

3J CONSULTING

CIVIL ENGINEERING | WATER RESOURCES | COMMUNITY PLANNING

PRELIMINARY STORMWATER SITE PLAN

Swickard BMW
18624 Highway 99
Lynnwood, WA

Land Use #: TBD

January 31, 2023

Prepared For:

Eric Iversen
Swickard Auto Group
25035 SW Parkway Avenue
Wilsonville, OR 97070



Prepared By:
3J Consulting, Inc.
9600 SW Nimbus Avenue, Suite 100
Beaverton, Oregon 97008
Project No: 22798
PJP

Swickard BMW

Introduction: The purpose of this report is to provide the site design information for the proposed Swickard BMW development. Onsite stormwater design follows the requirements presented in the 2019 release of the Stormwater Management Manual for Western Washington (SWMMWW) and has been prepared to support preliminary permit review and land use approval. The project site is located at 18624 Highway 99 at parcel number 00374300500201. The site abuts Highway 99 and 188th Street SW.

Site Address: 18624 Highway 99
Lynnwood, WA 98037

Applicant: Eric Iversen
Swickard Auto Group
25035 SW Parkway Avenue
Wilsonville, NJOR 97070

Tax Parcel Number: 00374300500201

Total Parcel Area: 9.91 acres

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SECTION I - PROJECT LOCATION

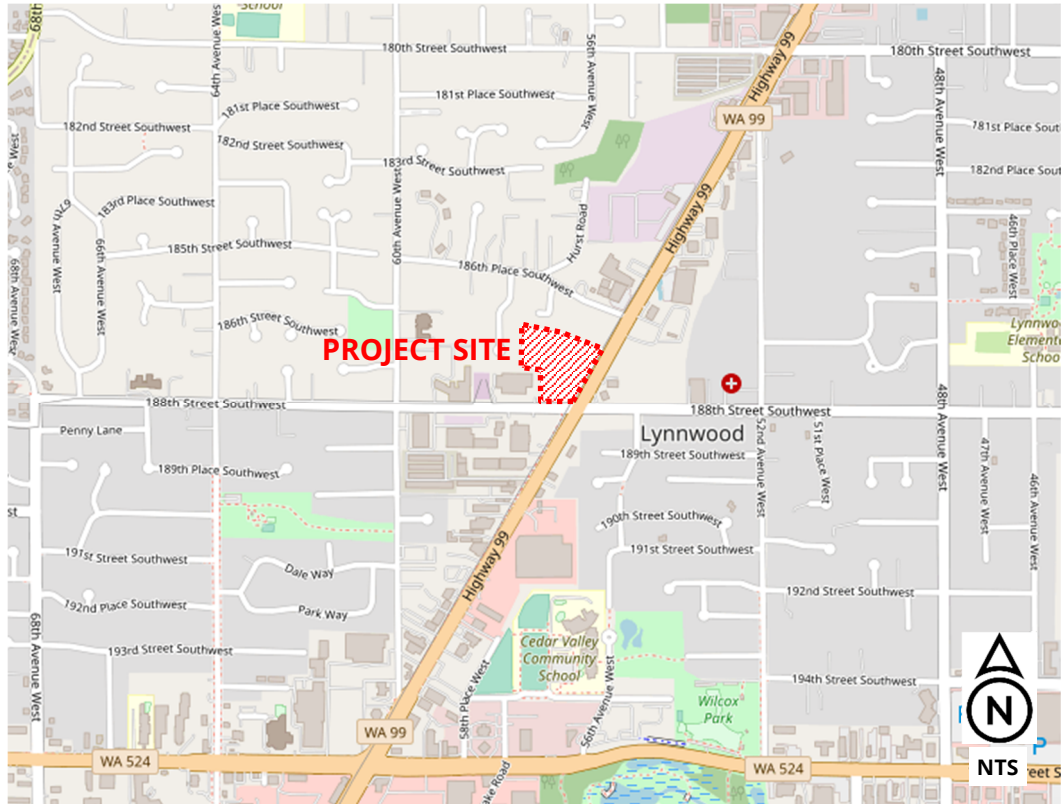


Figure 1 - Vicinity Map



Figure 2 - Aerial Photo



SECTION 2 – PROJECT DESCRIPTION

This Preliminary Stormwater Site Plan follows the requirements outlined in the Stormwater Management Manual for Western Washington (SWMMWW, 2019). All proposed stormwater facilities are expected to sufficiently treat and manage post-development runoff; all required information is included below.

2.1: Existing Conditions

The project is located at 18624 Highway 99 on parcel 00374300500201, located in NW 1/4 Section 16, Township 27 North, Range 4 East. The parcel has a total area of 9.91 acres; however, the area of analysis (project site) for this report is 5.39 acres. The parcel is bound by a Porsche dealership to the north, a Harley-Davidson dealership to the southwest, Alderwood Townhome Apartments to the northwest, Highway 99 to the east, and 188th Street SW to the south. A survey was completed by S&F Land Services in March 2020.

In existing conditions, the site consists of a former manufactured home park and a portion of Emerald City Harley-Davidson dealership. Runoff from the entire Harley-Davidson dealership is currently treated and managed by a swale and underground detention tank; these stormwater facilities will be replaced as part of this project. For hydrologic analyses, the project site will be referred to as the “Onsite Basin” and the undisturbed portion of the dealership will be referred to as “Upstream Basin”. Table 1 below outlines the existing basin areas, which concurs with the Existing Conditions exhibit in Appendix A.

Collectively, the basins function as a single Threshold Discharge Area (TDA), which discharges to the public 24” storm line in Highway 99. This public storm system ultimately discharges to Scriber Creek. There are no streams, wetlands, or water bodies on the site. Additionally, flood hazards on or adjacent to the site are not present. The site is not located in an aquifer or wellhead protection area.

Existing Basin	Impervious Area		Pervious Area		Total Area	
	sf	ac	sf	ac	sf	ac
Onsite	96,820	2.22	138,140	3.17	234,960	5.39
Upstream	69,703	1.60	18,942	0.43	88,645	2.04

Table 1 – Existing Basin Areas

2.2: Post-Developed Conditions

In post-developed conditions, the site will consist of two new buildings, parking areas, driveways, other hardscaping, and landscaping. Runoff from onsite improvements and the undisturbed Upstream Basin will drain to proposed stormwater management facilities, which will be described in later sections. The stormwater facilities will discharge either to the private storm drain system on the Porsche Seattle North site to the north, or directly to the public storm system within Highway 99. All post-developed onsite runoff will eventually confluence in the public storm system within Highway 99. Table 2 below outlines the post-developed basin areas, which concurs with the Post-Developed Conditions exhibit in Appendix A.

Post-Dev. Onsite Basin	sf	ac
Impervious Area	183,015	4.20
Pervious Area	51,945	1.19
Total Area	234,960	5.39

Table 2 – Post-Developed Basin Areas



SECTION 3 – APPLICABLE REQUIREMENTS

3.1: Determination of Applicable Minimum Requirements

The project is expected to disturb 5.39 acres onsite and result in a net increase of 1.98 ac of impervious area. Per Table 1 above, the existing onsite impervious coverage is approximately 41%. When comparing Tables 1 & 2, the post-developed impervious area exceeds the existing impervious area by approximately 89%. As a result, this project shall meet Minimum Requirements 1-9 of the SWMMWW.

3.2: Minimum Requirements (MR)

MR #1: Preparation of Stormwater Site Plans

The project is expected to disturb 5.39 acres onsite and result in a net increase in impervious area of 1.98 ac. The previous land use of the project site was a former mobile home park and a portion of Emerald City Harley-Davidson. The basin areas are shown in Table 1 above and indicate an onsite impervious coverage of 41%. This results in the project being classified as Redevelopment.

MR #2: Construction Stormwater Pollution Prevention (SWPPP)

A construction Stormwater Pollution Prevention Plan (SWPPP) will be incorporated into the site construction plans. The total disturbance area of the project, 5.39 ac, requires a Notice of Intent Application for coverage under the Construction Stormwater General Permit. The application will be submitted by the owners prior to construction.

MR #3: Source Control of Pollution

Per Volume IV of the SWMM, the following BMPs shall be applied to the proposed development regardless of the type of development:

- S410 BMPs for Correcting Illicit Discharges to Storm Drains
- S453 BMPs for Formation of a Pollution Prevention Team
- S454 BMPs for Preventative Maintenance/Good Housekeeping
- S455 BMPs for Spill Prevention and Cleanup
- S456 BMPs for Employee Training
- S457 BMPs for Inspections
- S458 BMPs for Record Keeping

The following BMPs shall be applied to the proposed project due to the nature of development:

- S431 BMPs for Washing and Steam Cleaning Vehicles/Equipment/Building Structures
- S421 BMPs for Parking and Storage of Vehicles and Equipment
- S414 BMPs for Maintenance and Repair of Vehicles and Equipment

Further details of the BMPs listed in this section are provided in Appendix B.

MR #4: Preservation of Natural Drainage Systems and Outfalls

No natural drainage systems or outfalls are on or adjacent to the site. Post-developed runoff will be collected and conveyed to underground detention facilities and piped to the public storm lines within Highway 99 and 188th Street SW.

MR #5: On-Site Stormwater Management

Support documents for this subsection are provided in Appendix C.

A Geotechnical Engineering Services Report was completed by GeoEngineers in March 2021. According to the report, the site generally consists of fill, weathered glacial till, glacial till, and advanced outwash. Fill and topsoil generally extend from ground surface to depths of 9 feet below ground surface. In October



2022, in conjunction with construction activities associated with the Porsche dealership, GeoEngineers performed a PIT test 2 ft below that development’s detention facility. The bottom of the test pit was observed to be wet, which concurred with groundwater assessments made in the March 2021 report. GeoEngineers observed no measurable infiltration (~0 in/hr). As a result, no infiltration will be modeled in the sizing of this project’s detention facilities.

According to the NRCS Web Soil Survey, the site is mapped with Alderwood-Urban land complex. Volume III of the 2019 SWMM for Western Washington lists Alderwood soils as Hydrologic Soils Group C.

All disturbed landscaped surfaces shall preserve or restore the health and water holding capacity of the soils by applying the DOE BMP T5.13: Post-Construction Soil Quality and Depth. As such, all proposed landscaped surfaces were modeled in WWHM2012 as pasture.

MR #6: Runoff Treatment

Due to the nature of the development and the site’s receiving waterbodies, Scriber Creek and Scriber Lake, enhanced treatment is required for the site. Five (5) Oldcastle BioPods are proposed onsite, which are approved for General Use for Enhanced Treatment by DOE. All BioPods are proposed upstream of proposed detention facilities.

Contributing drainage areas to each proposed treatment BMP were delineated and are denoted as Subbasins 1 through 6 (see Appendix A: Post-Developed Conditions). Runoff from Subbasin 2 and the existing Harley-Davidson site (Upstream Basin) will drain to the same storm drain system and BioPod facility. Also, Subbasin 6 will drain to an existing 6x12 BioPod facility on the previously developed Porsche Site to the northeast. That BioPod was reevaluated to demonstrate sufficient treatment of Subbasin 6. See the Post-Developed Conditions Exhibit (Appendix A) for the basin areas for the undisturbed portion of the Porsche Site.

WWHM was used to determine the required water quality flow rates for each BMP (See Appendix D). Table 3 below outlines the required treatment flow rate and proposed BMP for each subbasin.

Post-Dev. Subbasin	Basin Areas (ac)		Treatment BMP	Treatment Flow Rate (cfs)	
	Impervious	Pervious		Required ⁽¹⁾	Provided
1	1.10	0.36	6x12 BPU ⁽²⁾	0.172	0.213
2 + Ex. HD Site	3.08	0.66	8x24 BPU ⁽²⁾	0.480	0.570
3	1.31	0.44	6x12 BPU ⁽²⁾	0.204	0.213
4	0.07	0.01	4x6 BPS ⁽³⁾	0.011	0.074
5	0.03	0.001	4x6 BPS ⁽³⁾	0.005	0.074
6 + Ex. Porsche Site	1.24	0.35	Ex. 6x12 BPU ⁽²⁾⁽⁴⁾	0.206	0.213

Table 3 – Post-Developed Treatment BMPs

⁽¹⁾From WWHM (see Appendix D); ⁽²⁾BPU – BioPod Underground; ⁽³⁾BPS – BioPod Surface; ⁽⁴⁾Rechecking existing BMP.

MR #7: Flow Control

Stormwater discharges from the site will match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. WWHM results for Detention Sizing can be found in Appendix D. As previously mentioned, infiltration is infeasible.



Pre-developed land conditions were assumed to be forested. The post-developed site will consist of landscaping, roofs, driveways, and roads. All post-developed landscaped areas were modeled as pasture since BMP T5.13: Post-Construction Soil Quality and Depth will be implemented.

Figure 3 shows the preliminarily sized detention facility to mitigate the post-developed flow duration curve to predeveloped conditions for the onsite disturbed areas. Figure 4 shows flow duration curves for stream protection.

