330	20		17	87/11"		7						
325	25		6	50/6"		8						
320	30		17	98/11"		9			Grades to with gravel			
315	35		15	82		10						

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Locational Survey. Vertical approximated based on Google Earth.

Date:2/27/23 Path:\\GEOENGINEERS.COM\WA\PROJECTS\6\6407016\GINT\6407016GDT.GPJ DBLibrary\Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI6_GEOTECH_STANDARD_NF_NO_GW

Log of Boring GEI-6

GeoEngineers

Project: 20800 44th Avenue West
Project Location: Lynnwood, Washington
Project Number: 6407-016-00

Figure A-7
Sheet 1 of 1

APPENDIX B
Laboratory Testing

APPENDIX B
LABORATORY TESTING

Soil samples obtained from the explorations were transported to GeoEngineers' laboratory and evaluated to confirm or modify field classifications, as well as to evaluate engineering properties of the soil samples. Representative samples were selected for laboratory testing to determine the moisture content, percent fines (material passing the U.S. No. 200 sieve) and sieve analysis (grain-size distribution). The tests were performed in general accordance with test methods of ASTM International (ASTM) or other applicable procedures.

The sieve analysis results are presented in Figure B-1. The results of the moisture content and percent fines determinations are presented at the respective sample depths on the exploration logs included in Appendix A.

Moisture Content (MC)

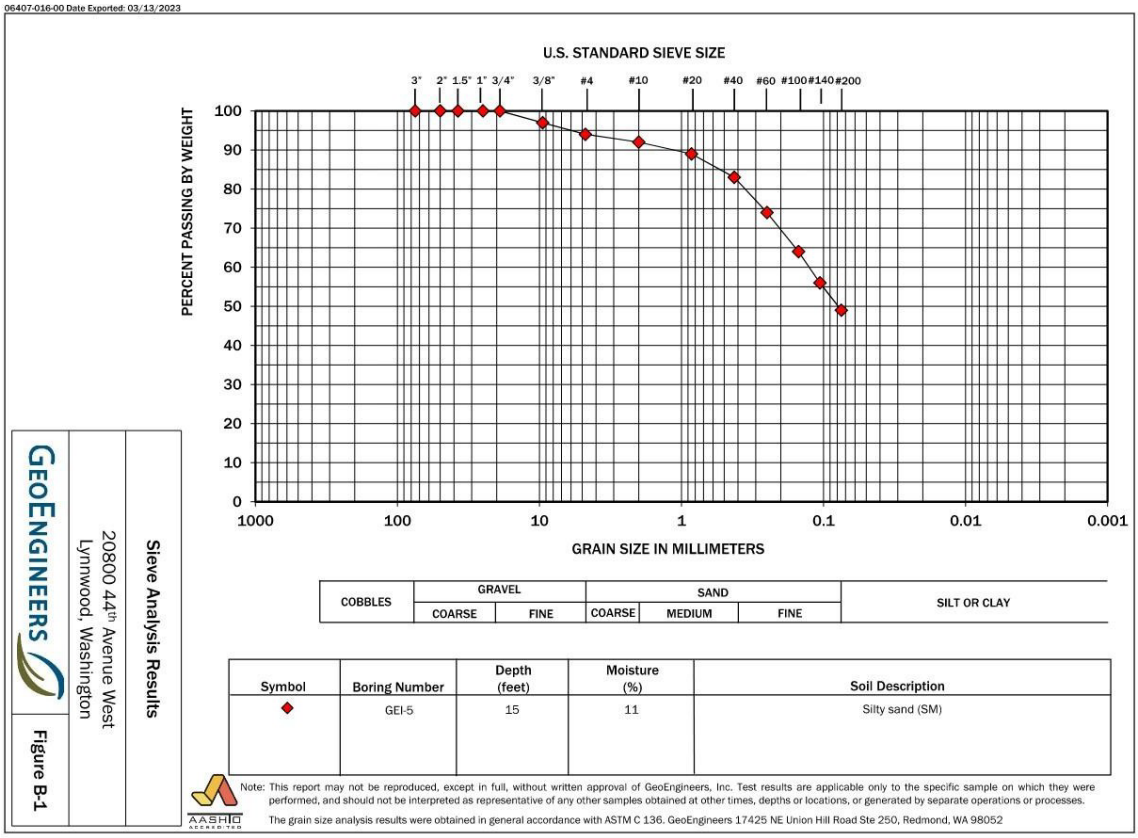
Moisture content tests were completed in general accordance with ASTM D 2216 for representative samples obtained from the explorations. The results of these tests are presented on the exploration logs at the respective sample depths.

Percent Passing U.S. No. 200 Sieve (%F)

Selected samples were "washed" through the U.S. No. 200 mesh sieve to estimate the relative percentages of coarse- and fine-grained particles in the soil. The percent passing value represents the percentage by weight of the sample finer than the U.S. No. 200 sieve. These tests were conducted to verify field descriptions and to estimate the fines content for analysis purposes. The tests were conducted in accordance with ASTM D 1140, and the results are shown on the exploration logs at the respective sample depths.

Sieve Analyses (SA)

Sieve analyses were performed on selected samples in general accordance with ASTM D 422. The wet sieve analysis method was used to determine the percentage of soil greater than the U.S. No. 200 mesh sieve. The results of the sieve analyses were plotted, were classified in general accordance with the Unified Soil Classification System (USCS) and are presented in Figure B-1.

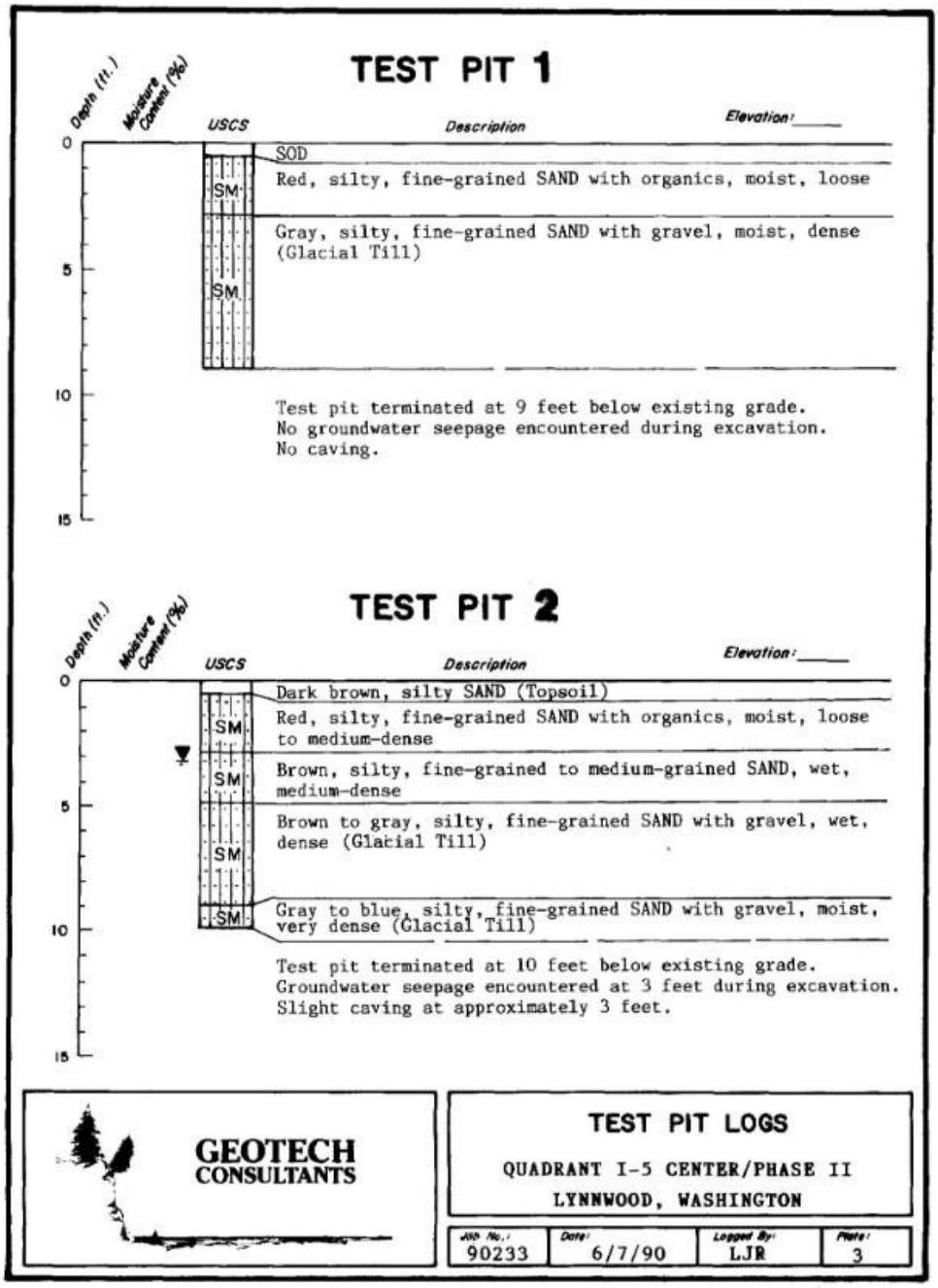

06407-016-00 Date Exported: 03/13/2023
U.S. STANDARD SIEVE SIZE
3" 2" 1.5" 1" 3/4" 3/8" #4 #10 #20 #40 #60 #100 #140 #200
PERCENT PASSING BY WEIGHT
100 90 80 70 60 50 40 30 20 10 0
1000 100 10 1 0.1 0.01 0.001
GRAIN SIZE IN MILLIMETERS
COBBLES
GRAVEL
COARSE FINE
SAND
COARSE MEDIUM FINE
SILT OR CLAY
Symbol Boring Number Depth (feet) Moisture (%) Soil Description
GEI-5 15 11 Silty sand (SM)
Note: This report may not be reproduced, except in full, without written approval of GeoEngineers, Inc. Test results are applicable only to the specific sample on which they were performed, and should not be interpreted as representative of any other samples obtained at other times, depths or locations, or generated by separate operations or processes.
The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052
AASHTO ACCREDITED
GeoEngineers
Figure B-1
20800 44th Avenue West
Lynnwood, Washington
Sieve Analysis Results