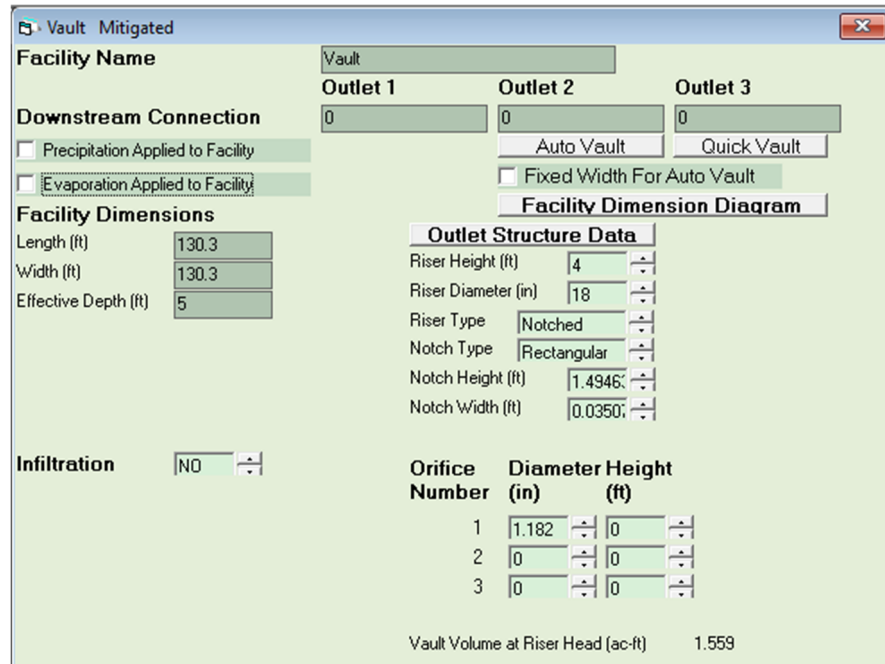


Figure 3 - Detention and Flow Control Structure

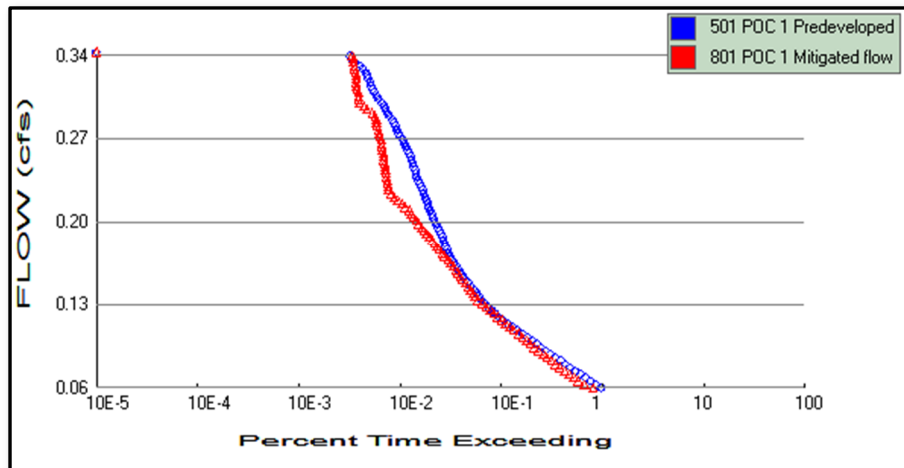


Figure 4 - Stream Protection Duration Curves

Using the results from Figure 3, the required detention volume is estimated to be 84,890 cf. This value does not include the volume needed to replace the existing onsite detention facility currently managing runoff for the Harley-Davidson site (Upstream Basin). As-built details on the existing facility will be procured and used to develop the actual predeveloped flow duration curve during the development of the final Stormwater Site Plan.



It is tentatively planned to distribute detention facilities across the site. The detention facilities will be fully detailed in the final Stormwater Site Plan; however, the facilities are depicted on the Post-Developed Conditions exhibit (Appendix A) based on ratios of contributing impervious area to each facility with respect to total post-developed impervious area.

MR #8: Wetlands Protection

There are no existing wetlands on or adjacent to the project site.

MR #9: Operation and Maintenance

The storm facilities will be maintained by the owner. An operation and maintenance plan will be prepared and submitted as part of the final Stormwater Site Plan.

SECTION 4 – OFF-SITE ANALYSIS

4.1 Downstream Analysis

Stormwater from the TDA discharges into an existing 24" storm pipe crossing Highway 99 that releases water into Scriber Creek. Scriber Creek has been analyzed extensively to prepare the Scriber Creek Corridor Management Plan State Route 99 to Scriber Lake, by Herrera Environmental Consultants, Inc dated October 21, 2016. According to the plan, flooding and sedimentation problems reside within this corridor. A phased approach was outlined in the plan to alleviate the issues including culvert replacements on Scriber Creek between 188th St SW and 191st St SW. According to the City, culvert replacement projects will begin in approximately five years. No further analysis has been completed due to the already existing studies completed on the creek.

4.2 Upstream Analysis

The undisturbed portion of the existing Harley-Davidson dealership (Upstream Basin) to the west of the project site has been included in sizing a proposed treatment BMP. The dealership will be included in detention sizing and conveyance analyses during development of construction drawings and the final Stormwater Site Plan.

SECTION 5 – CONVEYANCE ANALYSIS

The SWMMWW does not provide guidance for evaluating conveyance capacity of storm drain systems. Standard engineering practice is to provide a capacity/conveyance analysis that demonstrates sufficient conveyance for the post-developed 10-yr storm event.

The onsite conveyance systems will be analyzed using the SBUH method, via XPSTORM, to demonstrate sufficient flow capacity during the 10-yr storm event. Full details of the proposed onsite conveyance system will be included in the final Stormwater Site Plan.

APPENDIX

A) Site Maps

- Tax Map
- Existing Conditions
- Post-Developed Conditions
- Land Use Plan Set

B) Source Control BMP Fact Sheets (from SWMMWW)

C) Geotechnical Documents

- Geotechnical Engineering Services Report (GeoEngineers, Mar 2021)
- Infiltration Testing Results (email correspondence with GeoEngineers, Oct 2022)
- NRCS Web Soil Survey: Snohomish County Area, Washington
- Table III-2.4: Hydrologic Soil Series for Selected Soils in Washington State (from SWMMWW)

D) WWHM Reports

- Detention Sizing
- Water Quality Sizing

REFERENCES

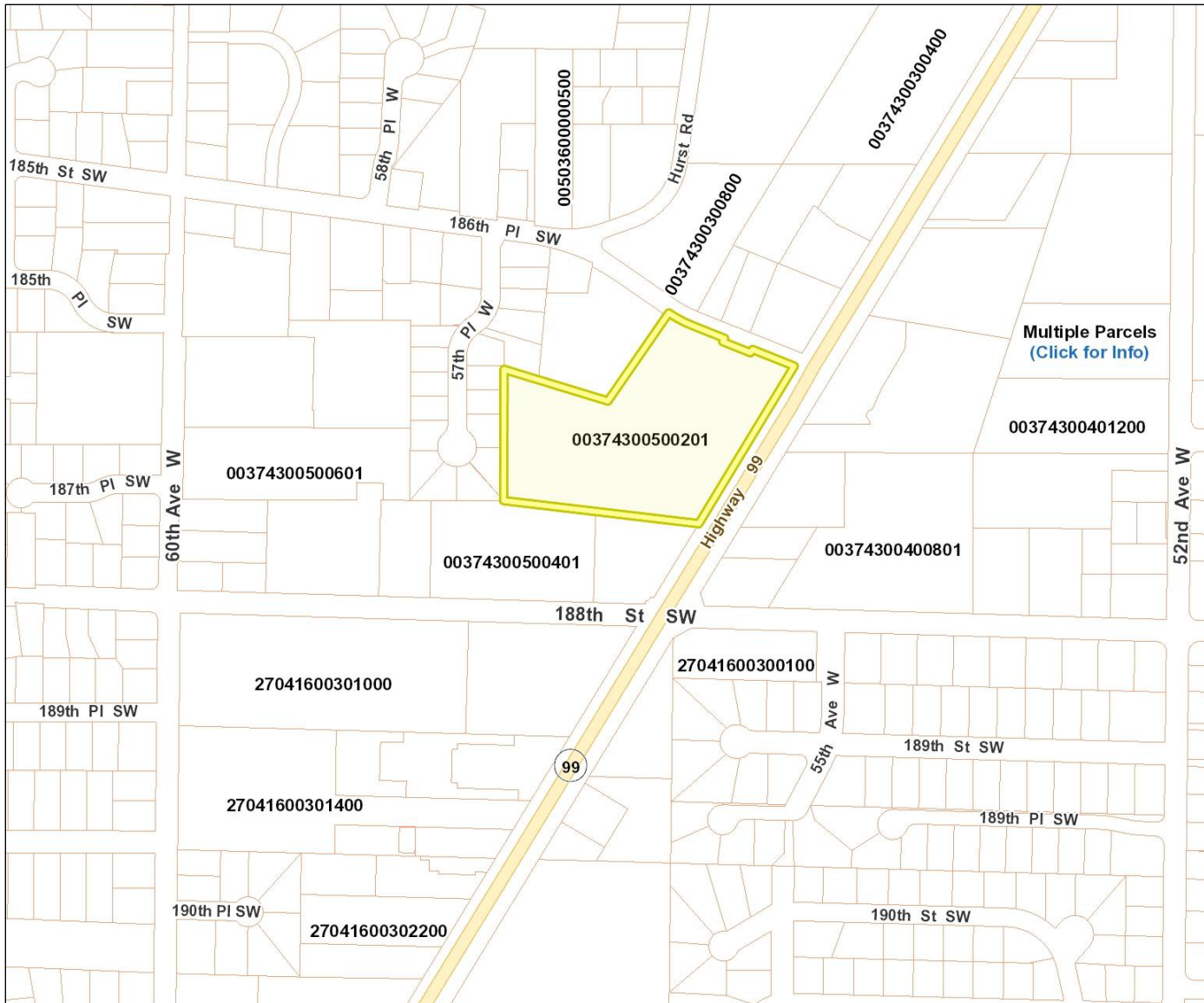
1. *Stormwater Management Manual for Western Washington* (SWMMWW). Washington Department of Ecology, Issued in 2019.



APPENDIX A

Site Maps

Tax Map



Legend

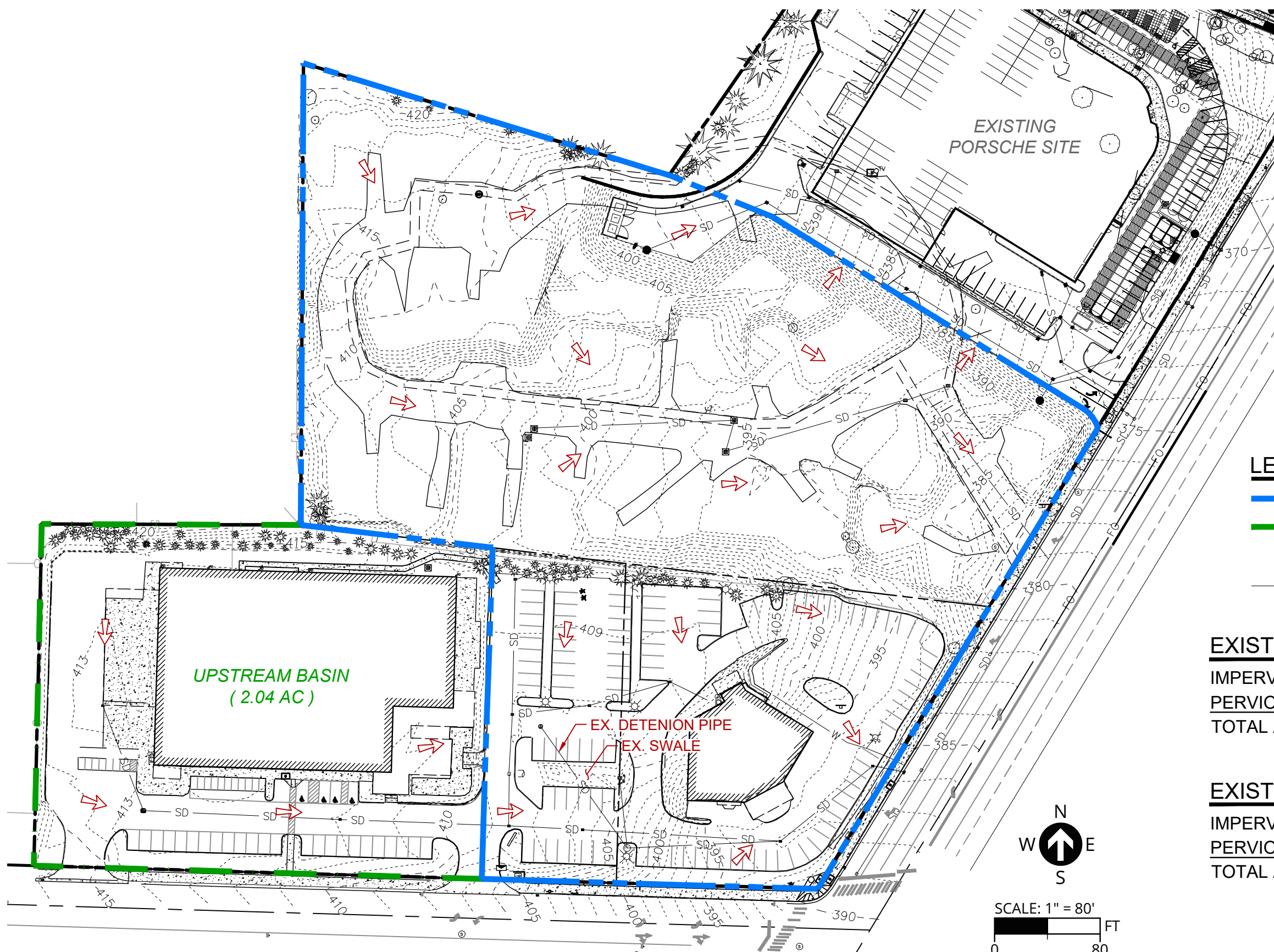
- Parcel
- Recent Sales 2020
- Recent Sales 2019
- Recent Sales 2018
- City Boundary
- County Park
- National Forest
- Water

Street Types

- Interstate
- State Route
- Local Road

All maps, data, and information set forth herein ("Data"), are for illustrative purposes only and are not to be considered an official citation to, or representation of, the Snohomish County Code. Amendments and updates to the Data, together with other applicable County Code provisions, may apply which are not depicted herein. Snohomish County makes no representation or warranty concerning the content, accuracy, currency, completeness or quality of the Data contained herein and expressly disclaims any warranty of merchantability or fitness for any particular purpose. All persons accessing or otherwise using this Data assume all responsibility for use thereof and agree to hold Snohomish County harmless from and against any damages, loss, claim or liability arising out of any error, defect or omission contained within said Data. Washington State Law, Ch. 42.56 RCW, prohibits state and local agencies from providing access to lists of individuals intended for use for commercial purposes and, thus, no commercial use may be made of any Data comprising lists of individuals contained herein.