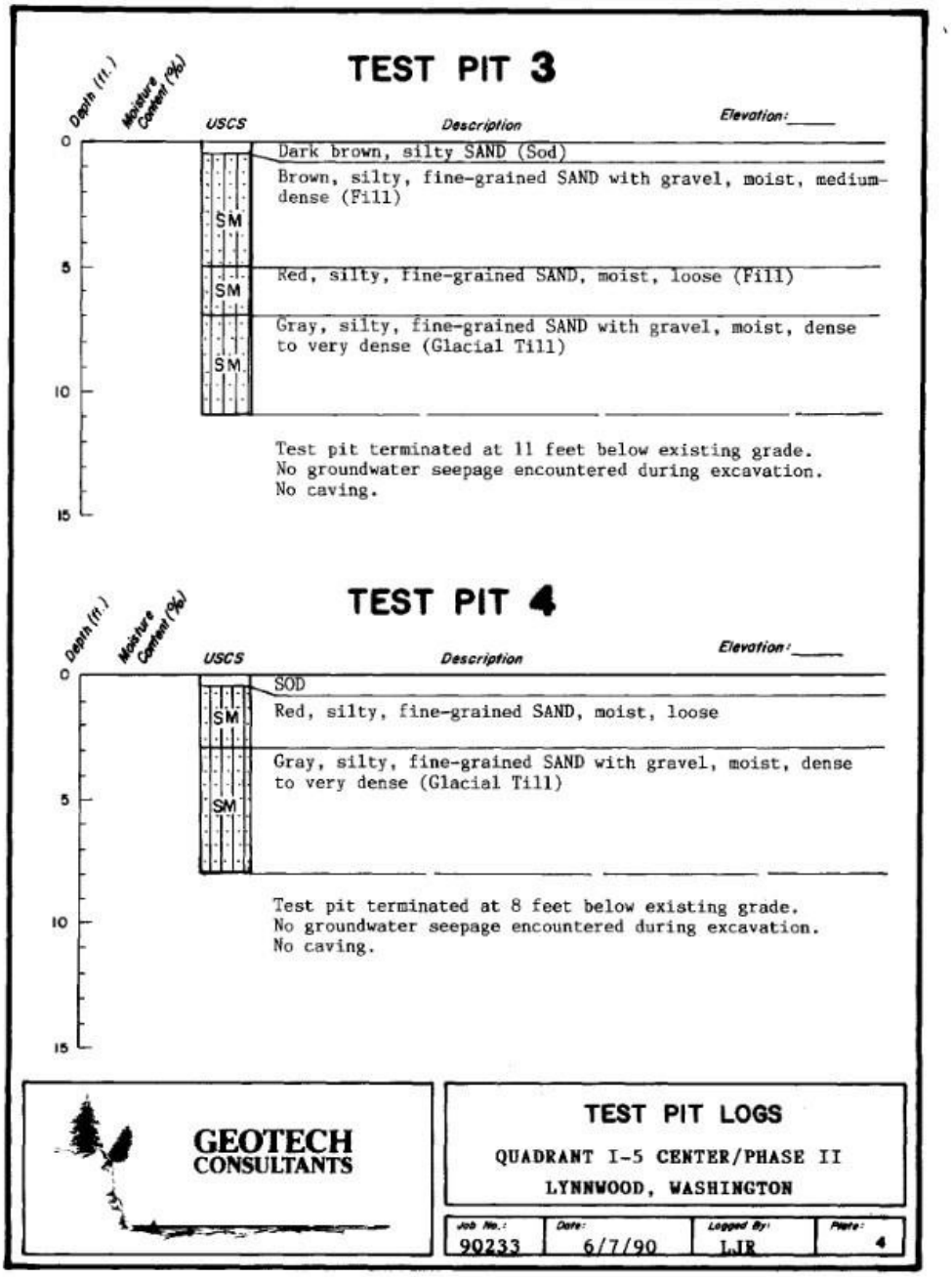
APPENDIX C
Test Pit Logs from Previous Studies

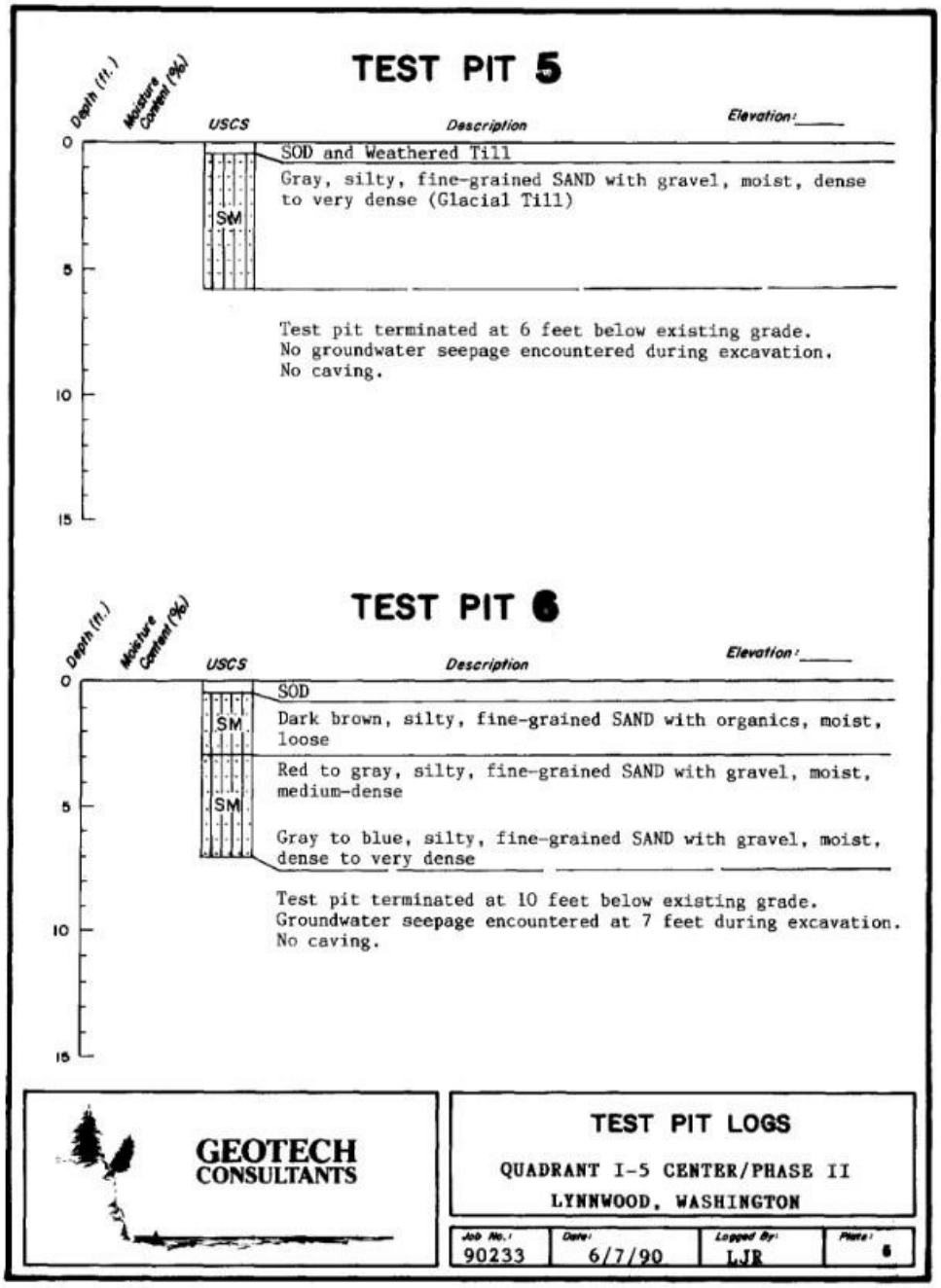
APPENDIX C
TEST PIT LOGS FROM PREVIOUS STUDIES

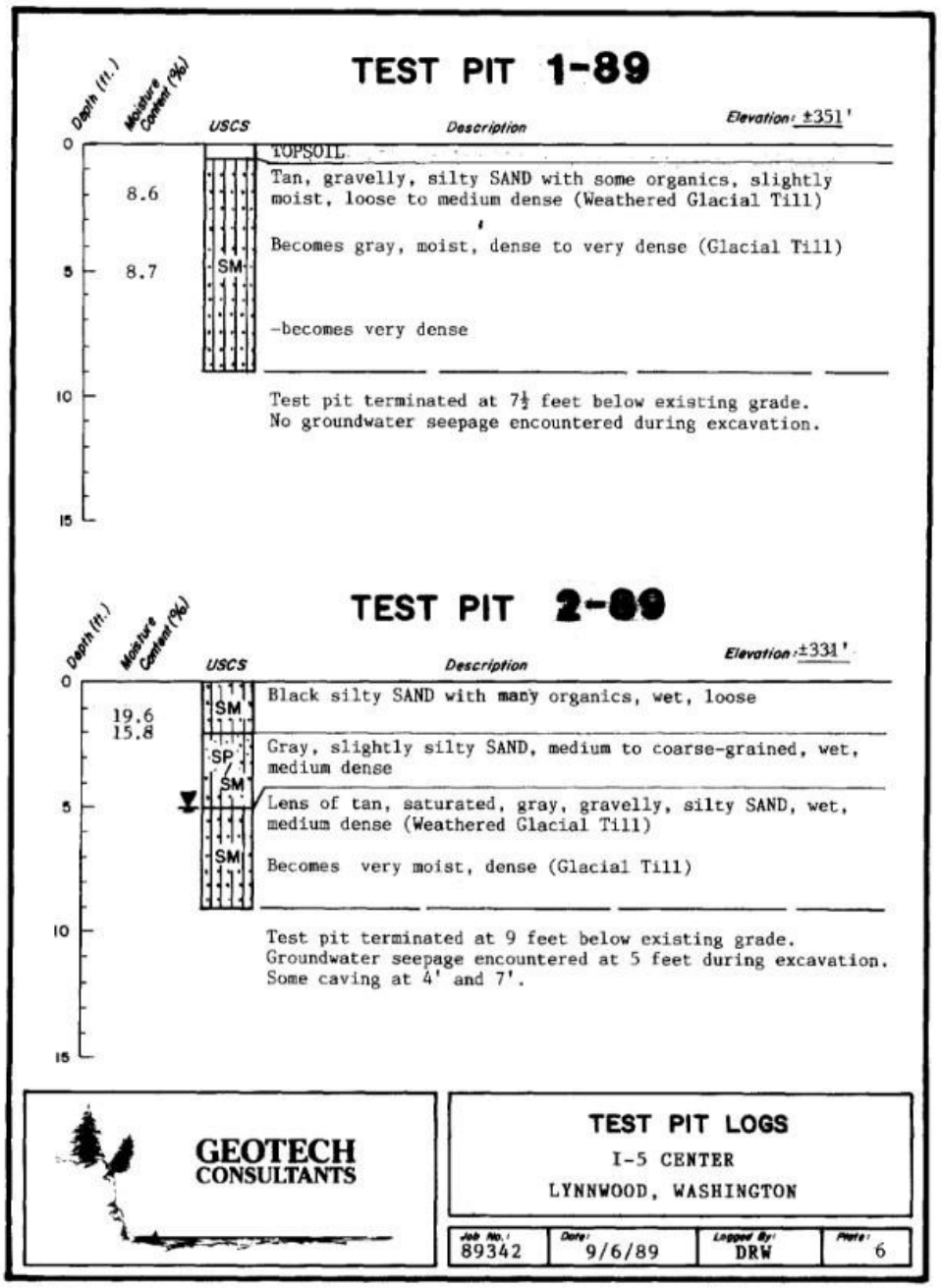
Included in this section are test pit logs from previous studies completed in the immediate vicinity of the project site.

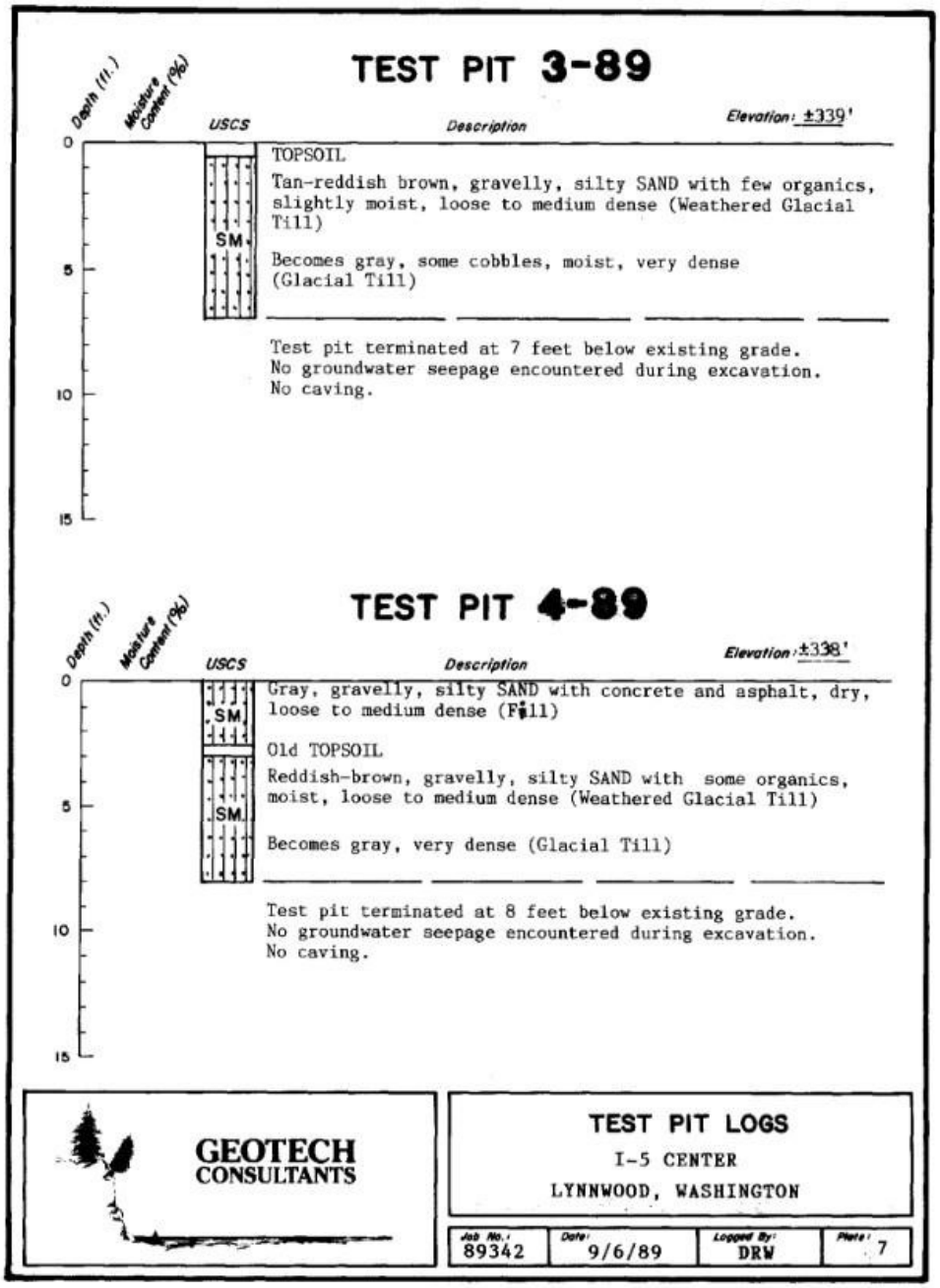
- The logs of six test pits (TP-1 through TP-6) completed by Geotech Consultants in 1990 for the Quadrant I-5 Center/Phase II Parking Garage project; and
- The logs of six test pits (TP-1-89 through TP-6-89) completed by Geotech Consultants in 1989 for the I-5 Center project.