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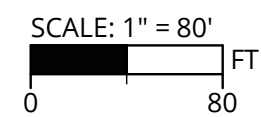
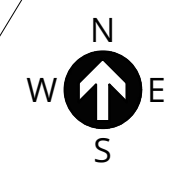
	BASIN BOUNDARY
	UPSTREAM BASIN BOUNDARY
	SURFACE FLOW DIRECTION
	EXISTING STORM DRAIN

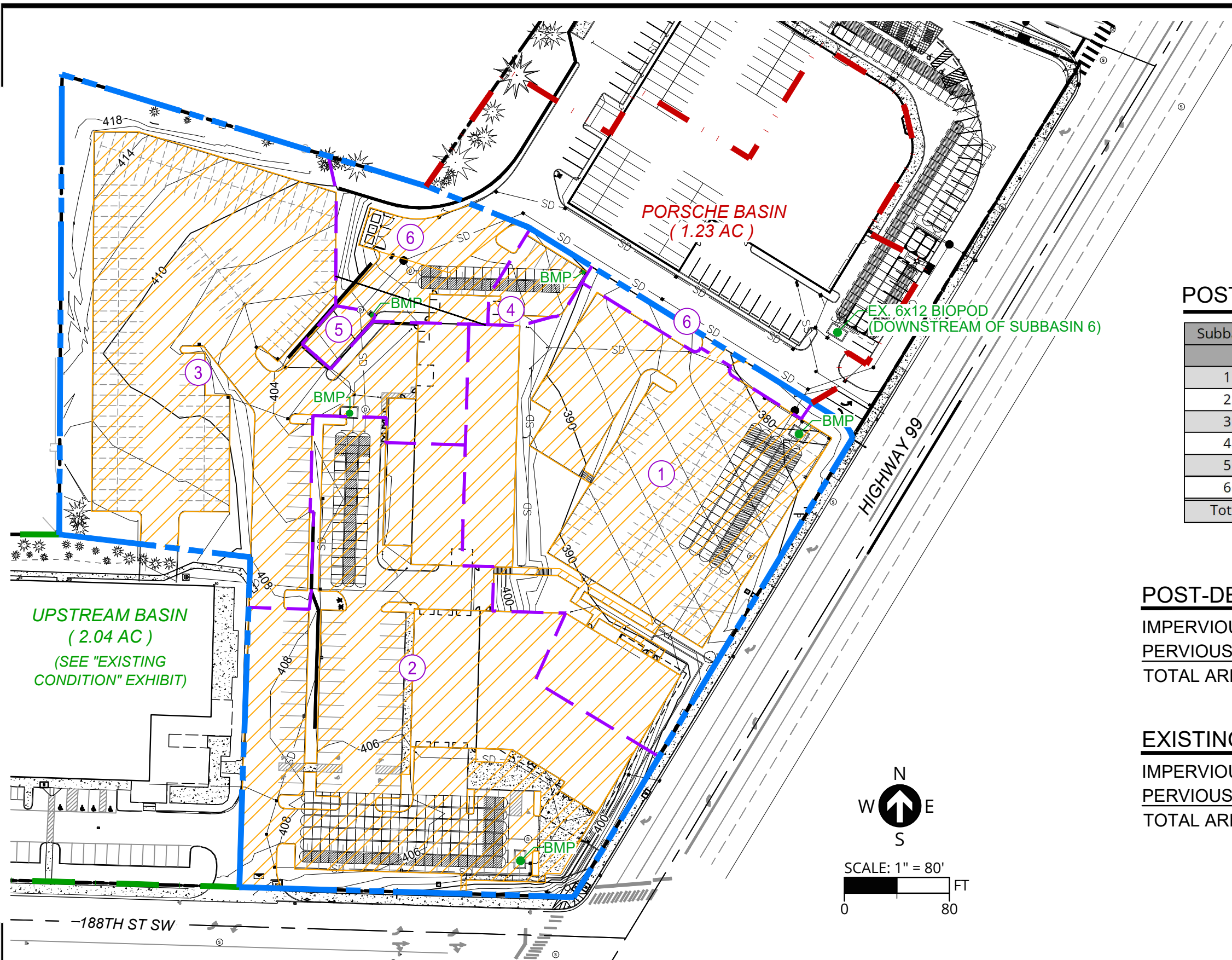
EXISTING BASIN AREAS - ONSITE

IMPERVIOUS AREA	= 96,820 SF	= 2.22 AC
PERVIOUS AREA	= 138,140 SF	= 3.17 AC
TOTAL AREA	= 234,960 SF	= 5.39 AC

EXISTING BASIN AREAS - UPSTREAM

IMPERVIOUS AREA	= 69,703 SF	= 1.60 AC
PERVIOUS AREA	= 18,942 SF	= 0.43 AC
TOTAL AREA	= 88,645 SF	= 2.04 AC





LEGEND

- — — — — BASIN BOUNDARY
- — — — — UPSTREAM BASIN BOUNDARY
- — — — — DOWNSTREAM BASIN BOUNDARY
- — — — — SUBBASIN BOUNDARY
- Ⓝ SUBBASIN TAG

POST-DEV. SUBBASIN AREAS

Subbasin	Imp ac	Per ac	Total ac	Treatment BMP
1	1.10	0.36	1.46	6x12 BioPod
2	1.48	0.22	1.70	8x24 BioPod
3	1.31	0.44	1.75	6x12 BioPod
4	0.07	0.01	0.08	4x6 BioPod
5	0.03	0.001	0.03	4x6 BioPod
6	0.21	0.16	0.36	6x12 BioPod (Ex.)
Total	4.20	1.19	5.39	

POST-DEV BASIN AREAS - ONSITE

IMPERVIOUS AREA	= 183,015 SF	= 4.20 AC
PERVIOUS AREA	= 51,945 SF	= 1.19 AC
TOTAL AREA	= 234,960 SF	= 5.39 AC

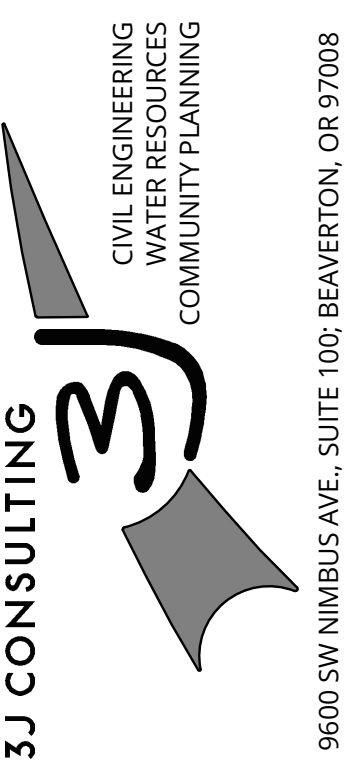
EXISTING BASIN AREAS - PORSCHE

IMPERVIOUS AREA	= 47,264 SF	= 1.09 AC
PERVIOUS AREA	= 6,265 SF	= 0.14 AC
TOTAL AREA	= 53,529 SF	= 1.23 AC



PUBLISH DATE
12/15/2022
ISSUED FOR
LAND USE
REVISIONS

EXISTING CONDITIONS
SWICKARD BMW
18624 HWY 99
HOLMAN LYNNWOOD RED, LLC
LYNNWOOD, WA



PROJECT INFORMATION
3J PROJECT # | 22798
TAX LOT(S) | 00374300500201
LAND USE # | TBD
DESIGNED BY | JUS, SRC, JGW
CHECKED BY | AJM

SHEET NUMBER
C100

DEMOLITION KEY NOTES

- 1 SHUT OFF, DISCONNECT, AND REMOVE UTILITY LINES AND DISPOSE OFF-SITE.
- 2 REMOVE EXISTING STRUCTURE AND FOUNDATION AND DISPOSE OFF-SITE AFTER ALL UTILITY LINES ARE PROPERLY SHUT OFF AND DISCONNECTED.
- 3 REMOVE EXISTING FENCING AND ASSOCIATED APPURTENANCES AND DISPOSE OFF-SITE.
- 4 REMOVE EXISTING AC AND DISPOSE OF OFF-SITE.
- 5 APPROXIMATE LOCATION OF EXISTING DETENTION SYSTEM PER ASBUILT RECORDS. ASSUMED 8'0" X 11'0" CMP. REMOVE AND DISPOSE OFF SITE.

EXISTING CONDITIONS PLAN

THIS PLAN HAS BEEN PREPARED FOR INFORMATIVE PURPOSES ONLY. SITE BACKGROUND INFORMATION AND FEATURES HAVE BEEN GENERATED FROM A COMBINATION OF TOPOGRAPHIC SURVEY DATA PROVIDED BY S&F LAND SERVICES, AERIAL IMAGERY, PUBLIC GIS DATA AND SITE ASSESSMENT/OBSERVATION. NO WARRANTY OR GUARANTEE OF ACCURACY IS EXPRESSED OR IMPLIED.

VERTICAL DATUM

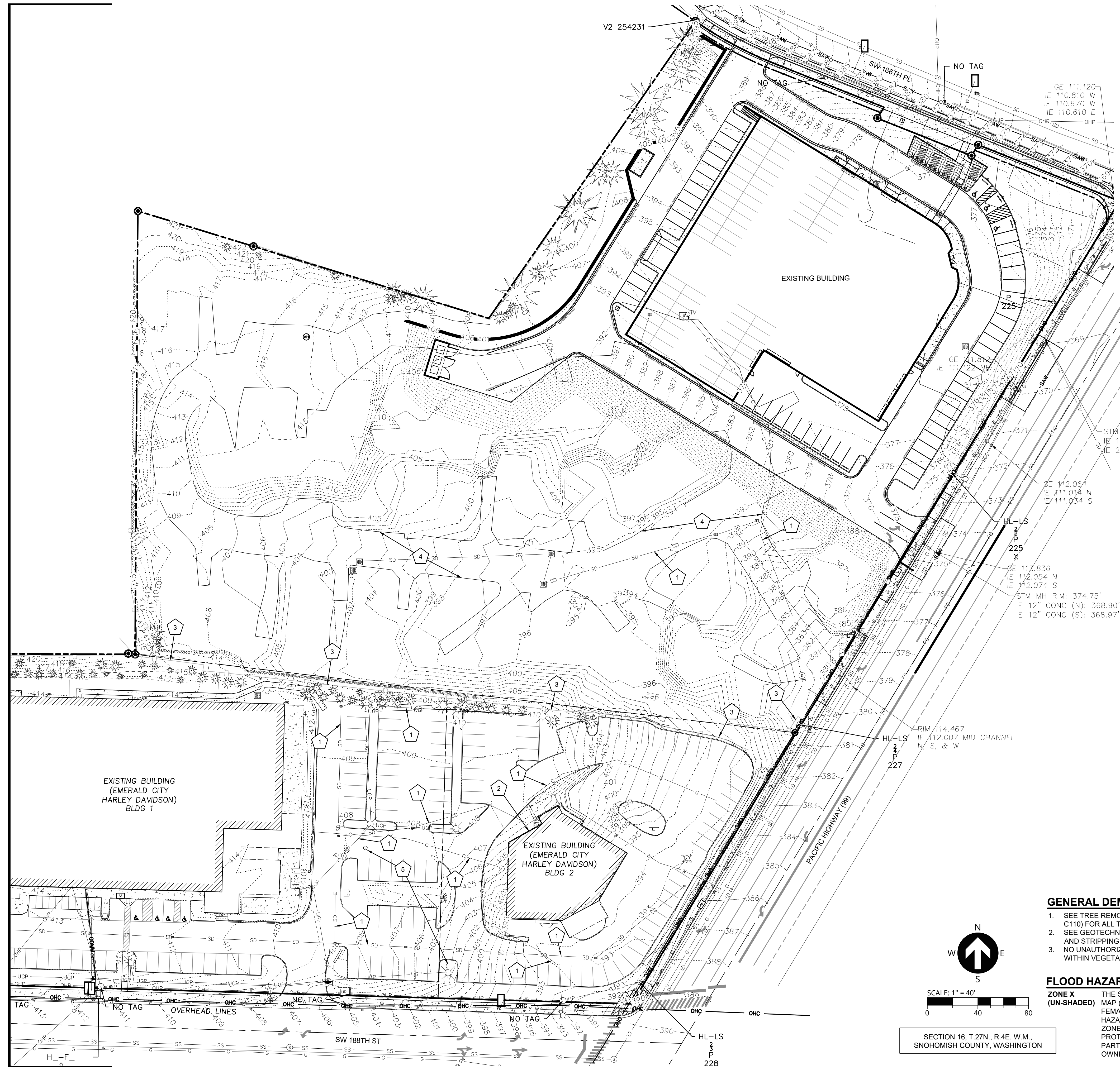
NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) BASED ON GPS OBSERVATIONS.

HORIZONTAL DATUM (BASIS OF BEARINGS)

WASHINGTON NORTH 4801 STATE PLANE COORDINATE SYSTEM NAD 83 (2011) DISTANCES SHOWN HEREON ARE GROUND DISTANCES, U.S. SURVEY FEET.

LEGEND

	EXISTING BUILDING
	PROJECT BOUNDARY
	RIGHT-OF-WAY LINE
	RIGHT-OF-WAY CENTERLINE
	EASEMENT LINE
	EXISTING LOT LINE
	EXISTING CONCRETE
	EXISTING GRAVEL
	EXISTING CURB
	EXISTING FENCE LINE
	EXISTING STRIPING: WHITE
	EXISTING TELECOM. LINE
	EXISTING GAS LINE
	EXISTING CABLE LINE
	EXISTING UNDERGROUND POWER
	EXISTING OVERHEAD POWER
	EXISTING VEGETATION LIMITS LINE
	EXISTING SANITARY SEWER
	EXISTING STORM DRAIN
	EXISTING WATER MAIN
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	EXISTING FIRE HYDRANT
	EXISTING WATER VALVE
	EXISTING BLOW-OFF VALVE
	EXISTING CONIFEROUS TREE
	EXISTING DECIDUOUS TREE
	EXISTING SIGN
	EXISTING UTILITY POLE
	EXISTING SANITARY MANHOLE
	EXISTING STORM MANHOLE
	EXISTING UTILITY BOX

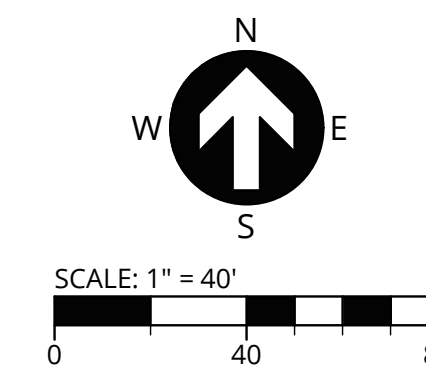


GENERAL DEMOLITION NOTES

1. SEE TREE REMOVAL AND PRESERVATION PLAN (SHEET C110) FOR ALL TREE REMOVAL INFORMATION.
2. SEE GEOTECHNICAL REPORT FOR SURFACE GRUBBING AND STRIPPING INFORMATION.
3. NO UNAUTHORIZED GROUND DISTURBANCE MAY OCCUR WITHIN VEGETATED CORRIDOR AND SENSITIVE AREA.