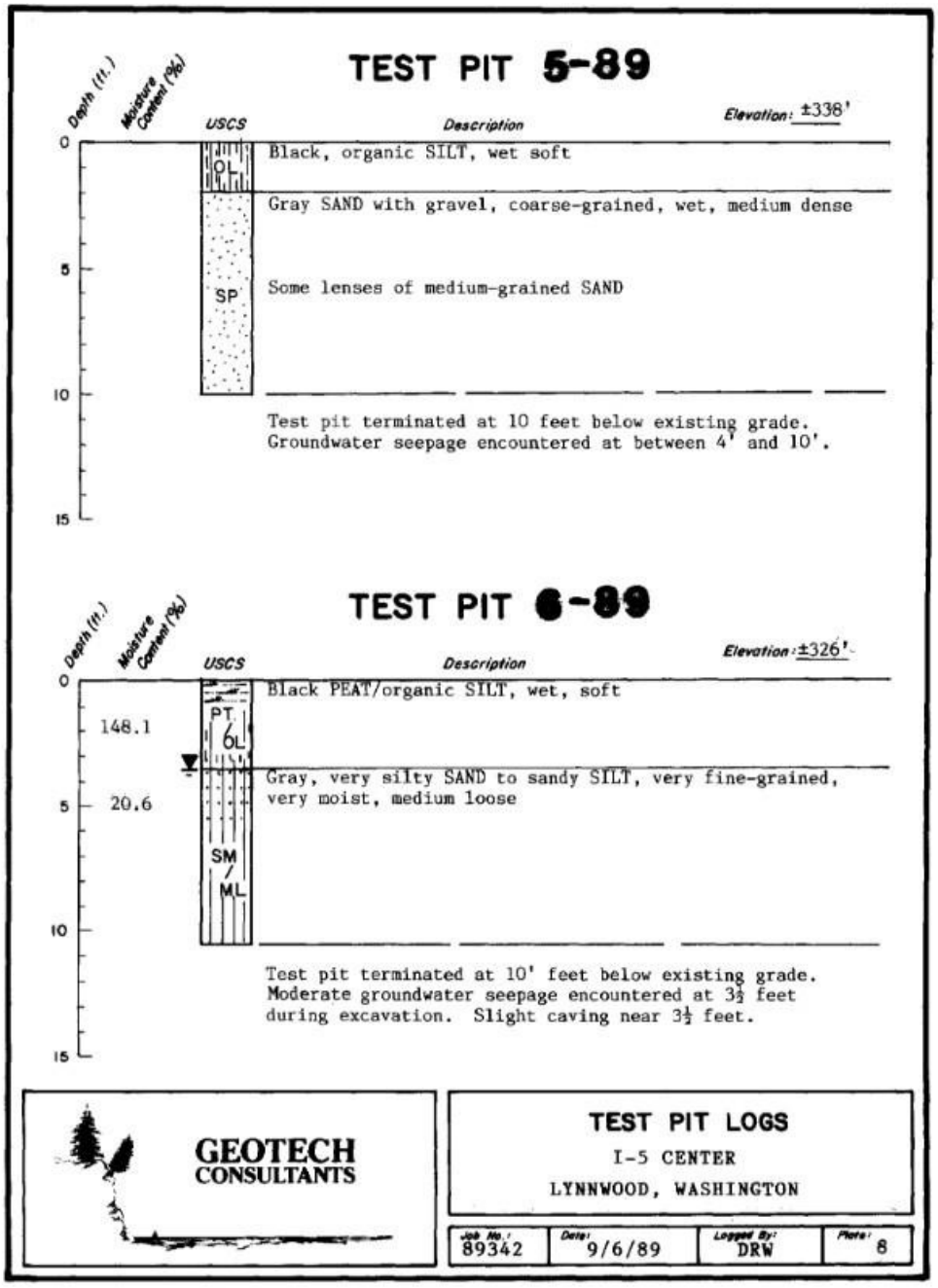

TEST PIT 1
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation:
0
5
10
15
SM
SM
SOD
Red, silty, fine-grained SAND with organics, moist, loose
Gray, silty, fine-grained SAND with gravel, moist, dense (Glacial Till)
Test pit terminated at 9 feet below existing grade.
No groundwater seepage encountered during excavation.
No caving.
TEST PIT 2
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation:
0
5
10
15
SM
SM
SM
SM
Dark brown, silty SAND (Topsoil)
Red, silty, fine-grained SAND with organics, moist, loose to medium-dense
Brown, silty, fine-grained to medium-grained SAND, wet, medium-dense
Brown to gray, silty, fine-grained SAND with gravel, wet, dense (Glacial Till)
Gray to blue, silty, fine-grained SAND with gravel, moist, very dense (Glacial Till)
Test pit terminated at 10 feet below existing grade.
Groundwater seepage encountered at 3 feet during excavation.
Slight caving at approximately 3 feet.
GEOTECH CONSULTANTS
TEST PIT LOGS
QUADRANT I-5 CENTER/PHASE II
LYNNWOOD, WASHINGTON
Job No.: 90233
Date: 6/7/90
Logged By: LJR
Plate: 3


TEST PIT 3
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation:
0
5
10
15
SM
SM
SM
Dark brown, silty SAND (Sod)
Brown, silty, fine-grained SAND with gravel, moist, medium-dense (Fill)
Red, silty, fine-grained SAND, moist, loose (Fill)
Gray, silty, fine-grained SAND with gravel, moist, dense to very dense (Glacial Till)
Test pit terminated at 11 feet below existing grade.
No groundwater seepage encountered during excavation.
No caving.
TEST PIT 4
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation:
0
5
10
15
SM
SM
SOD
Red, silty, fine-grained SAND, moist, loose
Gray, silty, fine-grained SAND with gravel, moist, dense to very dense (Glacial Till)
Test pit terminated at 8 feet below existing grade.
No groundwater seepage encountered during excavation.
No caving.
GEOTECH CONSULTANTS
TEST PIT LOGS
QUADRANT I-5 CENTER/PHASE II
LYNNWOOD, WASHINGTON
Job No.: 90233
Date: 6/7/90
Logged By: LJR
Plate: 4


TEST PIT 5
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation:
0
5
10
15
SM
SOD and Weathered Till
Gray, silty, fine-grained SAND with gravel, moist, dense to very dense (Glacial Till)
Test pit terminated at 6 feet below existing grade.
No groundwater seepage encountered during excavation.
No caving.
TEST PIT 6
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation:
0
5
10
15
SM
SM
SOD
Dark brown, silty, fine-grained SAND with organics, moist, loose
Red to gray, silty, fine-grained SAND with gravel, moist, medium-dense
Gray to blue, silty, fine-grained SAND with gravel, moist, dense to very dense
Test pit terminated at 10 feet below existing grade.
Groundwater seepage encountered at 7 feet during excavation.
No caving.
GEOTECH CONSULTANTS
TEST PIT LOGS
QUADRANT I-5 CENTER/PHASE II
LYNNWOOD, WASHINGTON
Job No.: 90233
Date: 6/7/90
Logged By: LJR
Plate: 6


TEST PIT 1-89
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation: ±351'
0
5
10
15
8.6
8.7
SM
TOPSOIL
Tan, gravelly, silty SAND with some organics, slightly moist, loose to medium dense (Weathered Glacial Till)
Becomes gray, moist, dense to very dense (Glacial Till)
-becomes very dense
Test pit terminated at 7½ feet below existing grade.
No groundwater seepage encountered during excavation.
TEST PIT 2-89
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation: ±331'
0
5
10
15
19.6
15.8
SM
SP
SM
SM
Black silty SAND with many organics, wet, loose
Gray, slightly silty SAND, medium to coarse-grained, wet, medium dense
Lens of tan, saturated, gray, gravelly, silty SAND, wet, medium dense (Weathered Glacial Till)
Becomes very moist, dense (Glacial Till)
Test pit terminated at 9 feet below existing grade.
Groundwater seepage encountered at 5 feet during excavation.
Some caving at 4' and 7'.
GEOTECH CONSULTANTS
TEST PIT LOGS
I-5 CENTER
LYNNWOOD, WASHINGTON
Job No.: 89342
Date: 9/6/89
Logged By: DRW
Plate: 6


TEST PIT 3-89
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation: ±339'
0
5
10
15
SM
TOPSOIL
Tan-reddish brown, gravelly, silty SAND with few organics, slightly moist, loose to medium dense (Weathered Glacial Till)
Becomes gray, some cobbles, moist, very dense (Glacial Till)
Test pit terminated at 7 feet below existing grade.
No groundwater seepage encountered during excavation.
No caving.
TEST PIT 4-89
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation: ±338'
0
5
10
15
SM
SM
Gray, gravelly, silty SAND with concrete and asphalt, dry, loose to medium dense (Fill)
Old TOPSOIL
Reddish-brown, gravelly, silty SAND with some organics, moist, loose to medium dense (Weathered Glacial Till)
Becomes gray, very dense (Glacial Till)
Test pit terminated at 8 feet below existing grade.
No groundwater seepage encountered during excavation.
No caving.
GEOTECH CONSULTANTS
TEST PIT LOGS
I-5 CENTER
LYNNWOOD, WASHINGTON
Job No.: 89342
Date: 9/6/89
Logged By: DRW
Plate: 7


TEST PIT 5-89
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation: ±338'
0
OL
Black, organic SILT, wet soft
Gray SAND with gravel, coarse-grained, wet, medium dense
5
SP
Some lenses of medium-grained SAND
10
Test pit terminated at 10 feet below existing grade.
Groundwater seepage encountered at between 4' and 10'.
15
TEST PIT 6-89
Depth (ft.)
Moisture Content (%)
USCS
Description
Elevation: ±326'
0
148.1
PT / OL
Black PEAT/organic SILT, wet, soft
5
20.6
SM / ML
Gray, very silty SAND to sandy SILT, very fine-grained, very moist, medium loose
10
Test pit terminated at 10' feet below existing grade.
Moderate groundwater seepage encountered at 3½ feet during excavation. Slight caving near 3½ feet.
15
GEOTECH CONSULTANTS
TEST PIT LOGS
I-5 CENTER
LYNNWOOD, WASHINGTON
Job No.: 89342
Date: 9/6/89
Logged By: DRW
Plate: 8

APPENDIX D
Ground Anchor Load Tests and Shoring Monitoring Program

APPENDIX D
GROUND ANCHOR LOAD TESTS AND SHORING MONITORING PROGRAM

Ground Anchor Load Testing

The locations of the load tests shall be approved by the Engineer and shall be representative of the field conditions. Load tests shall not be performed until the nail/tieback grout and shotcrete wall facing, where present, have attained at least 50 percent of the specified 28-day compressive strengths.

Where temporary casing of the unbonded length of test nails/tiebacks is provided, the casing shall be installed to prevent interaction between the bonded length of the nail/tieback and the casing/testing apparatus.

The testing equipment shall include two dial gauges accurate to 0.001 inch, a dial gauge support, a calibrated jack and pressure gauge, a pump and the load test reaction frame. The dial gauge should be aligned within 5 degrees of the longitudinal nail/tieback axis and shall be supported independently from the load frame/jack and the shoring wall. The hydraulic jack, pressure gauge and pump shall be used to apply and measure the test loads.

The jack and pressure gauge shall be calibrated by an independent testing laboratory as a unit. The pressure gauge shall be graduated in 100 pounds per square inch (psi) increments or less and shall have a range not exceeding twice the anticipated maximum pressure during testing unless approved by the Engineer. The ram travel of the jack shall be sufficient to enable the test to be performed without repositioning the jack.

The jack shall be supported independently and centered over the nail/tieback so that the nail/tieback does not carry the weight of the jack. The jack, bearing plates and stressing anchorage shall be aligned with the nail/tieback. The initial position of the jack shall be such that repositioning of the jack is not necessary during the load test.

The reaction frame should be designed/sized such that excessive deflection of the test apparatus does not occur and that the testing apparatus does not need to be repositioned during the load test. If the reaction frame bears directly on the shoring wall facing, the reaction frame should be designed so as not to damage the facing.

Verification Tests

Prior to production soil nail/tieback installation, at least two soil nails/tiebacks for each soil type shall be tested to validate the design pullout value. All test nails/tiebacks shall be installed by the same methods, personnel, material and equipment as the production anchors. Changes in methods, personnel, material or equipment may require additional verification testing as determined by the Engineer. At least two successful verification tests shall be performed for each installation method and each soil type. The nails/tiebacks used for the verification tests may be used as production nails/tiebacks if approved by the Engineer.

For soil nails, the unbonded length of the test nails shall be at least 3 feet unless approved otherwise by the Engineer. The bond length of the test nails shall not be less than 10 feet and shall not be longer than

the bond length that would prevent testing to 200 percent of the design load while not exceeding the allowable bar load. The allowable bar load during testing shall not exceed 80 percent of the steel ultimate strength for Grade 150 bars or 90 percent of the steel ultimate strength for Grade 60 and 75 bars. The allowable tieback load should not exceed 80 percent of the steel ultimate strength.

For soil nails, the design test load shall be determined by multiplying the bond length of the nail times the design load pullout resistance (load transfer). Tieback design test loads should be the design load specified on the shoring drawings. Verification test nails/tiebacks shall be incrementally loaded and unloaded in accordance with the following schedule:

Load	Hold Time
Alignment Load	1 minute
0.25 Design Load (DL)	1 minute
0.5DL	1 minute
0.75DL	1 minute
1.0DL	1 minute
1.25DL	1 minute
1.5DL	60 minutes
1.75DL	1 minute
2.0DL	10 minutes

The alignment load shall be the minimum load required to align the testing apparatus and should not exceed 5 percent of the design load. The dial gauge should be zeroed after the alignment load is applied. Nail/tieback deflections during the 1.5DL test load shall be recorded at 1, 2, 3, 5, 6, 10, 20, 30, 50, and 60 minutes.

Proof Tests

Proof tests shall be completed on approximately 5 percent of the production nails at locations selected by the owner's representative. Additional testing may be required where nail installation methods are substandard. Proof tests shall be completed on each production tieback.

For soil nails, the unbonded length of the test nails shall be at least 3 feet unless approved otherwise by the Engineer. The bond length of the test nails shall not be less than 10 feet and shall not be longer than the bond length that would prevent testing to 200 percent of the design load while not exceeding the allowable bar load. The allowable bar load during testing shall not exceed 80 percent of the steel ultimate strength for Grade 150 bars or 90 percent of the steel ultimate strength for Grade 60 and 75 bars. The allowable tieback load should not exceed 80 percent of the steel ultimate strength.

For soil nails, the design test load shall be determined by multiplying the bond length of the nail times the design load pullout resistance (load transfer). Tieback design test loads should be the design load specified on the shoring drawings. Proof test nails/tiebacks shall be incrementally loaded and unloaded in accordance with the following schedule:

Load	Hold Time
Alignment Load	1 minute
0.25 Design Load (DL)	1 minute
0.5DL	1 minute
0.75DL	1 minute
1.0DL	1 minute
1.25DL (soil nails)	1 minute
1.33DL (tiebacks) 1.5DL (soil nails)	10 minutes

The alignment load shall be the minimum load required to align the testing apparatus and should not exceed 5 percent of the design load. The dial gauge should be zeroed after the alignment load is applied. Nail/tieback deflections during the 1.33DL and 1.5DL test loads shall be recorded at 1, 2, 3, 5, 6, and 10 minutes.

Depending upon the nail/tieback deflection performance, the load hold period at 1.33DL (tiebacks) or 1.5DL (soil nails) may be increased to 60 minutes. Nail/tieback movement shall be recorded at 1, 2, 3, 5, 6, and 10 minutes. If the nail/tieback deflection between 1 and 10 minutes is greater than 0.04 inches, the 1.33DL/1.5DL load shall be continued to be held for a total of 60 minutes and deflections recorded at 20, 30, 50, and 60 minutes.

Test Nail/Tieback Acceptance

A test nail/tieback shall be considered acceptable when:

1. For verification tests, a nail/tieback is considered acceptable if the creep rate is less than 0.08 inches per log cycle of time between 6 and 60 minutes and the creep rate is linear or decreasing throughout the creep test load hold period.
2. For proof tests, a nail/tieback is considered acceptable if the creep rate is less than 0.04 inches per log cycle of time between 1 and 10 minutes or the creep rate is less than 0.08 inches per log cycle of time between 6 and 60 minutes, 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 percent of the theoretical elastic elongation of the unbonded length.
4. Pullout failure does not occur. Pullout failure is defined as the load at which continued attempts to increase the test load result in continued pullout of the test nail/tieback.

Acceptable proof-test nails/tiebacks may be incorporated as production nails/tiebacks provided that the unbonded test length of the nail/tieback hole has not collapsed and the test nail/tieback length and bar size/number of strands are equal to or greater than the scheduled production nail/tieback at the test

location. Test nails/tiebacks meeting these criteria shall be completed by grouting the unbonded length. Maintenance of the temporary unbonded length for subsequent grouting is the contractor's responsibility.

The Engineer shall evaluate the verification test results. Nail/tieback installation techniques that do not satisfy the nail/tieback testing requirements shall be considered inadequate. In this case, the contractor shall propose alternative methods and install replacement verification test nails/tiebacks.

The Engineer may require that the contractor replace or install additional production nails/tiebacks in areas represented by inadequate proof tests.

Shoring Monitoring

Preconstruction Survey

A shoring monitoring program should be established to monitor the performance of the temporary shoring walls and to provide early detection of deflections that could potentially damage nearby improvements. We recommend that a preconstruction survey of adjacent improvements, such as streets, utilities and buildings, be performed prior to commencing construction. The preconstruction survey should include a video or photographic survey of the condition of existing improvements to establish the preconstruction condition, with special attention to existing cracks in streets or buildings.

Optical Survey

The shoring monitoring program should include an optical survey monitoring program. The recommended frequency of monitoring should vary as a function of the stage of construction as presented in the following table.

Construction Stage	Monitoring Frequency
During shoring and excavation and until wall movements have stabilized	Twice weekly
During shoring and excavation if lateral wall movements exceed 1 inch and until wall movements have stabilized	Three times per week
After shoring and excavation is complete and building foundations are complete adjacent to the shoring wall. This is only if wall movements have also stabilized.	Once weekly
After shoring and excavation is complete and wall movements have stabilized, and before the floors of the building reach the top of the excavation	Twice monthly

Monitoring should include vertical and horizontal survey measurements accurate to at least 0.01 feet. A baseline reading of the monitoring points should be completed prior to beginning shoring installation or excavation activities. The survey data should be provided to GeoEngineers for review within 24 hours. It should be noted that shoring installation, as referenced above, includes the installation of any shoring elements (vertical or horizontal), or excavation in preparation for shoring installation for the project.

For shoring walls, we recommend that optical survey points be established: (1) along the top of the shoring walls; (2) at the curb on the south side of 20800 Block, on the west side of 44th Avenue West, and the north side of 209th Street Southwest; and (3) on existing buildings located within 25 feet of the excavation. The survey points should be located on every other soldier pile along the wall face for soldier pile and tieback shoring and at an approximate spacing of 20 feet for soil nail shoring, and the points along the curb

line/back of alley/existing buildings should be located at an approximate spacing of 20 feet. If lateral wall movements are observed to be in excess of ½ inch between successive readings or if total wall movements exceed 1 inch, construction of the shoring walls should be stopped to determine the cause of the movement and to establish the type and extent of remedial measures required.

APPENDIX E
Report Limitations and Guidelines for Use

APPENDIX E
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Geotechnical Services Are Performed for Specific Purposes, Persons and Projects

This report has been prepared for the exclusive use of the Nitze-Stagen & Company, Inc. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. Our report is prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

A Geotechnical Engineering or Geologic Report Is Based on a Unique Set of Project-specific Factors

This report has been prepared for the 20800 44th Avenue West project in Lynnwood, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- The function of the proposed structure;
- Elevation, configuration, location, orientation or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

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[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

Most Geotechnical and Geologic Findings Are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Geotechnical Engineering Report Recommendations Are Not Final

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from GeoEngineers' professional judgment and opinion. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by GeoEngineers should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GeoEngineers confer with appropriate members of the design team after submitting the report. Also retain GeoEngineers to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having GeoEngineers participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

Contractors Are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical, Geologic and Environmental Reports Should Not Be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants and no conclusions or inferences should be drawn regarding Biological Pollutants, as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

If Client desires these specialized services, they should be obtained from a consultant who offers services in this specialized field.


GeoEngineers

APPENDIX G –CRITICAL AREAS REPORT

Critical Areas Report & Mitigation Plan

Polaris at Lynnwood
Lynnwood, Washington

31 March 2026

PREPARED FOR:
Inland Group

PREPARED BY:
Wet.land, LLC
206-309-8100
Wet.land



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DISCLAIMER

This report has been prepared by Wet.land, LLC based on our best professional judgment, and is intended for the use outlined in Section 1.3 below. Use of this report or its appendices outside of its intended purpose is a breach of the contract under which this document was prepared.