FLOOD HAZARD INFORMATION


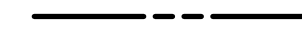
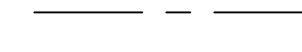
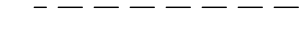

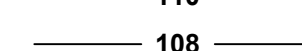
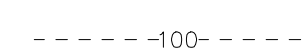
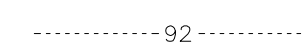
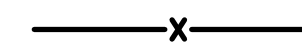
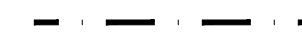




ZONE X (UN-SHADED) THE SITE IS LOCATED WITHIN ZONE X (UN-SHADED) PER FLOOD INSURANCE RATE MAP (FIRM) COMMUNITY-PANEL NUMBER 53061C1310F. FEMA'S DEFINITION OF ZONE X (UN-SHADED) IS AN AREA OF MINIMAL FLOOD HAZARD. USUALLY DEPICTED ON FIRMS AS ABOVE THE 500-YEAR FLOOD LEVEL. ZONE X IS THE AREA DETERMINED TO BE OUTSIDE THE 500-YEAR FLOOD AND PROTECTED BY LEVEE FROM 100-YEAR FLOOD. IN COMMUNITIES THAT PARTICIPATE IN THE NFIP, FLOOD INSURANCE IS AVAILABLE TO ALL PROPERTY OWNERS AND RENTERS IN THESE ZONES.

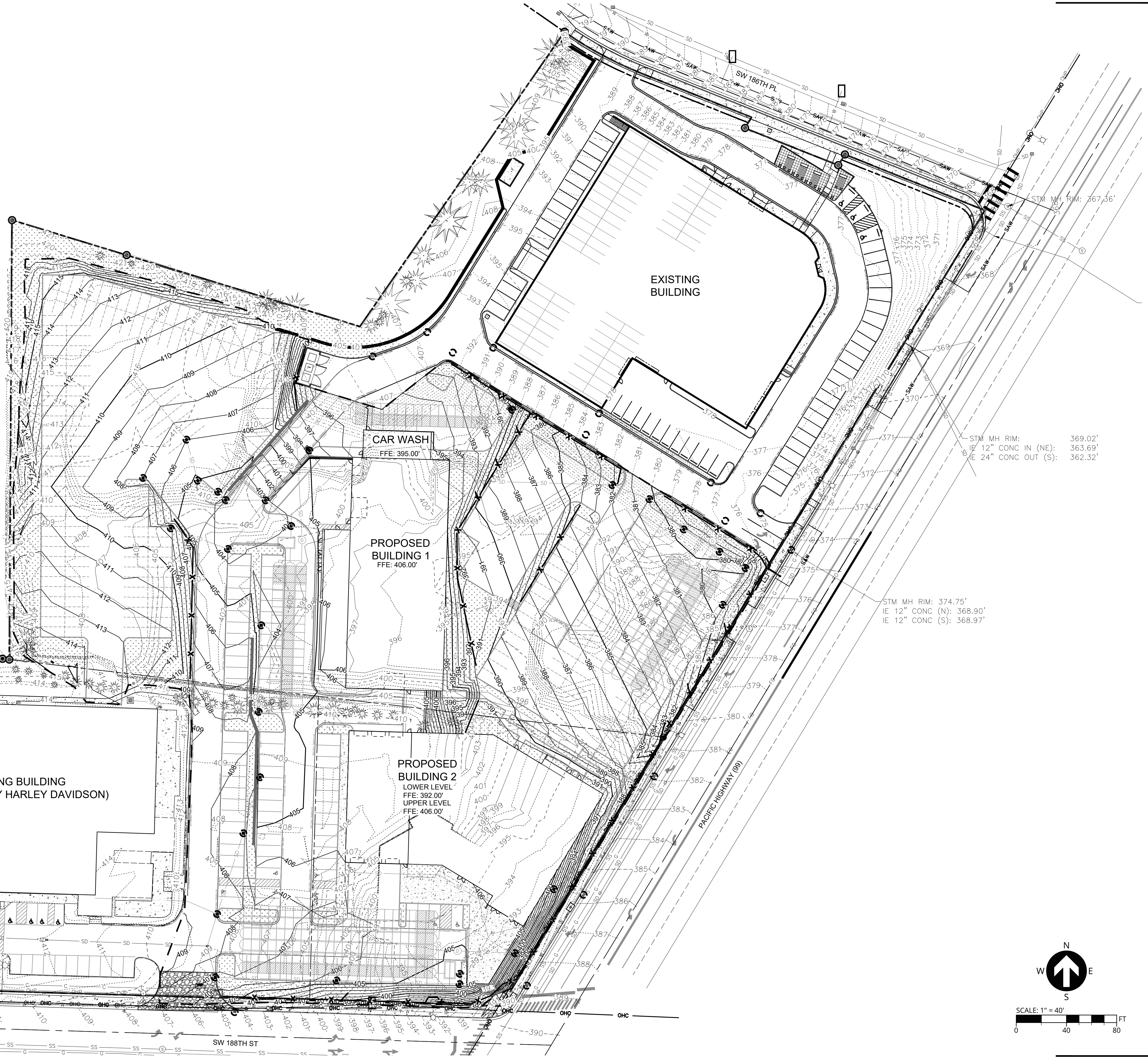


SECTION 16, T.27N., R.4E, W.M., SNOHOMISH COUNTY, WASHINGTON



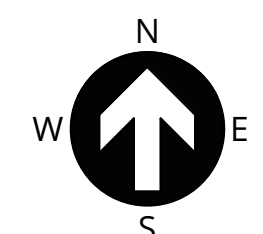
LEGEND

-  PROJECT BOUNDARY
-  RIGHT-OF-WAY LINE
-  RIGHT-OF-WAY CENTERLINE
-  EASEMENT LINE
-  EXISTING LOT LINE
-  110 PROPOSED MAJOR CONTOUR
-  108 PROPOSED MINOR CONTOUR
-  100 EXISTING MAJOR CONTOUR
-  92 EXISTING MINOR CONTOUR
-  PROPOSED SILT FENCING
-  PROPOSED LIMITS OF DISTURBANCE
-  PROPOSED CONSTRUCTION ENTRANCE
-  PROPOSED INLET PROTECTION
-  SURFACE RUN-OFF FLOW ARROW



STM MH RIM: 369.02'
 IE 12" CONC IN (NE): 363.69'
 IE 24" CONC OUT (S): 362.32'

STM MH RIM: 374.75'
 IE 12" CONC (N): 368.90'
 IE 12" CONC (S): 368.97'



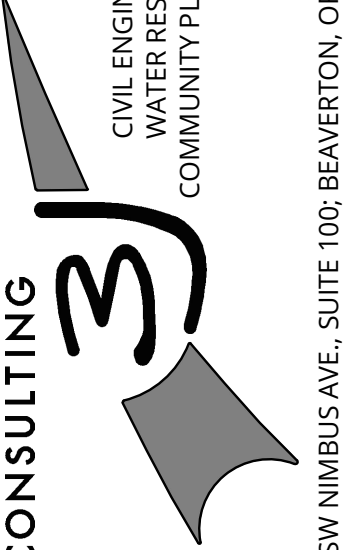
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PUBLISH DATE
 12/15/2022
 ISSUED FOR
 LAND USE
 REVISIONS

GRADING AND EROSION CONTROL PLAN
SWICKARD BMW
18624 HWY 99
 HOLMAN LYNNWOOD RED, LLC
 LYNNWOOD, WA

3J CONSULTING



CIVIL ENGINEERING
 WATER RESOURCES
 COMMUNITY PLANNING

9600 SW NIMBUS AVE., SUITE 100, BEAVERTON, OR 97008

PROJECT INFORMATION
 3J PROJECT # | 22798
 TAX LOT(S) | 00374300500201
 LAND USE # | TBD
 DESIGNED BY | JUS, SRC, JGW
 CHECKED BY | AJM

SHEET NUMBER
C220

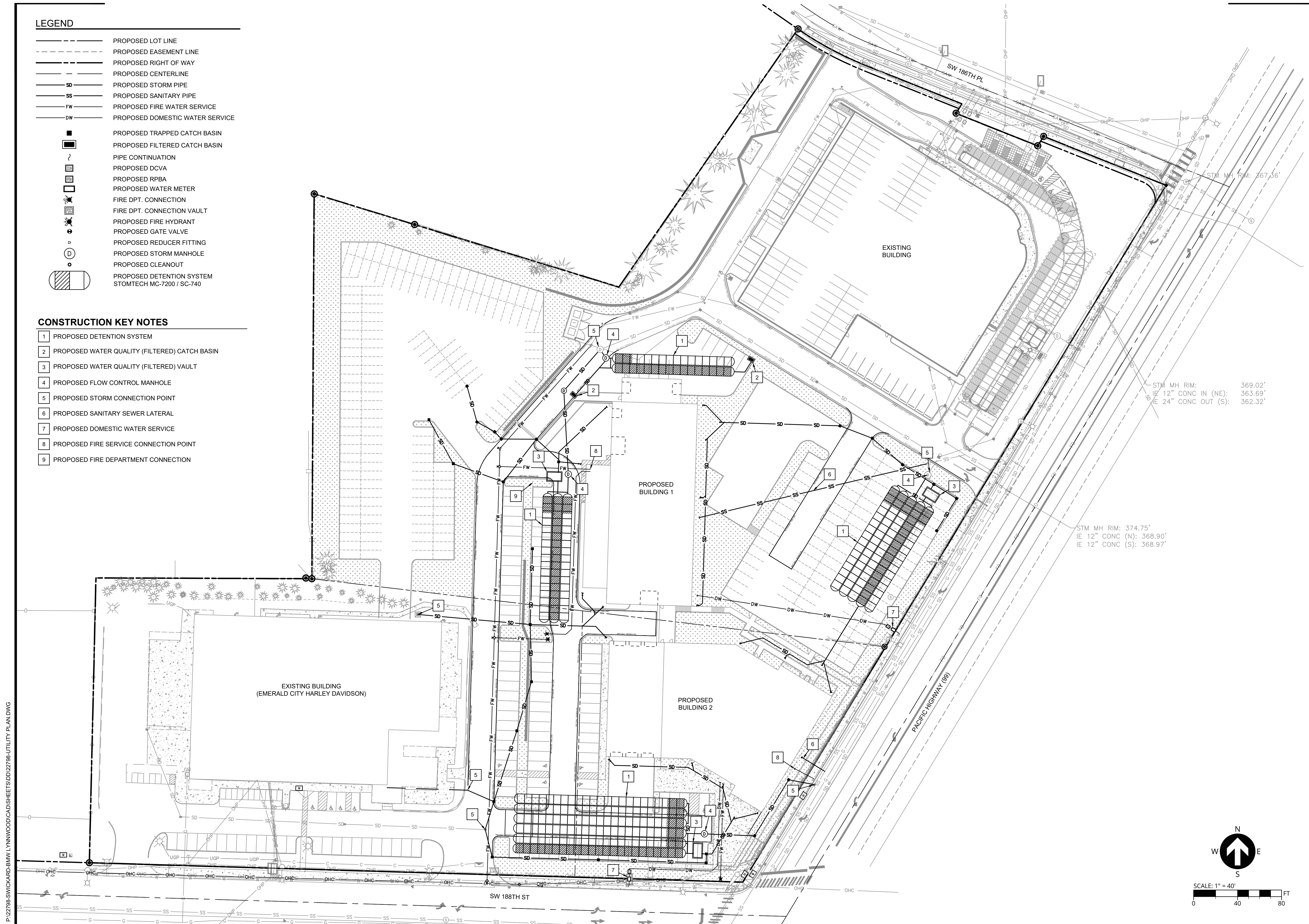
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LEGEND

- PROPOSED LOT LINE
- PROPOSED EASEMENT LINE
- PROPOSED RIGHT OF WAY
- PROPOSED CENTERLINE
- SD PROPOSED STORM PIPE
- SS PROPOSED SANITARY PIPE
- FW PROPOSED FIRE WATER SERVICE
- DW PROPOSED DOMESTIC WATER SERVICE
- PROPOSED TRAPPED CATCH BASIN
- PROPOSED FILTERED CATCH BASIN
- ~ PIPE CONTINUATION
- PROPOSED DCVA
- PROPOSED RPBA
- PROPOSED WATER METER
- ⊗ FIRE DPT. CONNECTION
- ⊗ FIRE DPT. CONNECTION VAULT
- ⊗ PROPOSED FIRE HYDRANT
- ⊗ PROPOSED GATE VALVE
- ⊗ PROPOSED REDUCER FITTING
- ⊗ PROPOSED STORM MANHOLE
- ⊗ PROPOSED CLEANOUT
- PROPOSED DETENTION SYSTEM
- STOMTECH MC-7200 / SC-740

CONSTRUCTION KEY NOTES

- 1 PROPOSED DETENTION SYSTEM
- 2 PROPOSED WATER QUALITY (FILTERED) CATCH BASIN
- 3 PROPOSED WATER QUALITY (FILTERED) VAULT
- 4 PROPOSED FLOW CONTROL MANHOLE
- 5 PROPOSED STORM CONNECTION POINT
- 6 PROPOSED SANITARY SEWER LATERAL
- 7 PROPOSED DOMESTIC WATER SERVICE
- 8 PROPOSED FIRE SERVICE CONNECTION POINT
- 9 PROPOSED FIRE DEPARTMENT CONNECTION



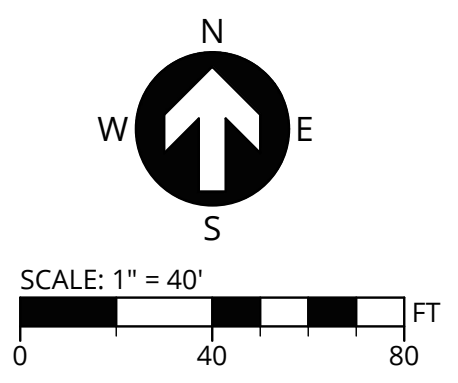
PUBLISH DATE
12/15/2022
ISSUED FOR
LAND USE
REVISIONS

UTILITY PLAN
SWICKARD BMW
18624 HWY 99
HOLMAN LYNNWOOD RED, LLC
LYNNWOOD, WA

3J CONSULTING
CIVIL ENGINEERING
WATER RESOURCES
COMMUNITY PLANNING
9600 SW NIMBUS AVE., SUITE 100, BEAVERTON, OR 97008

PROJECT INFORMATION
3J PROJECT # | 22798
TAX LOT(S) | 00374300500201
LAND USE # | TBD
DESIGNED BY | JUS, SRC, JGW
CHECKED BY | AJM

SHEET NUMBER
C240



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APPENDIX B

Source Control BMPs

IV-1 Source Control BMPs Applicable to All Sites

S410 BMPs for Correcting Illicit Discharges to Storm Drains

Description of Pollutant Sources: Illicit discharges are unpermitted sanitary or process wastewater discharges to a storm sewer or to surface water, rather than to a sanitary sewer, industrial process wastewater, or other appropriate treatment. They can also include swimming pool water, filter backwash, cleaning solutions/washwaters, cooling water, etc. Experience has shown that illicit discharges are common, particularly in older buildings.