Any delineations, wetland ratings, stream typings, or general characterizations were completed in accordance with the applicable regulations at the time field work was completed. Where information was provided by Others and not collected directly by Wet.land, LLC, such is stated within the report.

Conclusions presented within this report are based on the information available at the time of report preparation, and are accurate and true to the best of our knowledge. The opinions and conclusions contained within this report are a reflection of our interpretation of applicable regulations and are not final until concurrence is provided by the appropriate agencies.

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1. Report Purpose

1.1 Project Name and Purpose

Polaris proposes to develop a 3.08-acre lot into a multistory building with associated parking and infrastructure. The redevelopment will require restoration of a heavily disturbed wetland buffer onsite.

1.2 Applicant

The Applicant for Polaris is Inland Group, represented by Andrew Bernard.

Email: abernard@inlandconstruction.com
Phone: (509) 951-4814

1.3 Report Purpose

This report has been prepared in accordance with the requirements of the Lynnwood Municipal Code (LMC) Chapter 17.10 *Environmentally Critical Areas*. This report has also been prepared in light of applicable State and Federal regulations.

1.4 Preparer Qualifications

Field investigations were previously completed by other consultants (summarized in **Chapter 3** below), and the results of their work are provided within this report. No field delineations were completed by Wet.land, LLC staff. The existing conditions and critical areas present within the Site were verified by Wet.land, LLC (**Appendix A**).

Jennifer Marriott has a Bachelor's Degree and a Master's Degree in Biology from University of Central Florida, and a second Master's Degree in Soil and Environmental Science from the University of Florida. She has over 20 years of experience in wetland delineations and environmental permitting.

2. Project Site

2.1 Project Location

The Project Site is located at 20800 44th Avenue West in Lynnwood, Washington (**Figure 1**). The parcel number is 2704210040-7600. The latitude/longitude coordinate for the center of the parcel is 47.8098, -122.2934. The Public Land Survey System location is the SE ¼ of Section 21, Township 27 North, Range 4 East, Willamette Meridian (W.M.).

2.2 Project Site Description & Site History

The parcel is 3.08-acre and is bound to the east by 44th Avenue West, developed properties to the west, south, and east, and a wetland to the north. The parcel is zoned Planned Community Development (PCD). The property has been developed as a parking lot since 2002.

The Site is currently a level paved area that occupies the majority of the parcel. Little native soil occurs onsite. Native vegetation occurs at the southern and western edges of the parcel though there are landscape islands present within the parking lot. Invasive species are present.

Elevations at the property range from 338 to 364, and the Site slopes downhill from south to north. The property drains to the north to Scriber Creek.

More detail on the existing conditions of these parcels is provided below in **Chapter 3**.

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3. Existing Site Conditions

In-depth analysis of existing conditions within the Project Site is described below.

3.1 Previous Critical Areas Assessment

The wetland to the north was previously evaluated by GeoEnginers in 2023 in conjunction with their review of the Site. Their findings are documented in their report *Wetland and Stream Delineation Report*, dated 20 November 2023 (**Appendix C**). These findings were verified by Wet.land.

Table 1. *Summary of Critical Areas*

Critical Area ID	Wetland Category	Standard Buffer (ft) LMC 17.10.052
Wetland A	Category II/Habitat Score 6	165

3.2 Database Review Summary

An in-depth review of Agency database results for this Project Site follows in **Table 2**, below. Databases were reviewed for features on the site and within 200 feet of the site. Copies of database results are provided in **Appendix C**. Databases referenced include:

- Natural Resource Conservation Service (NRCS), Websoils Survey (NRCS)
- US Fish and Wildlife (USFWS), Wetlands Online Mapper (National Wetlands Inventory, NWI) (USFWS)
- Washington State Department of Ecology (ECY) Water Quality Atlas
- Washington State Department of Fish and Wildlife (WDFW) Priority Species and Habitats
- Washington State Department of Natural Resources (WDNR) Forest Practices Application Mapping Tool (FPAMT)
- Statewide Integrated Fish Distribution (SWIFD) Web Map
- Fish Passage Culverts Map
- Google Earth
- Historic Aerials, www.historicaerials.com
- Snohomish County PDS Map Portal

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Table 2. Summary of Background Review of Publicly Available Databases (all accessed on 10 March 2026).

Database	Agency (Database Manager)	Data Checked
Township, Range, Section Map	WSDOT	SE ¼ of Section 21, Township 27 North, Range 4 East, W.M.
Watershed Boundaries	ArcGIS	HUC 8 (12) – 17110012(0303) WRIA 8, Cedar - Sammamish Watershed: Swamp Creek
NRCS Websoils	NRCS	6 – Alderwood-Urban land complex, 8 to 15% slopes 19 - Everett very gravelly sandy loam, 15 to 30% slopes None of the soil map units listed as hydric.
National Wetlands Inventory	USFWS	No features located onsite, but NWI wetlands mapped around Scriber Creek to north.
Map Service Center	FEMA	Property is not mapped within a FEMA floodplain.
Washington State Water Quality Atlas	ECY	One (1) 303(d) water listed within Study Area, Scriber Creek. Project located within Swamp Creek Bacteria TMDL and Sammamish River and Tribs Multi-parameter TMDL (in development).
Priority Habitats and Species (PHS)	WDFW	Scriber Creek is mapped north of the Site but more than 330 feet away.
Forest Practices Application Mapping Tool	WDNR	No features located within Study Area. Scriber Creek is more than 300 feet away.
Statewide Integrated Fish Distribution (SWIFD) Web Map	NWIFC	No salmonids were mapped within the Study Area.
Washington State Fish Passage	WDFW	No features were mapped within the Study Area.
Snohomish County PDS Map Portal	Snohomish County	**Figure 3.** Scribers Creek, type F stream mapped off-site to the north, over 600 feet to the north.

3.3 Field Investigation Results

Critical areas were evaluated by a previous consultant. We evaluated the site, including a review of the previous delineations from 2023. A summary of these findings is provided below. A photodocument of typical site conditions is included in **Appendix D**. No test pits were collected as the site is entirely either formal landscaping or pavement.

3.3.1 Wetlands

One (1) wetland (Wetland A) was observed adjacent to the property that was previously identified and delineated by GeoEngineers in 2023. That delineation remains accurate. A very small portion of Wetland A occurs at the north end of the Site. The majority of the wetland occurs offsite to the north. This wetland is heavily constrained by the existing built environment. The wetland outlets to the north into another wetland/ponded area that is directly connected to Scriber Creek.

Wetland A is fully offsite, but its buffer extends over the Project Site. However, almost all of the onsite buffer is either a parking lot or one of several scattered landscape islands. The vegetated buffer onsite that is physically connected to the wetland is mostly Himalayan blackberry. Native species are present in the existing southeast portion of the buffer that overlaps an area that is part of the perimeter landscaping. The wetland itself appears to be mostly native species except for edge effects at the perimeter of reed canarygrass or Himalayan blackberry (offsite and onsite).

3.3.2 Streams

No streams were identified on or near the property. One stream, Scriber Creek, was observed more than 600 feet north of the property. While Scriber Creek occurs over 600 feet away, the wetland/ponded complex that Wetland A discharges to just north of the Site is located within 300 feet of the Site. This feature is in turn connected through surface hydrology to Scriber Creek. Given this specific feature appears to contain significant ponding that appears at least in part permanent, it is assumed that salmonids also have the potential to occur within this feature – thus occurring within 300 feet of the Site, even though Scriber Creek itself is much farther away.

3.3.3 Native Vegetation

The only native plants present onsite were planted as part of the onsite landscaping. The edge of the wetland and the limited buffer that is connected to the wetland directly, without pavement in between, contains large amounts of Himalayan blackberry.

3.4 Wildlife

General observations on expected and observed wildlife usage is below.

3.4.1 General Wildlife Usage

Common urban wildlife such as small to medium mammals and birds are expected to use the Site, though connectivity for land-based wildlife is poor given the area is surrounded by intense urban development. Opportunities for listed species is very limited given the dearth of available habitat on the Site. However, connectivity is over a small road to the north and into a large riparian complex where listed species (salmonids) are present downstream.

3.4.2 Federally Listed Species

No habitat occurs onsite that would support federally listed species.

3.4.3 State Listed Species

No state listed species are known or were observed using the Site.

3.4.4 Local Species

Common urban wildlife are expected to use the Site, though the City of Lynnwood does not have its own list of local species of importance.

4. Regulatory Review

The Site falls under the jurisdiction of the City of Lynnwood, State of Washington, and the US Army Corps of Engineers. A summary of the relevant regulations follows.

4.1 Federal Regulations

Waters of the US, including the wetlands and watercourses, occur on or adjacent to the Site and may be subject to applicable Federal regulations. Wetland and stream (watercourse) impacts are regulated at the Federal level by Sections 404 and 401 of the Clean Water Act. The US Army Corps of Engineers (USACE) is responsible for administering compliance with Section 404 via the issuance of Nationwide or Individual Permits for any fill or dredging activities within wetlands under Corps jurisdiction. If no actions are proposed that would directly impact a wetland or stream, then no coordination with the USACE is necessary for Section 404 compliance.

4.2 State Regulations

Critical areas on the Site are subject to applicable State regulations. However, City regulations retaining to wetlands and streams are based on state guidelines and will dictate critical areas protections.

4.2.1 Washington State Department of Ecology (ECY)

Any project that is subject to Section 404 permitting is also required to comply with Section 401 Water Quality Certification, which is administered by the Washington State Department of Ecology (ECY). If no actions are proposed that would directly impact a wetland or stream, then no coordination with the USACE is necessary for Section 404 compliance, which would also include Section 401 compliance.

4.2.2 Washington State Department of Fish and Wildlife (WDFW)

WDFW regulates streams and project actions that may affect the bed, bank or flow of a stream. Projects that only proposed buffer modifications and/or vegetative enhancement actions that do not modify the stream channel or add stormwater outfalls or similar would not require coordination with WDFW.

4.3 Local Regulations

The Site falls within the City of Lynnwood limits and is subject to the regulations of LMC Chapter 17.10 – *Environmentally Critical Areas*.

4.3.1 Shoreline Jurisdiction

The Site does not occur within Shoreline jurisdiction.

4.3.2 Non-Shoreline Jurisdiction

Critical areas on the Site are subject to the regulations of LMC Chapter 17.10 – *Environmentally Critical Areas*.

Wetlands

A wetland is located at the north end of the Site that extends offsite. This wetland rated as a Category II wetland with a habitat score of 6. The initial report by GeoEngineers documented a Habitat Score of 5, but that was a

mistype regarding the priority habitats within 330 feet. Rating question H3.1 should be a High, thus bumping the habitat score from a 5 to a 6. Category II wetlands with a habitat score of 6 require a standard buffer of 165 feet.

Regardless of the standard buffer, the actual buffer is less due to pre-existing non-conforming site conditions. LMC 17.10.044 notes that all existing developed areas located within a critical area, including wetland buffers, have a legal nonconforming status. Therefore, the buffer would stop at the edge of the existing pavement of the parking lot. The designed and installed landscape islands would not be considered as buffer even where these areas occur within the limits of the current buffer because they are discontinuous, and a known, permitted plant installation that is actively managed. As a result, the actual buffer onsite ranges between 5-14 feet along most of the length of the wetland because of the pre-existing parking lot on this Site. There is one spot at the eastern edge of the parcel where the existing buffer is 99 feet of vegetation due to the buffer extending over areas that were planted as part of the permitted perimeter landscape plantings from when the parking lot was constructed.

Streams

No streams occur on or near the Site, and no stream buffers extend over the Site. The streams occur farther away.

Building/Structure Setback

The wetland buffer requires a 15-foot building setback line to prevent encroachment into the critical areas following construction (LMC 17.10.080).

4.3.3 Flood Hazard Area

No 100-year floodplains are mapped on or adjacent to the Site.

5. Proposed Project

5.1 Proposed Project

The Polaris Project proposes to redevelop the property into a multistory building with an associated parking lot (**Appendix B, Figure 3 and see Civil Plans**). Stormwater management will meet current City standards.

Access to the Project will be provided by using the existing access locations from the northwest, southwest, and east.

Offsite stormwater is currently piped across this Site and released into Wetland A. This Project cannot modify offsite stormwater. However, all stormwater from onsite will be managed and treated prior to release into the newly created buffer area. The stormwater will be released at one of two proposed dispersion trenches that will allow for the stormwater to infiltrate into the newly created buffer (see below for discussion).

5.2 Site Development Alternatives

The existing property has already been disturbed with asphalt and concrete which encompasses the majority of the parcel. The standard wetland buffer encumbers the site, most of which is paved.

6. Critical Areas Impacts

6.1 Assessment of Development Impacts

No direct, permanent impacts to any wetlands or streams will result from this Project. The existing reduced width buffer onsite will remain as is but will be included in the mitigation actions for enhancement. The functional wetland buffer will be expanded from 5-14 feet across most of the wetland edge to a minimum buffer width of 30 feet.

6.1.1 Wetland Buffer Impacts

Approximately 6,500 square feet of vegetated but disturbed buffer occur onsite. The existing wetland buffer onsite is minimal, disturbed, and provides little function. The remainder of the buffer is non-existent – it's the paved condition that qualifies as a pre-existing non-conforming use that excludes this area as being considered buffer. The Project will remove the pavement from within 28,170 square feet of the standard buffer that is currently a pre-existing non-conforming use and restore this area as functional buffer. This restoration is proposed to offset 37,209 square feet of paved (pre-existing non-conforming) standard buffer that will remain in a paved/built condition.

The targeted mitigation area will be fully restored through the removal of the pavement and any underlying substrates down to native soil. Soil additions and amendments will be added to ensure a minimum of 12" of suitable soil material for planting. This area will then be densely planted and mulched. The area will be contoured so that there is a natural gradient from the edge of the Project to the elevation at the wetland edge.

Stormwater from the Project will be routed through the onsite treatment before being released into the wetland buffer through dispersion trenches located within the restored buffer. Elevations, and thus locations, of the dispersion trenches are controlled by the elevations of the stormwater treatment system outlets. An existing outfall structure occurs onsite that conveys offsite stormwater to the wetland edge. This outfall will not be modified. The offsite stormwater will remain separate from the onsite stormwater.

The combination of upgraded stormwater facilities and removal of a large area of parking lot will ensure a significant improvement to onsite critical areas. The reconstructed buffer will provide a higher functioning buffer compared to current conditions through the importation of soil, removal of pavement, allowing for onsite infiltration of water into the soil, and dense plantings of native woody plants. The addition of the woody plants will improve habitat function and availability for local species to use/forage/nest, as well as generally reducing the water that continues offsite since the plants will absorb/retain water, especially the tree species planted. This will have a net positive impact to the immediate downstream areas where water runoff can be less managed and sometimes have negative impacts in this particular area. Wetland A does not currently suffer from too little water, and arguably needs a larger, functional buffer in order to improve the overall quality of this wetland.

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6.1.2 Listed Species Impacts

The project is expected to have a net positive impact to state and federally listed species that use downstream waters through the buffer enhancement and restoration proposed and the upgrade of the onsite stormwater facilities to meet current standards. The buffer restoration actions will ensure that all stormwater leaving the Project will be routed through soil before entering Wetland A and eventually downstream waters where salmonids are known to occur.

The Project is not likely to adversely affect listed species.

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7. Proposed Mitigation Plan

7.1 Agency Policies and Guidance

The proposed mitigation plan was designed in accordance with the policies and guidance provided in the following documents:

- LMC, Chapter 17.10 – Environmentally Critical Areas;
- The Washington State Department of Ecology (ECY) Publication #21-06-003, Wetland Mitigation in Washington State – Part 1: Agency Policies and Guidance (Version 2), and Part 2 (Publication #06-06-011b): Developing Mitigation Plans (Version 1), dated March 2006 (Washington State Department of Ecology, U.S. Army Corps of Engineers Seattle District, and U.S. Environmental Protection Agency Region 10 2006a, 2006b); and
- The Federal Compensatory Mitigation for Losses of Aquatic Resources Final Rule (33 CFR Parts 325 and 332, April 10, 2008), effective June 9, 2008 (U.S. Army Corps of Engineers Seattle District and U.S. Environmental Protection Agency Region 10 2008).

All proposed mitigation shall be based on best available science and shall demonstrate no net loss of critical area functions and values.

7.2 Mitigation Sequencing

Mitigation sequencing has been applied to the proposed project pursuant to the mitigation definition and preferred sequence definition outlined in LMC 17.10.030, and as required by the USACE. The City mitigation sequencing requirements are as follows, and are consistent with the USACE requirements:

1. Avoiding impacts altogether by not taking a certain action or parts of an action;
2. Minimizing impacts by limiting the degree of magnitude of the action and its implementation by using appropriate technology, or by taking affirmative steps to avoid or reduce impacts;
3. Rectifying the impact by repairing, rehabilitating or restoring the affected critical area;
4. Reducing or eliminating the impact over time by preservation or maintenance operations during the life of the development proposal;
5. Compensating for the impact by replacing, enhancing, or providing substitute critical areas; or
6. Monitoring the impact and taking appropriate corrective measures.

All direct, permanent impacts to critical areas have been avoided with the current Site Plan. Modification of the pre-existing non-conforming buffer onsite will be required to accommodate this project. Almost 30,000 square feet of buffer restoration will occur onsite to compensate for the pre-existing non-conforming buffer that will remain in a disturbed condition. Restoration will occur onsite where fill and pavement will be removed prior to plantings with soil amendments and mulch added.

7.3 Proposed Mitigation Components

The mitigation plan includes the following elements to compensate for the project impacts to critical areas:

7.3.1 Buffer Restoration

A planting plan is provided as part of the Landscape Plans. Proposed buffer restoration measures include:

1. Removing fill, asphalt/pavement, and any remaining structures;
2. Clearing and grubbing all invasive, non-native weedy species in the mitigation areas;
3. Decompacting soils, scarify and add topsoil (see Landscape Plan for specifications);
4. Installing a minimum of 3 inches of bark mulch in all bare soil areas;
5. Planting a variety of native deciduous and evergreen tree and shrub species; and
6. Installing critical area fencing and signs at buffer boundaries where required.

7.4 Mitigation Design Elements

7.4.1 Irrigation

A temporary irrigation system will be provided for the proposed mitigation areas that will provide head-to-head coverage at least twice a week through the summer months.

7.4.2 Plantings

All plantings will only be native species typical for the region that have been site located based on that species' tolerances for light, water, and soil type. A variety of tree and shrub species will be chosen with the intent to provide structural and species diversity within the mitigation areas. It is expected that natural recruitment of species occurring in the area will also occur and contribute to the species diversity and cover in the mitigation area. The detailed plantings are outlined in the Landscape Plans prepared by others.