Pollutant Control Approach: Identify and eliminate unpermitted discharges or obtain an NPDES permit, where necessary, particularly at industrial and commercial facilities.

Applicable Operational BMPs:

- For all real properties, responsible parties must examine their plumbing systems to identify any potential illicit discharges. Review site plans, engineering drawings, or other sources of information for the plumbing systems on the property.
- If an illicit discharge is suspected, trace the source using an appropriate method such as visual reconnaissance, smoke test, flow test, dye test with a nontoxic dye, or closed circuit television (CCTV) inspection. These tests are to be performed by qualified personnel such as a plumbing contractor. Note: Contact Ecology prior to performing a dye test which may result in a discharge to a receiving water.
- If illicit connections are found, permanently plug or disconnect the connections.
- Eliminate prohibited discharges to storm sewer, ground water, or surface water.
- Convey unpermitted discharges to a sanitary sewer if allowed by the local sewer authority, or to other approved treatment.
- Obtain all necessary permits for altering or repairing side sewers and plumbing fixtures. Restrictions on certain types of discharges, particularly industrial process waters, may require pretreatment of discharges before they enter the sanitary sewer. It is the responsibility of the property owner or business operator to obtain the necessary permits and to replace the connection.
- Obtain appropriate state and local permits for these discharges.

Recommended Additional Operational BMPs:

At commercial and industrial facilities, conduct a survey of wastewater discharge connections to storm drains and to surface water as follows:

- Conduct a field survey of buildings, particularly older buildings, and other industrial areas to locate storm drains from buildings and paved surfaces. Note where these discharge.
- During non-stormwater conditions, inspect each storm drain for non-stormwater discharges. Record the locations of all non-stormwater discharges. Include all permitted discharges.
- If useful, prepare a map of each area. Show on the map the known location of storm sewers, sanitary sewers, and permitted and unpermitted discharges. Aerial photos may be useful. Check records such as piping schematics to identify known side sewer connections and show these on the map. Consider using smoke, dye, or chemical analysis tests to detect connections between two conveyance systems (e.g., process water and stormwater). If desirable, conduct TV inspections of the storm drains and record the footage on videotape.
- Compare the observed locations of connections with the information on the map and revise the map accordingly. Note suspect connections that are inconsistent with the field survey.
- Identify all connections to storm sewers or to surface water and take the actions specified above as applicable BMPs.

S453 BMPs for Formation of a Pollution Prevention Team

The pollution prevention team should be responsible for implementing and maintaining all BMPs and treatment for the site. This team should be able to address any corrective actions needed on site to mitigate potential stormwater contamination. The team members should:

- Consist of those people who are familiar with the facility and its operations.
- Possess the knowledge and skills to assess conditions and activities that could impact stormwater quality at your facility, and who can evaluate the effectiveness of control measures.
- Assign pollution prevention team staff to be on duty on a daily basis to cover applicable permittee facilities when those facilities are in operation.
- Have the primary responsibility for developing and overseeing facility activities necessary to comply with stormwater requirements.
- Have access to all applicable permit, monitoring, SWPPP, and other records.
- Be trained in the operation, maintenance and inspections of all BMPs and reporting procedures.
- Establish responsibilities for inspections, operation, maintenance, and emergencies.
- Regularly meet to review overall facility operations and BMP effectiveness.

S454 BMPs for Preventive Maintenance / Good Housekeeping

Preventative maintenance and good housekeeping practices reduce the potential for stormwater to come into contact with pollutants and can reduce maintenance intervals for the drainage system and sewer system.

Applicable BMPs:

- Prevent the discharge of unpermitted liquid or solid wastes, process wastewater, and sewage to ground or surface water, or to storm drains that discharge to surface water, or to the ground. Conduct all oily parts cleaning, steam cleaning, or pressure washing of equipment or containers inside a building, or on an impervious contained area, such as a concrete pad. Direct contaminated stormwater from such an area to a sanitary sewer where allowed by local sewer authority, or to other approved treatment.
- Promptly contain and clean up solid and liquid pollutant leaks and spills including oils, solvents, fuels, and dust from manufacturing operations on an exposed soil, vegetation, or paved area.
- If a contaminated surface must be pressure washed, collect the resulting washwater for proper disposal (usually involves plugging storm drains, or otherwise preventing discharge and pumping or vactoring up washwater, for discharge to sanitary sewer or for vactor truck transport to a waste water treatment plant for disposal).
- Do not hose down pollutants from any area to the ground, storm drains, conveyance ditches, or receiving water. Convey pollutants before discharge to a treatment system approved by the local jurisdiction.
- Sweep all appropriate surfaces with vacuum sweepers quarterly, or more frequently as needed, for the collection and disposal of dust and debris that could contaminate stormwater. Use mechanical sweepers, and manual sweeping as necessary to access areas that a vacuum sweeper can't reach to ensure that all surface contaminants are routinely removed.
- Do not pave over contaminated soil unless it has been determined that ground water has not been and will not be contaminated by the soil. Call Ecology for assistance.
- Construct impervious areas that are compatible with the materials handled. Portland cement concrete, asphalt, or equivalent material may be considered.
- Use drip pans to collect leaks and spills from industrial/commercial equipment such as cranes at ship/boat building and repair facilities, log stackers, industrial parts, trucks and other vehicles stored outside.
- At industrial and commercial facilities, drain oil and fuel filters before disposal. Discard empty oil and fuel filters, oily rags, and other oily solid waste into appropriately closed and properly labeled containers, and in compliance with the Uniform Fire Code or International Building Code.
- For the storage of liquids use containers, such as steel and plastic drums, that are rigid and

durable, corrosion resistant to the weather and fluid content, non-absorbent, water tight, rodent-proof, and equipped with a close fitting cover.

- For the temporary storage of solid wastes contaminated with liquids or other potential polluted materials use dumpsters, garbage cans, drums, and comparable containers, which are durable, corrosion resistant, non-absorbent, non-leaking, and equipped with either a solid cover or screen cover to prevent littering. If covered with a screen, the container must be stored under a roof or other form of adequate cover.
- Where exposed to stormwater, use containers, piping, tubing, pumps, fittings, and valves that are appropriate for their intended use and for the contained liquid.
- Clean oils, debris, sludge, etc. from all stormwater facilities regularly, including catch basins, settling/detention basins, oil/water separators, boomed areas, and conveyance systems to prevent the contamination of stormwater. Refer to [Ecology Requirements for Generators of Dangerous Wastes](#) in [I-2.15 Other Requirements](#) for references to assist in handling potentially dangerous waste.
- Promptly repair or replace all substantially cracked or otherwise damaged paved secondary containment, high-intensity parking, and any other drainage areas, subjected to pollutant material leaks or spills. Promptly repair or replace all leaking connections, pipes, hoses, valves, etc., which can contaminate stormwater.
- Do not connect floor drains in potential pollutant source areas to storm drains, surface water, or to the ground.

Recommended BMPs:

- Where feasible, store potential stormwater pollutant materials inside a building or under a cover and/or containment.
- Minimize use of toxic cleaning solvents, such as chlorinated solvents, and other toxic chemicals.
- Use environmentally safe raw materials, products, additives, etc. such as substitutes for zinc used in rubber production.
- Recycle waste materials such as solvents, coolants, oils, degreasers, and batteries to the maximum extent feasible. Contact Ecology's *Hazardous Waste & Toxics Reduction Program* at <https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Hazardous-Waste-Toxics-Reduction> for recommendations on recycling or disposal of vehicle waste liquids and other waste materials.
- Empty drip pans immediately after a spill or leak is collected in an uncovered area.
- Stencil warning signs at stormwater catch basins and drains, e.g., “Dump no waste – Drains to waterbody”.
- Use solid absorbents, e.g., clay and peat absorbents and rags for cleanup of liquid spills/leaks, where practicable.
- Promptly repair/replace/reseal damaged paved areas at industrial facilities.

- Recycle materials, such as oils, solvents, and wood waste, to the maximum extent practicable.

Note: Evidence of stormwater contamination by oils and grease can include the presence of visible sheen, color, or turbidity in the runoff, or present or historical operational problems at the facility. Operators can use simple pH tests, for example with litmus or pH paper. These tests can screen for high or low pH levels (anything outside a 6.5-8.5 range) due to contamination in stormwater.

S455 BMPs for Spill Prevention and Cleanup

Description of Pollutant Sources: Spills and leaks can damage public infrastructure, interfere with sewage treatment, and cause a threat to human health or the environment. Spills are often preventable if appropriate chemical and waste handling techniques are practiced effectively and the spill response plan is immediately implemented. Additional spill control requirements may be required based on the specific activity occurring on site.

Applicable BMPs:

Spill Prevention

- Clearly label or mark all containers that contain potential pollutants.
- Store and transport liquid materials in appropriate containers with tight-fitting lids.
- Place drip pans underneath all containers, fittings, valves, and where materials are likely to spill or leak.
- Use tarpaulins, ground cloths, or drip pans in areas where materials are mixed, carried, and applied to capture any spilled materials.
- Train employees on the safe techniques for handling materials used on the site and to check for leaks and spills.

Spill Plan

- Develop and implement a spill plan and update it annually or whenever there is a change in activities or staff responsible for spill cleanup. Post a written summary of the plan at areas with a high potential for spills, such as loading docks, product storage areas, waste storage areas, and near a phone. The spill plan may need to be posted at multiple locations. Describe the facility, including the owner's name, address, and telephone number; the nature of the facility activity; and the general types of chemicals used at the facility.
- Designate spill response employees to be on-site during business activities. Provide a current list of the names and telephone numbers (home and office) of designated spill response employees who are responsible for implementing the spill plan.
- Provide a site plan showing the locations of storage areas for chemicals, inlets/catch basins, spill kits and other relevant infrastructure or materials information.
- Describe the emergency cleanup and disposal procedures. Note the location of all spill kits in

the spill plan.

- List the names and telephone numbers of public agencies to contact in the event of a spill.

Spill Cleanup Kits

- Store all cleanup kits near areas with a high potential for spills so that they are easily accessible in the event of a spill. The contents of the spill kit must be appropriate to the types and quantities of materials stored or otherwise used at the facility, and refilled when the materials are used. Spill kits must be located within 25 feet of all fueling/fuel transfer areas, including on-board mobile fuel trucks.

Note: Ecology recommends that the kit(s) include salvage drums or containers, such as high density polyethylene, polypropylene or polyethylene sheet-lined steel; polyethylene or equivalent disposal bags; an emergency response guidebook; safety gloves/clothes/equipment; shovels or other soil removal equipment; and oil containment booms and absorbent pads; all stored in an impervious container.

Spill Cleanup and Proper Disposal of Waste

- Stop, contain, and clean up all spills immediately upon discovery.
- Implement the spill plan immediately.
- Contact the designated spill response employees.
- Block off and seal nearby inlets/catch basins to prevent materials from entering the drainage system or combined sewer.
- Use the appropriate material to clean up the spill.
- Do not use emulsifiers or dispersants such as liquid detergents or degreasers unless disposed of properly. Emulsifiers and dispersants are not allowed to be used on surface water, or in a place where they may enter storm drains, surface waters, treatments systems, or sanitary sewers.
- Immediately notify Ecology and the local jurisdiction if a spill has reached or may reach a sanitary or storm sewer, ground water, or surface water. Notification must comply with state and federal spill reporting requirements.
- Do not wash absorbent material into interior floor drains or inlets/catch basins.
- Place used spill control materials in appropriate containers and dispose of according to regulations.

S456 BMPs for Employee Training

Train all employees that work in pollutant source areas about the following topics:

- Identifying Pollution Prevention Team Members.
- Identifying pollutant sources.

- Understanding pollutant control measures.
- Spill prevention and response.
- Emergency response procedures.
- Handling practices that are environmentally acceptable. Particularly those related to vehicle/equipment liquids such as fuels, and vehicle/equipment cleaning.

Additional specialized training may be needed for staff who will be responsible for handling hazardous materials.

S457 BMPs for Inspections

Qualified personnel shall conduct inspections monthly. Make and maintain a record of each inspection on-site. The following requirements apply to inspections:

- Be conducted by someone familiar with the facility's site, operations, and BMPs.
- Verify the accuracy of the pollutant source descriptions in the SWPPP.
- Assess all BMPs that have been implemented for effectiveness and needed maintenance and locate areas where additional BMPs are needed.
- Reflect current conditions on the site.
- Include written observations of the presence of floating materials, suspended solids, oil and grease, discoloration, turbidity and odor in the stormwater discharges; in outside vehicle maintenance/repair; and liquid handling, and storage areas. In areas where acid or alkaline materials are handled or stored use a simple litmus or pH paper to identify those types of stormwater contaminants where needed.
- Eliminate or obtain a permit for unpermitted non-stormwater discharges to storm drains or receiving waters, such as process wastewater and vehicle/equipment washwater.
- Identify actions to address inspection deficiencies.

S458 BMPs for Record Keeping

See the applicable permit for specific record-keeping requirements and retention schedules for the following reports. At a minimum, retain the following reports for five years:

- Inspection reports which should include:
 - Time and date of the inspection
 - Locations inspected
 - Statement on status of compliance with the permit
 - Summary report of any remediation activities required
 - Name, title, and signature of person conducting the inspection

- Reports on spills of oil or hazardous substances in greater than Reportable Quantities (Code of Federal Regulations Title 40 Parts 302.4 and 117). Report spills of the following: antifreeze, oil, gasoline, or diesel fuel, that cause:
 - A violation of the State of Washington's Water Quality Standards.
 - A film or sheen upon or discoloration of the waters of the State or adjoining shorelines.
 - A sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.

To report a spill or to determine if a spill is a substance of a Reportable Quantity, call the Ecology regional office and ask for an oil spill operations or a dangerous waste specialist:

- Northwest Region (425)649-7000
- Southwest Region (360)407-6300
- Eastern Region (509)329-3400
- Central Region (509) 575-2490

In addition, call the Washington Emergency Management Division at 1-800-258-5990 or 1-800-OILS-911 AND the National Response Center at 1-800-424-8802.

Also, refer to *Focus on Emergency Spill Response* ([Ecology, 2009](#)).

The following is additional recommended record keeping:

Maintain records of all related pollutant control and pollutant generating activities such as training, materials purchased, material use and disposal, maintenance performed, etc.