7.5 Mitigation Goals, Objectives, and Performance Standards

The primary goal of the mitigation is to compensate for impacts to buffers and restore the impacted buffers. To accomplish these goals, the proposed project will:

- Buffer Restoration/Enhancement **28,170 square feet**

Mitigation actions will be evaluated through the following objectives and performance standards. See **Chapter 9** for a full description of the monitoring methods that will be used to evaluate the approved performance standards. Mitigation monitoring will be performed by a qualified biologist.

Objective A: Create structural and plant species diversity in all of the mitigation areas.

Performance Standard A1: Percent survival of all installed species must be at least 90% at the end of Year 1, and 80% at the end of Year 2.

Performance Standard A2: At least 4 species of desirable native plant species will be present in the buffer restoration and enhancement areas. Species may be comprised of both planted and naturally colonized vegetation.

Performance Standard A3: Percent cover of woody vegetation will be at least 35% in Year 3 and at least 50% in Year 5.

Objective B: Remove and control invasive plants to less than 10% cover in mitigation areas.

Performance Standard B1: After construction and throughout the 5-year monitoring period, aerial coverage by non-native invasive plant species shall be maintained at 10% or less throughout the mitigation site. These species include, but are not limited to: Scot's broom, Himalayan and evergreen blackberry, purple loosestrife, hedge bindweed, and bittersweet nightshade.

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8. Construction Sequencing

8.1 Mitigation Construction Sequencing

The following provides the general sequence of activities anticipated to construct this mitigation project. Some of these activities may be conducted concurrently as the project progresses.

1. Conduct a site meeting between the Contractor, project Biologist or Ecologist, and the Owner's Representative to review the project plans, staging/stockpile areas, and material disposal areas.
2. A pre-construction meeting with City staff will be required in advance of beginning any construction activities.
3. Survey clearing limits.
4. Install silt fence and any other erosion and sedimentation control BMPs necessary for work in the project areas.
5. Install tree protection measures as determined necessary.
6. Clear and grub designated buffers to remove non-native, invasive species and any existing fill, structures, and infrastructure.
7. Ensure a minimum of 12" of suitable soil is present within areas where fill was removed. Import appropriate soil, as needed.
8. Plant cleared and grubbed areas per the planting typicals/plans.
9. Mulch all grubbed and cleared areas and provide a three-inch-deep mulch ring around all container-planted material outside of wetland.
10. Install irrigation system. Ensure that the system is capable of head-to-head coverage.
11. Install critical area fencing and signs at outer limits of mitigation site.
12. Complete site cleanup.

8.2 Post-Construction Approval

Once construction is approved, a qualified wetland ecologist shall conduct a post-construction assessment. The purpose of this assessment will be to establish baseline conditions at Year 0 of the required monitoring period. A Baseline Assessment report including "as-built" drawings will be submitted to all of the required agencies. The as-built plan set will identify and describe any changes in grading, planting, or other constructed features in relation to the original approved plan.

8.3 Post-Construction Assessment

The Permittee or representative shall notify the permitting agencies (City) when the mitigation plan has been fully installed and is ready for a final site inspection and subsequent final approval. Once final approval is obtained in writing, and "as-built" plans are approved, the monitoring period will begin.

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9. Monitoring Plan

Performance monitoring of the mitigation areas will be conducted according to all applicable code/regulatory requirements and permit conditions. Monitoring will be conducted according to LMC 17.10.055 for up to five years for the City. Monitoring will be conducted according to the schedule presented in **Table 3** below, and will be performed by a qualified biologist or ecologist. The performance monitoring period will be complete when the mitigation site meets all performance standards, at which point one can conclude that the goals and objectives for the mitigation site have been met.

Table 3. *Projected Schedule for Performance Monitoring & Maintenance Events*

Year	Date	Maintenance Review	Performance Monitoring	Report Due to Agencies
Year 0 As-built and Baseline Assessment	Fall	X	X	X
1	Spring	X	X	
	Fall	X	X	X
2	Spring	X	X	
	Fall	X	X	X
3	Spring	X		
	Fall	X	X	X
4	Spring	X		
	Fall	X	X	X
5	Spring	X		
	Fall	X	X	X*

ⓘ *Final approvals from the City may be requested to facilitate release of any financial guarantees assuming performance criteria are met.

9.1 Monitoring Reports

Each monitoring report will adhere to the requirements of LMC 17.10.055. The reports will include: 1) Project Overview, 2) Requirements, 3) Summary Data, 4) Maps and Plans, and 5) Conclusions. Monitoring reports will be submitted to the City Planning Director by December 1st during the years in which monitoring is conducted.

9.2 Monitoring Methods

The following monitoring methods will be used to evaluate the mitigation site for compliance with the approved performance standards.

9.2.1 Vegetation Monitoring

Vegetation monitoring methods may include counts; photo-points; random sampling; sampling plots, quadrats, or transects; stem density; visual inspection; and/or other methods deemed appropriate by the permitting agencies.

Vegetation monitoring components shall include general appearance, health, mortality, colonization rates, percent cover, percent survival, volunteer plant species, and invasive weed cover.

Permanent vegetation sampling plots, quadrats, and/or transects will be established at selected locations to adequately sample and represent all of the plant communities within the mitigation project areas. The number, exact size, and location of transects, sampling plots, and quadrats will be determined at the time of the baseline assessment and shown on a map for use in the baseline assessment report, as well as future annual monitoring reports.

Percent aerial cover of woody vegetation will be evaluated through the use of point-intercept sampling methodology. Using this methodology, a tape will be extended between two permanent markers at each end of an established transect. Trees and shrubs intercepted by the tape will be identified, and the intercept distance recorded. Percent cover by species will then be calculated by adding the intercept distances and expressing them as a total proportion of the tape length.

The established vegetation sampling locations will be monitored and compared to the baseline data during each performance monitoring event to aid in determining the success of plant establishment. Percent survival of shrubs and trees will be evaluated in a 10-foot-wide strip along each established transect. The species and location of all shrubs and trees within this area will be recorded at the time of the baseline assessment and will be evaluated during each monitoring event to determine percent survival.

9.2.2 Photo Documentation

Permanent photo stations will be established at a minimum of three (3) locations within the mitigation site from which panoramic photographs will be taken throughout the monitoring period. Photo-point locations will be shown on a map and submitted with the baseline assessment report and yearly performance monitoring reports. These photographs will document general appearance and relative changes within the plant community. Review of the photos over time will provide a semi-quantitative representation of success of the planting plan.

9.2.3 Wildlife

Direct and indirect observations of wildlife usage will be recorded during scheduled monitoring events. Direct observations entail actual sightings of the animal, while indirect observations include noticing tracks, scat, nests, or other indications of a species using the area.

9.2.4 Water Quality

Water quality will be visually observed during scheduled monitoring events for a qualitative assessment that is only intended to notice obvious discrepancies from expected conditions. No water quality sampling is proposed in conjunction with this parameter. Qualitative water quality assessment parameters include oil sheens (or other surface films); abnormal color or odor of water; stressed or dead vegetation or aquatic fauna, if present; or obvious turbidity.

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9.2.5 Site Stability

General observations of slope stability in the mitigation site will be made during each scheduled monitoring event. Any observations of unexpected erosion will be recorded and discussed with appropriate Team members or Agency staff to determine any necessary corrective measures.

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10. Maintenance Plan and Contingency Measures

Regular maintenance reviews will be performed according to schedule presented in **Table 4** as part of the performance monitoring program to address any conditions that could jeopardize the success of the mitigation project. Required maintenance on the site will be implemented within ten (10) business days of submission of a maintenance memo to the maintenance contractor and permittee.

The established performance standards identified in **Section 7.5** (above) will be compared to the yearly monitoring results to evaluate the success of the mitigation. Adjustments to the mitigation will be made as needed based on these regular evaluations to bring the mitigation back on track for success.

The following list includes examples of maintenance (M) actions that may be implemented during the course of the monitoring period. This list is not intended to be exhaustive, and other actions may be implemented as deemed necessary.

- Replace all dead woody plant material during Year One (M).
- Remove/control weedy or exotic invasive plants in a manner consistent with current Agency guidelines and recommendations. Use of herbicides or pesticides within the mitigation area would only be implemented if other measures failed or were considered unlikely to be successful and would require prior agency approval. All non-native vegetation must be removed and disposed of off-site (M).
- Weed all trees and shrubs to the dripline and provide 3-inch-deep mulch rings 24 inches in diameter for shrubs and 36 inches in diameter for trees (M).
- Remove trash and other debris from the mitigation areas twice a year (M).
- Selectively prune woody plants at the direction of Project Ecologist or Biologist to meet the mitigation plan's goal and objectives (e.g., thinning and removal of dead or diseased portions of trees/shrubs) (M).
- Repair or replace damaged structures including signs, or bat/bird boxes (M).

If, during the course of the monitoring period, there appears to be a significant problem with achieving the performance standards, the permittee shall work with the City and other permitting agencies to develop a Contingency Plan in order to get the project back into compliance with the performance standards. Contingency plans can include, but are not limited to, the following actions: additional plant installation, erosion control, bank stabilization, modifications to hydrology, and plant substitutions of type, size, quantity, and/or location. If required, a Contingency Plan shall be submitted to the City by December 1st of any year when deficiencies are discovered.

The following list includes examples of contingency (C) actions that may be implemented during the course of the monitoring period. This list is not intended to be exhaustive, and other actions may be implemented as deemed necessary.

- Replace dead plants with the same species or a substitute that meets mitigation plan goals and objectives, subject to project Biologist/Ecologist and agency approval (C).

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- Re-plant area after reason for failure has been identified (e.g., moisture regime, poor plant stock, disease, shade/sun conditions, wildlife damage, etc.) (C).