IV-2 Cleaning or Washing Source Control BMPs

S431 BMPs for Washing and Steam Cleaning Vehicles / Equipment / Building Structures

Description of Pollutant Sources: Pollutant sources include the commercial cleaning of vehicles, aircraft, vessels, and other transportation, restaurant kitchens, carpets, and industrial equipment, and large buildings with low- or high-pressure water or steam. This includes “charity” car washes at gas stations and commercial parking lots. The cleaning can include hand washing, scrubbing, sanding, etc. Washwater from cleaning activities can contain oil and grease, suspended solids, heavy metals, soluble organics, soaps, and detergents that can contaminate stormwater.

Permitting Requirements: Obtain all necessary permits for installing, altering, or repairing onsite drainage and side sewers. Restrictions on certain types of discharges may require pretreatment before they enter the sanitary sewer.

Pollutant Control Approach: The preferred approach is to cover and/or contain the cleaning activity, or conduct the activity inside a building, to separate the uncontaminated stormwater from the washwater sources. Convey washwater to a sanitary sewer after approval by the local sewer authority. Provide temporary storage before proper disposal, or recycling. Under this preferred approach, no discharge to the ground, to a storm drain, or to surface water should occur.

The Industrial Stormwater General Permit prohibits the discharge of process wastewater (e.g., vehicle washing wastewater) to ground water or surface water. Stormwater that commingles with process wastewater is considered process wastewater.

Facilities not covered under the Industrial Stormwater General Permit that are unable to follow one of the preferred approaches listed above may discharge washwater to the ground only after proper treatment in accordance with *Vehicle and Equipment Washwater Discharges Best Management Practices Manual* ([Ecology, 2012](#)).

The quality of any discharge to the ground after proper treatment must comply with Ecology's Ground Water Quality Standards, [Chapter 173-200 WAC](#).

Facilities not covered under the Industrial Stormwater General Permit that are unable to comply with one of the preferred approaches and want to discharge to storm sewer, must meet their local stormwater requirements. Local authorities may require treatment prior to discharge.

Contact the local Ecology Regional Office to discuss permitting options for discharge of washwater to surface water or to a storm drain after on-site treatment.

Applicable Structural Source Control BMPs:

Conduct vehicle/equipment washing in one of the following locations:

- At a commercial washing facility in which the washing occurs in an enclosure and drains to the sanitary sewer, or

- In a building constructed specifically for washing of vehicles and equipment, which drains to a sanitary sewer.

Conduct outside washing operations in a designated wash area with the following features:

- In a paved area, construct a spill containment pad to prevent the run-on of stormwater from adjacent areas. Slope the spill containment area to collect washwater in a containment pad drain system with perimeter drains, trench drains or catchment drains. Size the containment pad to extend out a minimum of four feet on all sides of the washed vehicles and/or equipment.
- Convey the washwater to a sump (like a grit separator) and then to a sanitary sewer (if allowed by the local Sewer Authority), or other appropriate wastewater treatment or recycle system. The containment sump must have a positive control outlet valve for spill control with live containment volume, and oil/water separation. Size the minimum live storage volume to contain the maximum expected daily washwater flow plus the sludge storage volume below the outlet pipe. Shut the outlet valve during the washing cycle to collect the washwater in the sump. The valve should remain shut for at least two hours following the washing operation to allow the oil and solids to separate before discharge to a sanitary sewer.
- Use a two way valve for discharges from the containment pad. This valve should be normally switched to direct water to treatment, but may be switched to the drainage system after that pad is clean to handle stormwater runoff. The stormwater can then drain into the conveyance/discharge system outside of the wash pad (essentially bypassing the sanitary sewer or recycle system). Post signs to inform people of the operation and purpose of the valve. Clean the concrete pad thoroughly until there is no foam or visible sheen in the washwater prior to closing the inlet valve and allowing uncontaminated stormwater to overflow and drain off the pad.

Note that the purpose of the valve is to convey only washwater and contaminated stormwater to a treatment system.

- Collect the washwater from building structures and convey it to appropriate treatment such as a sanitary sewer system if it contains oils, soaps, or detergents. If the washwater does not contain oils, soaps, or detergents (in this case only a low pressure, clean, cold water rinse is allowed) then it could drain to soils that have sufficient natural attenuation capacity for dust and sediment.
- Sweep surfaces prior to cleaning/washing to remove excess sediment and other pollutants.
- If roof equipment or hood vents are cleaned, ensure that no washwater or process water is discharged to the roof drains or drainage systems.
- Label all mobile cleaning equipment as follows: "Properly dispose of all wastewater. Do not discharge to an inlet/catch basin, ditch, stream, or on the ground."

Recommended Additional BMPs:

- Mark the wash area at gas stations, multifamily residences and any other business where non-employees wash vehicles.

- Operators may use a manually operated positive control valve for uncovered wash pads, but a pneumatic or electric valve system is preferable. The valve may be on a timer circuit and opened upon completion of a wash cycle. After draining the sump or separator, the timer would then close the valve.
- Minimize the use of water and detergents in washing operations when practicable.
- Use phosphate-free biodegradable detergents when practicable.
- Use the least hazardous cleaning products available.
- Consider recycling the washwater.

Operators may use soluble/emulsifiable detergents in the wash medium and should use it with care and the appropriate treatment. Carefully consider the selection of soaps and detergents and treatment BMPs. Oil/water separators are ineffective in removing emulsified or water soluble detergents. Another treatment appropriate for emulsified and water soluble detergents may be required.

Exceptions:

- At gas stations (for charity car washes) or commercial parking lots, where it is not possible to discharge the washwater to a sanitary sewer, a temporary plug or a temporary sump pump can be used at the storm drain to collect the washwater for off-site disposal such as to a nearby sanitary sewer.
- New and used car dealerships may wash vehicles in the parking stalls as long as employees use a temporary plug system to collect the washwater for disposal as stated above, or an approved treatment system for the washwater is in place.

At industrial sites, contact Ecology for NPDES Permit requirements even when not using soaps, detergents, and/or other chemical cleaners in washing trucks.

S434 BMPs for Dock Washing

Description of Pollutant Sources: Washing docks (or wharves, piers, floats, and boat ramps) can result in the discharge dirt, bird feces, soaps, and detergents that can be toxic to aquatic life, especially after they take on contaminants while cleaning. The BMPs in this section do not address dry docks, graving docks, or marine railway cleaning operations.

Pollutant Control Approach: Use dry methods and equipment (scraping, sweeping, vacuuming) to remove debris and contaminants prior to cleaning with water to prevent these substances from entering surface water.

NA

Applicable Operational BMPs:

Surface Preparation and Spot Cleaning

- Scoop and collect debris and bird feces.
- Sweep, capture, and dispose of debris from the dock as solid waste. Sweep or vacuum docks to minimize the need for chemical cleaners.

Applicable Operational BMPs:

Maintain stormwater treatment facilities per the operations and maintenance (O&M) procedures presented in [Appendix V-A: BMP Maintenance Tables](#) in addition to the following BMPs:

- Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine necessary O&M improvements.
- Promptly repair any deterioration threatening the structural integrity of stormwater facilities. These include replacement of clean-out gates, catch basin lids, and rock in emergency spillways.
- Ensure adequacy of storm sewer capacities and prevent heavy sediment discharges to the sewer system.
- Regularly remove debris and sludge from BMPs used for peak-rate control, treatment, etc. and discharge to a sanitary sewer if approved by the sewer authority, or truck to an appropriate local or state government approved disposal site.
- Clean catch basins when the depth of deposits reaches 60 percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin. However, in no case should there be less than six inches clearance from the debris surface to the invert of the lowest pipe. Some catch basins (for example, WSDOT's *Catch Basin Type 1L* ([WSDOT, 2011](#))) may have as little as 12 inches sediment storage below the invert. These catch basins need frequent inspection and cleaning to prevent scouring. Where these catch basins are part of a stormwater collection and treatment system, the system owner/operator may choose to concentrate maintenance efforts on downstream control devices as part of a systems approach.
- Properly dispose of all solids, polluted material, and stagnant water collected through system cleaning. Do not decant water back into the drainage system from eductor trucks or vacuum equipment since there may be residual contaminants in the cleaning equipment. Do not jet material downstream into the public drainage system.
- Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catch basin.
- Post warning signs; "Dump No Waste - Drains to Ground Water," "Streams," "Lakes," or emboss on or adjacent to all storm drain inlets where possible.
- Disposal of sediments and liquids from the catch basins must comply with [Appendix IV-B: Management of Street Waste Solids and Liquids](#).

S421 BMPs for Parking and Storage of Vehicles and Equipment

Description of Pollutant Sources: Public and commercial parking lots such as retail store, fleet vehicle (including rent-a-car lots and car dealerships), equipment sale and rental parking lots, and

parking lot driveways, can be sources of toxic hydrocarbons and other organic compounds, including oils and greases, metals, and suspended solids.

Pollutant Control Approach: If the parking lot meets the site use thresholds to determine if the site is expected to generate high concentrations of oil, as defined in [Step 2: Determine if an Oil Control BMP is Required](#) in [III-1.2 Choosing Your Runoff Treatment BMPs](#), provide oil removal equipment for the contaminated stormwater runoff.

Applicable Operational BMPs:

- If a parking lot must be washed, discharge the washwater to a sanitary sewer, if allowed by the local sewer authority, or other approved wastewater treatment system, or collect washwater for off-site disposal.
- Do not hose down the area to a storm sewer or receiving water. Vacuum sweep parking lots, storage areas, and driveways regularly to collect dirt, waste, and debris. Mechanical or hand sweeping may be necessary for areas where a vacuum sweeper cannot reach.
- Clean up vehicle and equipment fluid drips and spills immediately.
- Place drip pans below leaking vehicles (including inoperative vehicles and equipment) in a manner that catches leaks or spills, including employee vehicles. Drip pans must be managed to prevent overfilling and the contents disposed of properly.

Recommended Operational BMPs:

- Encourage employees to repair leaking personal vehicles.
- Encourage employees to carpool or use public transit through incentives.
- Encourage customers to use public transit by rewarding valid transit pass holders with discounts.
- Install catch basin inserts to collect excess sediment and oil if necessary. Inspect and maintain catch basin inserts to ensure they are working correctly.

Applicable Treatment BMPs:

Establishments subject to high-use intensity are significant sources of oil contamination of stormwater. Examples of potential high use areas include customer parking lots at fast food stores, grocery stores, taverns, restaurants, large shopping malls, discount warehouse stores, quick-lube shops, and banks.

Refer to [Step 2: Determine if an Oil Control BMP is Required](#) in [III-1.2 Choosing Your Runoff Treatment BMPs](#) for the site use thresholds that determine if an oil control BMP is required, and for a list of oil control BMPs.

S430 BMPs for Urban Streets

Description of Pollutant Sources: Urban streets can be the source of vegetative debris, paper, fine dust, vehicle liquids, tire and brake wear residues, heavy metals (lead and zinc), soil particles,

S414 BMPs for Maintenance and Repair of Vehicles and Equipment

Description of Pollutant Sources: Pollutant sources include parts/vehicle cleaning, spills/leaks of fuel and other liquids, replacement of liquids, outdoor storage of batteries/liquids/parts, and vehicle parking.

Pollutant Control Approach: Control of leaks and spills of fluids using good housekeeping and cover and containment BMPs.

Applicable Operational BMPs:

- Inspect all incoming vehicles, parts, and equipment stored temporarily outside for leaks.
- Use drip pans or containers under parts or vehicles that drip or that are likely to drip liquids, such as during dismantling of liquid containing parts or removal or transfer of liquids. Inspect drip pans regularly to prevent accumulation of stormwater or other liquids, and dispose of any accumulated liquid appropriately.
- Remove batteries and liquids from vehicles and equipment in designated areas designed to prevent stormwater contamination. Store cracked batteries in a covered non-leaking secondary containment system.
- Remove liquids from vehicles retired for scrap.
- Empty oil and fuel filters before disposal. Provide for proper disposal of used oil and fuel.
- Do not pour/convey washwater, liquid waste, or other pollutants into storm drains or to surface water. Check with the local sanitary sewer authority for approval to convey water to a sanitary sewer.
- Do not connect maintenance and repair shop floor drains to storm drains or to surface water.
- To allow for snowmelt during the winter, install a drainage trench with a sump for particulate collection. Use the drainage trench for draining the snowmelt only. Do not discharge any vehicular or shop pollutants to the trench drain.

Applicable Structural Source Control BMPs:

- Conduct all maintenance and repair of vehicles and equipment in a building, or other covered impervious containment area that is sloped to prevent run-on of uncontaminated stormwater and runoff of contaminated water.
- Operators may conduct maintenance of refrigeration engines in refrigerated trailers in the parking area. Exercise due caution to avoid the release of engine or refrigeration fluids to storm drains or surface water.
- Park large mobile equipment, such as log stackers, in a designated contained area.

Applicable Treatment BMPs:

Convey contaminated stormwater runoff from vehicle staging and maintenance areas to a sanitary sewer, if allowed by the local sewer authority, or to an API or CP oil and water separator followed by a Basic Treatment BMP (See [Volume V](#)), applicable filter, or other equivalent oil treatment system.

Note this applicable treatment BMP for contaminated stormwater.

Recommended Additional Operational BMPs:

- Store damaged vehicles inside a building or other covered containment, until successfully removing all liquids.
- Clean parts with aqueous detergent based solutions or non-chlorinated solvents such as kerosene or high flash mineral spirits, and/or use wire brushing or sand blasting whenever practicable. Avoid using toxic liquid cleaners such as methylene chloride, 1,1,1-trichloroethane, trichloroethylene or similar chlorinated solvents. Choose cleaning agents that can be recycled.
- Inspect all BMPs regularly, particularly after a significant storm. Identify and correct deficiencies to ensure that the BMPs are functioning as intended.
- Avoid hosing down work areas. Use dry methods for cleaning leaked fluids.
- Recycle greases, used oil, oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic fluids, transmission fluids, and engine oils. Contact Ecology's Hazardous Waste & Toxics Reduction Program for recommendations on recycling or disposal of waste materials. (<https://ecology.wa.gov/About-us/Get-to-know-us/Our-Programs/Hazardous-Waste-Toxics-Reduction>)
- Do not mix dissimilar or incompatible waste liquids stored for recycling.

S418 BMPs for Manufacturing Activities - Outside

Description of Pollutant Sources: Manufacturing pollutant sources include outside process areas, stack emissions, and areas where manufacturing activity has taken place in the past and significant exposed pollutant materials remain.

Pollution Control Approach: Cover and contain outside manufacturing and prevent stormwater run-on and contamination, where feasible.

Applicable Operational BMP:

NA

- Sweep paved areas regularly, as needed, to prevent contamination of stormwater.
- Alter the activity by eliminating or minimizing the contamination of stormwater.

Applicable Structural Source Control BMPs:

- Enclose the activity (see [Figure IV-7.1: Enclose the Activity](#)). If possible, enclose the manufacturing activity in a building.
- Cover the activity and connect floor drains to a sanitary sewer, if approved by the local sewer

APPENDIX C

Geotechnical Documents

Geotechnical Engineering Services Report

Lynnwood Auto Dealership
188th Street SW and SR 99
Lynnwood, Washington

for
Holman Automotive Group, Inc.
c/o 3J Consulting

March 3, 2021



Geotechnical Engineering Services Report

Lynnwood Auto Dealership
188th Street SW and SR 99
Lynnwood, Washington

for

Holman Automotive Group, Inc.
c/o 3J Consulting

March 3, 2021



17425 NE Union Hill Road, Suite 250
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Geotechnical Engineering Services Report

Lynnwood Auto Dealership 188th Street SW and SR 99 Lynnwood, Washington

File No. 24789-001-00

March 3, 2021


Prepared for:

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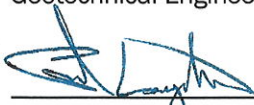
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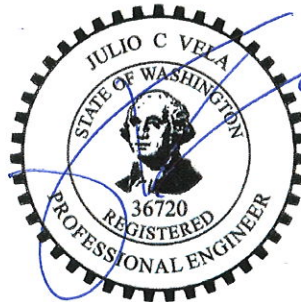
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1.0 INTRODUCTION

This report presents the results of GeoEngineers' geotechnical engineering services for the proposed Lynnwood Auto Dealership located at 18624 Highway 99 in Lynnwood, Washington (Parcel No. 00374300500201). The site is shown relative to surrounding physical features in Figure 1, Vicinity Map and Figures 2A and 2B, Existing and Proposed Exploration and Site Plans, respectively.

The purpose of this report is to provide geotechnical engineering conclusions and recommendations for the design of the Lynnwood Auto Dealership. GeoEngineers' geotechnical engineering services have been completed in general accordance with our services agreement executed October 28, 2020.

2.0 SCOPE OF SERVICES

GeoEngineers' scope of work for this report included:

- Review of existing subsurface and geologic information available for the site and surrounding area.
- Completed 11 borings across the site of the proposed auto dealership to evaluate soil conditions for the proposed buildings, parking garages and potential retaining walls to be part of site grading and development.
- Completed dynamic cone penetrometer (DCP) tests.
- Evaluated pertinent physical and engineering characteristics of the site soils by completing a laboratory testing program on samples obtained from the borings. The laboratory tests included moisture content determination, grain-size distribution and percent fines content.
- Provided recommendations for earthwork, including use of on-site and imported structural fill and fill placement and compaction requirements.
- Provided geotechnical recommendations, including shallow foundations, temporary shoring, slab-on-grade, temporary construction dewatering considerations, permanent drainage, and permanent below-grade wall recommendations.
- Geotechnical design recommendations for site retaining walls for walls less than 15 feet tall, including static and seismic active earth pressures, and drainage and backfill recommendations. Our scope did not include stability analyses, settlement, or design of walls.
- Recommendations for constructing asphaltic concrete (AC) pavements for the proposed new parking areas, including subgrade, drainage, base rock, and pavement section.
- Prepared this draft geotechnical engineering report.
- Finalize the geotechnical report after review and comment from the project team is provided.

3.0 PROJECT DESCRIPTION

Our understanding of the project is based on discussions with, and information provided by the project team, including the proposed building layout and grading plan provided to us via email on December 7, 2020. review of available soil information for the site, and our experience on similar projects.

The proposed auto dealership site is located on an approximate 6.15-acre site bounded by 186th Place SW to the north, Pacific Highway/Highway 99 to the east, 5615 188th SW and 7511 188th St SW to the south and residential housing and property to the west. Based on the information provided, we understand the proposed project will consist of two main buildings for uses, including showroom, offices, and service support along with a potential parking garage. The proposed showrooms and service centers will be two story buildings with car lifts. The proposed parking garage will include either three or four levels. At-grade surface parking is also planned along the western portion of the site as well as around the perimeter of the two proposed buildings.

4.0 FIELD EXPLORATIONS AND LABORATORY TESTING

4.1. Field Explorations

Subsurface conditions at the site were evaluated by completed 11 geotechnical borings (GEI-01 through GEI-11). Exploratory borings extended to depths ranging from 21½ to 41½ feet below ground surface (bgs) depending on location relative to the proposed development. Exploration locations are shown in Figures 2A and 2B. Descriptions of the field exploration program and detailed boring logs are presented in Appendix A of this report.

4.2. Laboratory Testing

Soil samples were obtained from geotechnical borings during the subsurface exploration program and transported to GeoEngineers' laboratory in Redmond, Washington for further evaluation. Selected samples were tested for determination of grain-size distribution (sieve analysis), fines content (percent passing U.S. No. 200 sieve) and moisture content. A description of the laboratory testing program and test results are presented in Appendix A. Laboratory results are also presented as part of the boring logs in Figures A-2 through A-12.

5.0 SITE CONDITIONS

5.1. Site Geology

The Puget Sound basin is a region of Quaternary (last 3 million years) sediments that range in thickness between 800 and 2,400 feet. The basin area has been repeatedly overridden by Pleistocene (between 11,000 and 3 million years ago) continental glacial ice depositing till, glacial sand and gravel. As the glacial ice retreated to the north, glaciofluvial sediment was deposited in the outwash channels. The most recent glacial cycle of sediment deposits is referred to as the Vashon Drift, occurring between 13,500 and 15,000 years ago.

We reviewed a United States Geological Survey (USGS) map for the project area, "Geologic Map of the Edmonds East and Part of the Edmonds West Quadrangles, Washington" (Minard 1983). Surficial geologic deposits in the site vicinity are mapped as recessional outwash, glacial till, and advance outwash. Recessional outwash typically consists of sand and gravel with varying amounts of silt that was deposited by meltwater from the stagnating and receding glacier. These soils are typically medium dense.

Glacial till is a generally heterogeneous mixture of sand, gravel, cobbles and occasional boulders in a silt and clay matrix that was deposited beneath a glacier. Advance outwash typically consists of well-stratified

sand with variable amounts of gravel and cobbles. The advance outwash is usually exposed where the overlying glacial till cap has been eroded away, typically in ravines and bluff margins. Both the glacial till and advance outwash have been overridden by thousands of feet of ice, and are typically dense to very dense. The Whidbey Formation underlies the advance outwash and typically consists of dense sands and gravels overlying or interbedded with stiff to hard silts. Subsurface soils encountered in our explorations are consistent with the geologic mapping. Specific details of subsurface conditions encountered in our explorations are presented in the sections below.

5.2. Geologic Hazards and Considerations

GeoEngineers has reviewed Environmentally Critical Area (ECA) maps available online through Snohomish County geographic information system (GIS). Based on our review, a portion of the site is located within a steep slope ECA, as shown in Figure 2A.

5.2.1. Steep Slope Definitions

Per City of Lynnwood (City) Municipal Code Chapter 17.10 Environmentally Critical Areas, steep slope hazard areas are defined as “areas with slopes steeper than 40 percent...” Based on our site reconnaissance and review of the existing topography, the northeast portion of the site has slopes steeper than 40 percent. Based on on-site explorations, the slope consists of fill likely placed as part of previous site development.

5.2.2. On-Site Slopes

GeoEngineers investigated subsurface conditions at the site and we estimate that approximately 5 to 10 feet of fill is present at the site. We understand that during previous development of the trailer park portion of the property, surficial soil was locally transported throughout the site to create an asphalt road that looped through the property as well as to create level benches for the trailer parking slips. In the northwest corner of the site, the existing slope was cut into and shored up with retaining walls that remain in place. We observed remnants of a demolished structure just to the east of the existing retaining walls. Based on current general topography, existing fill and near slope improvements, we conclude that the steep slope present on the site was completed as part of grading activities associated with previous site development. Although portions of the existing site are mapped as steep slopes in the City Municipal Code, the proposed grading plan for the Lynnwood Auto Dealership shows the slope will be regraded and reduced to significantly less than 40 percent and include an engineered retaining wall system. Regrading and slope modification may require civil permitting per Section 17.10 of the Lynnwood Municipal Code.

5.3. Surface Conditions

Existing site grades drop about 50 feet from west to east across the site, ranging from approximate Elevation 420 feet North American Vertical Datum of 1988 (NAVD 88) at the northwest portion of the site to approximately Elevation 370 feet along the east extent along SR 99. Low grasses, shrubs, and semi-mature to mature trees exist throughout the site. Within the northern portion of the site, we observed concrete rubble pile and a demolished structure adjacent to an existing concrete wall and an existing rocky wall. We observed asphalt pavement throughout the middle portion, southern portion, and the northeastern corner of the site.

Existing buried utilities are anticipated within and near the footprint of the project and within the public right-of-way along SR 99 and 186th Place SW. These utilities may include, but are not limited to, gas, electricity, sanitary sewer, storm drain, fiber optic, telecommunications and water.

5.4. Subsurface Soil Conditions

GeoEngineers' understanding of subsurface conditions is based on the 11 exploratory borings completed during the subsurface investigation. Approximate locations of the borings completed as part of this study are presented in Figures 2A and 2B.

Geologic units identified at the site generally consist of fill, weathered glacial till, glacial till and advanced outwash. The weathered till, glacial till and advanced outwash are glacially consolidated consistent with geologic mapping as described in Section 5.1 above. The weathered till and glacial till geologic units represent competent foundation bearing soils. The interpreted subsurface soil conditions are presented in Figure 3, Cross Section A-A', Figure 4, Cross Section B-B' and Figure 5, Cross Section C-C'.

- **Asphalt Concrete (AC) Pavement and Base Course:** Boring GEI-05 encountered AC pavement at the ground surface, as it was completed within the driveway loop in the central portion of the site. The AC measured approximately 1½ inches thick at the boring location. Existing asphalt thickness will likely vary across the site.
- **Fill and Topsoil:** The topsoil and fill layers, where encountered, generally extend to depths ranging from ground surface to 9 feet bgs. The fill and topsoil generally consisted of silty fine to coarse sand with variable organics and gravel.
- **Glacially Consolidated Soils:** Glacially consolidated soils were encountered below the fill and topsoil layers, where those units were present. Based on our experience in the vicinity, our review of existing information, and our borings completed for this project, three glacially consolidated units were encountered in the explorations: weathered till, glacial till, and advanced outwash as described below.

The weathered and glacial till generally overlie the advanced outwash, but layers of till-like deposits are also interbedded within the advanced outwash unit. It is important to note that boulders are commonly present in glacially consolidated soils in nearby excavations, and may be present at the site.

- **Weathered Till:** Weathered till is present below the pavement and shallow fill, and generally consists of medium dense to dense sand with variable silt and gravel. The weathered till extends to depths ranging from approximately 5 to 12 feet bgs.
- **Glacial Till:** Glacial till is present below the weathered till layer and generally consists of very dense silty sand with variable gravel with occasional sand with variable silt and gravel interbeds. The glacial till extends to depths ranging from approximately 5 to 29 feet bgs.
- **Advanced Outwash:** Advanced outwash is present underlying the glacial till deposits and generally consists of very dense sand with variable silt and gravel as well as hard silt with variable sand. All 11 borings terminated in the advanced outwash unit.

5.5. Groundwater Conditions

Table 1 below shows groundwater levels observed within the explorations at the time of drilling. Depths to groundwater noted at the time of drilling represent a short-term condition observed and may not represent the true static groundwater level. Based on the soils encountered and hydraulic conductivity, it can take hours, even days for the groundwater level observed in a boring to reach equilibrium. Groundwater levels

are expected to fluctuate seasonally, with varied precipitation and are likely influenced by Scriber Creek located to the east of Highway 99.

TABLE 1. OBSERVED GROUNDWATER LEVELS FROM EXPLORATIONS

Exploration	Estimated Surface Elevation (feet)	Date	Approximate Depth to Groundwater (feet)	Approximate Groundwater Elevation (feet)
GEI-01	388	11/30/2020	21	367
GEI-02	397	11/30/2020	26.5	370.5
GEI-03	409	11/30/2020	Not Observed	-
GEI-04	416	11/30/2020	Not Observed	-
GEI-05	409	12/01/2020	35	374
GEI-06	403	12/01/2020	30	373
GEI-07	400	12/01/2020	30	370
GEI-08	406	12/01/2020	36	370
GEI-09	409	12/02/2020	31.5	377.5
GEI-10	377	12/02/2020	Not Observed	-
GEI-11	372	12/02/2020	8	364

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1. Summary of Key Geotechnical Issues

The following is a summary of key geotechnical issues related to site development. Design level recommendations for each of these items, as well as other important geotechnical recommendations for the proposed project, are contained in subsequent sections of this report. The entire “Conclusions and Recommendations” Section 6.0 should be reviewed to obtain pertinent geotechnical recommendations.

- Based on the relatively thin layers of fill overlying dense to very dense glacially consolidated soils, the site is classified as Site Class C. The 2018 International Building Code (IBC) seismic design parameters are provided in a subsequent section.
- We recommend that the proposed buildings be supported on conventional spread footings bearing on undisturbed dense to very dense glacially consolidated soils or on compacted structural fill.
- We recommend an allowable soil bearing pressure of 12 kips per square foot (psf) where footings are supported on relatively undisturbed glacial till.
- Temporary dewatering may be required during construction activities to control perched groundwater conditions encountered in the northeast portion of the site. Based on the conditions encountered in the site explorations, we expect groundwater can be adequately managed by diverting to gravel lined ditches and the use of sumps and pumps.
- Permanent drainage layers should be provided behind all below-grade walls.

- If deep excavations are required in the native glacially deposited soils, they will require more effort and may involve heavy ripping. Large cobbles and occasional boulders should also be anticipated within the glacial deposits at the site.
- We recommend temporary slopes be inclined at 1½H:1V (horizontal to vertical) or flatter. Slope inclinations may have to be modified by the contractor if localized sloughing occurs or if seepage is present (particularly if loose fill soils are encountered). We recommend the Geotechnical Engineer evaluate the stability of cut slopes to confirm subsurface soils are as anticipated.
- The existing fill and native soils at the site contain sufficient fines content such that they are moisture sensitive and will be easily disturbed during the wet season. We recommend site preparation and fill placement be completed during extended periods of dry weather if practical. Wet weather construction will require the use of import soils that contain less than 5 percent fines passing the U.S. No. 200 sieve and export of wet native soils.

6.2. Foundation Support

We recommend that the proposed Lynnwood Auto Dealership buildings be supported on shallow spread footings supported on native, undisturbed glacial till, compacted structural fill or control density fill (CDF) extending to these soils. Proposed finished footing elevations for the two planned Auto Dealership buildings as shown on the information provided to us, is at approximate Elevation 378 feet for Building 1, and approximate Elevation 380 feet for Building 2.

At the time this report was prepared, building and pavement traffic loads were not provided. We have assumed typical loads for the type of structures discussed to develop preliminary geotechnical design considerations. We have assumed column and wall loads for Buildings 1 and 2 will be on the order of 110 kips per column and 5 kips per lineal foot (klf) of wall, and floor loads on the order of 100 psf. We have assumed that column and wall loads for the parking garage will be on the order of 240 kips per column and 5 klf of wall, and floor slabs on the order of 150 psf.

We anticipate that design loads will be provided to us by the project team prior to issuing our final geotechnical report, or that assumed loads as noted are greater than final design loads.

6.2.1. Foundation Subgrade Preparation

We suggest that the excavations for the footings be accomplished with a smooth bucket to minimize subgrade disturbance. Any loose or disturbed material should be removed from the excavation. The silty footing subgrade soils will be susceptible to disturbance when wet. We recommend that a representative of GeoEngineers observe the subgrade to determine if fill or any unsuitable soils are present and observe any overexcavation. If any overexcavation is required, it is critical that structural fill be placed properly for the recommended allowable bearing pressure. All structural fill below foundations should be placed and compacted to 95 percent of the maximum dry density (MDD) in accordance with ASTM International (ASTM) Standard Practices Test Method D 1557. The structural fill should extend horizontally beyond the edges of the footing a distance equivalent to the depth of the overexcavation. If the overexcavation will be backfilled with CDF or lean concrete, the overexcavation need only be nominally larger than the size of the footing.

6.2.2. Allowable Bearing Pressures

Proposed structures can be supported on shallow foundations bearing on native dense to very dense native till soils or on compacted crushed rock structural fill over native soils, or on upper medium dense material overlying the native till soils. Allowable bearing pressures will be different, depending on the underlying soils.

Based on proposed footing elevations provided to us by the project team, we anticipate that most of the footings will be founded directly on very dense glacial till. Foundations founded on very dense glacial till may be designed using an allowable soil bearing pressure of 12 kips per square foot (ksf).

Across the southern portion of the building, we anticipate that the footings will likely be supported on existing fill material overlying the glacial till soils. Based on the condition of the fill encountered in our borings, the fill appears to be medium dense. We recommend that the upper 18 inches of the exposed existing fill be re-compacted to a minimum of 95 percent of the MDD in accordance with ASTM D 1557 modified proctor. Where footings will be founded on compacted structural fill, we recommend an allowable soil bearing pressure of 3 ksf be utilized for design.

All exterior footings should be founded at least 18 inches below the lowest adjacent finished grade, while interior footings may be founded a minimum of 12 inches below top of slab. We recommend minimum footing widths of 18 inches and 3 feet for continuous and isolated footings, respectively.

The recommended bearing pressure has a factor of safety of at least 3 for dead plus long-term live loads. For short-term transient loads (e.g., seismic, wind loads), the allowable bearing capacity can be increased by one-third if permitted by the design standard.

6.2.3. Modulus of Subgrade Reaction

Large footings, such as large shear wall or brace-frame footings may be designed as mat foundations, which requires a soil subgrade modulus. Where the mat foundations bear on very dense glacial till, or a limited thickness of compacted structural fill extending to the glacial till, the subgrade may be assumed to have a subgrade modulus on the order of 85 pounds per cubic inch (pci). Existing undocumented fill below the foundation elements, if present, should be overexcavated and the subgrade prepared as described above.

6.2.4. Foundation Settlement

Provided all loose soil is removed and the subgrade is prepared as recommended under the “Construction Considerations” Section 6.2.6 below, we estimate the total settlement of shallow foundations will be about 1 inch or less. The settlements will occur rapidly, essentially as loads are applied. We anticipate differential settlements between footings could be half of the expected total settlement. Note that smaller settlements will result from lower applied loads.

6.2.5. Lateral Resistance

Lateral loads can be resisted by passive resistance on the sides of the footings and by friction on the base of the footings. Passive resistance should be evaluated using an equivalent fluid density of 370 pounds per cubic foot (pcf) where footings are poured neat against native soil or are surrounded by structural fill compacted to at least 95 percent of MDD, as recommended. Resistance to passive pressure should be calculated from the bottom of adjacent floor slabs and paving or below a depth of 1 foot where the adjacent

area is unpaved, as appropriate. Frictional resistance can be evaluated using 0.35 for the coefficient of base friction against footings. The above values incorporate a factor of safety of about 1.5.

If soils adjacent to footings are disturbed during construction, the disturbed soils must be recompacted or replaced with compacted structural fill, otherwise the lateral passive resistance value must be reduced.

6.2.6. Construction Considerations

We recommend 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 consistent with our geotechnical report.

If soft areas are present at the footing subgrade elevation, the soft areas should be removed and replaced with lean concrete or structural fill at the recommendation of GeoEngineers. In such instances, the zone of structural fill should extend laterally beyond the footing edges a horizontal distance at least equal to the thickness of the fill.

We recommend 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 level is required for placing foundation reinforcement. Temporarily leaving the subgrade high will help reduce damage to the subgrade resulting from inclement weather, construction traffic, or other activities on site.

6.2.7. Footing Drains

We recommend that footing drains be installed around the perimeter of the proposed building. The perimeter footing drains should be provided with cleanouts and should consist of at least 4-inch-diameter perforated pipe placed on a 3-inch bed of, and surrounded by, 6 inches of drainage material enclosed in a non-woven geotextile such as Mirafi 140N (or approved equivalent) to prevent fine soil from migrating into the drain material. We recommend against using flexible tubing for footing drainpipes. The perimeter drains should be sloped to drain by gravity to a suitable discharge point, preferably a storm drain. We recommend that the cleanouts be covered and placed in flush-mounted utility boxes. Water collected in roof downspout lines must not be routed to the footing drain lines.

6.3. Slab-on-Grade Floors

All slab subgrade areas should be evaluated as recommended in the “Site Preparation” Section 7.1 of the report. All loose soils should be removed below the slab footprint and the subgrade should be compacted to a minimum 95 percent of the MDD. We recommend a capillary break be placed beneath the slab to consist of a 6-inch-thick layer of clean crushed gravel with a maximum particle size of 1½ inches and negligible sand or silt (similar to American Association of State Highway and Transportation Officials [AASHTO] Grading No. 57). The subgrade should be evaluated by the geotechnical engineer prior to placing the recommended capillary break material. We recommend a subgrade modulus of 150 pci for slabs supported on compacted structural fill underlain by very dense glacial till, or directly on the capillary break material over the glacial till.

6.4. Excavation Support and Retaining Walls

Based on our discussions with the project team and review of preliminary plans, the project site will be regraded and incorporate several retaining walls. The planned wall heights are variable across the site and range from 5 to 16 feet in height. We recommend cantilever soldier pile and soldier pile and tieback walls

for use as temporary shoring or permanent retaining walls, as well as permanent below grade walls and cast-in-place walls. Geotechnical design recommendations are presented in the following sections.

6.4.1. Cantilever Soldier Pile Wall

Soldier pile walls consist of steel beams set in concrete shafts in drilled vertical holes located along the wall alignment, typically about 8 feet on center with timber or concrete lagging between pile elements. We recommend that the Earth Pressure Diagram for Cantilever Soldier Pile Walls shown in Figure 6 be used for retaining walls where the height of the excavation (H) is less than 10 feet. Retaining walls that are taller than 10 feet should be designed using tiedback soldier pile systems.

6.4.2. Soldier Pile and Tieback Walls

For taller wall sections, tiedback support is recommended for the soldier pile section. After excavation to specified elevations on the soldier pile wall, tiebacks are installed at specified depths, depending on wall design. Once tiebacks are installed, the pullout capacity of each tieback is tested, and the tieback is structurally connected (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.

6.4.2.1. Soldier Piles

We recommend soldier pile walls be designed using the earth pressure diagram presented in Figure 6. The pressures represent the estimated loads that will be applied to the wall system for various wall heights. Earth pressures shown are per foot of wall width. Pile design will depend on center to center spacing and tributary area to each pile.

Earth pressures presented in Figure 6 include loading from typical traffic surcharge. Other surcharge loads, such as cranes, construction equipment or construction staging areas, should be considered on a case-by-case basis in accordance with the recommendations presented in Figure 8, Recommended Surcharge Pressure. Seismic pressures included in Figure 6 should only be applied to permanent walls.

We recommend 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.” Axial capacity of the soldier piles must resist the downward component of tieback anchor loads and other vertical loads, as appropriate. We recommend using an allowable end bearing value of 30 ksf for piles supported on the glacially consolidated soils. The allowable end bearing value should be applied to the base area of the concrete shaft into which the soldier pile is embedded. This value includes a factor of safety of about 2.0. The allowable end bearing value assumes the shaft bottom is cleaned out immediately prior to concrete placement. If necessary, an allowable pile skin friction value of 1.5 ksf in glacially consolidated soils may be used on the embedded portion of the soldier piles to resist the vertical loads.

6.4.2.2. Timber Lagging

We recommend the temporary timber lagging be sized using the procedures outlined in the Federal Highway Administration’s Geotechnical Engineering Circular No. 4 (1999). The site soils are best described as

competent soils. The following table presents GeoEngineers' recommended lagging thicknesses (rough-cut) as a function of soldier pile clear span and depth.

TABLE 2. RECOMMENDED LAGGING THICKNESS

Depth (feet)	Recommended Lagging Thickness (rough-cut) for clear spans of:					
	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

Lagging should be installed promptly after excavation, especially in areas where groundwater is present or where clean sand and gravel soils are present and caving soil 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 practical. Voids should be backfilled immediately or within a single shift, depending on the selected method of backfilling. 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 as backfill behind the upper 10 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.

6.4.2.3. Tiebacks

Tieback anchors should extend far enough behind the wall to develop anchorage beyond the “no-load” zone and within a stable soil mass. As shown in Figure 6, the no-load zone is defined to extend horizontally behind the base of the wall a distance of H/4, where H is the height of the wall, and then up to the ground surface away from the wall face at an angle of 60 degrees measured from horizontal. The anchors should be inclined downward at 15 to 25 degrees below the horizontal. Corrosion protection is not required for 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 if the shoring contractor plans to grout both the bond zone and unbonded zone of the tiebacks in a single stage. If the shoring contractor does not plan to use a bond breaker to isolate the no-load zone, GeoEngineers should be contacted to provide recommendations.

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 the spacing between tiebacks be at least three times the diameter of the anchor hole to reduce the potential for group interaction. We recommend a preliminary 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 the tiebacks have adequate pullout capacity. Pullout resistance of tiebacks should be designed using a factor of safety of 2.0. The pullout resistance should be verified by completing at least two successful verification tests in each soil type and at least 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 B.

The tieback layout and inclination should be checked to confirm the tiebacks do not interfere with adjacent buildings, buried utilities, Washington Department of Transportation (WSDOT) structure foundations and retaining walls. The City and WSDOT minimum clearances between ground anchors and existing utilities and structures should be maintained.

6.4.2.4. Soldier Pile Wall Drainage

Drainage for soldier pile and lagging walls is achieved through seepage between the timber lagging boards. Seepage flows at the bottom of the excavation should be contained and controlled to prevent loss of soil from behind the lagging. Drainage should be incorporated into the permanent dewatering system as described in the “Permanent Below-Grade Walls Against Shoring” Section 6.4.3 of this report.

6.4.2.5. Construction Considerations

Temporary casing or drilling fluid may be required to install the soldier piles and casing may be necessary for tiebacks where:

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

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

6.4.3. Permanent Below-Grade Walls Against Shoring

Permanent below-grade walls constructed adjacent to temporary shoring walls should be designed for the same earth pressures as the temporary shoring walls with the addition of a rectangular seismic earth pressure equal to $9H$ psf (where H is the height of the wall in feet). Foundation surcharge loads and traffic surcharge loads should be incorporated into the design of the below-grade walls using the surcharge pressures presented in Figure 8. Other surcharge loads, such as from construction equipment or construction staging areas, should be considered on a case-by-case basis. We can provide the estimated lateral pressures from these surcharge loads as the design progresses.

Soil pressures recommended above assume that wall drains will be installed to prevent the buildup of hydrostatic pressure behind the walls, as described in the “Footing Drains” Section 6.2.7 and the “Slabs-on-Grade Floors” Section 6.3 of this report.

6.4.4. Other Cast-in-Place and Modular Block Walls

Conventional cast-in-place or modular block walls may be necessary for retaining structures or below-grade utility vaults located on site. Lateral soil pressures acting on conventional cast-in-place or precast 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). In addition, where applicable, utility vaults should be designed for full hydrostatic pressures unless adequate drainage as described below can be provided and the wall drainpipes can be tightlined to a suitable discharge location. For hydrostatic conditions, the wall should be designed using an equivalent fluid density of 90 pcf. For seismic loading conditions, a rectangular earth pressure equal to $9H$ 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 soils, the allowable friction 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 370 pcf (triangular distribution). The above coefficient of friction and passive equivalent fluid density values incorporate a factor of safety of about 1.5.

6.4.5. Permanent Below-Grade Wall Drainage

Drainage behind the permanent below-grade walls constructed in front of shoring walls is typically provided using a prefabricated drainage mat attached to the shoring walls. The drainage mat should be connected to weep pipes that extend through the permanent below-grade building walls at the footing elevation. The weep pipes through the permanent below-grade walls should be spaced no more than 12 feet on center and should have a minimum diameter of 2 inches. The weep pipes should be connected to perimeter footing drains (like those described under the “Footing Drains” Section 6.2.7 above), which are in turn tightlined to the underslab drainage system and permanent sump.

Full wall face coverage will be needed to minimize seepage and/or wet areas at the face of the permanent walls and to reduce the buildup of hydrostatic pressures acting on the basement walls. The drainage mat full face wall coverage should extend from the weep pipe elevation up to about 3 feet below the top of the wall to reduce the potential for surface water to enter the wall drainage system. The tops of the drainage mats should be sealed to prevent soil and water entry.

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, there is still a potential for these conditions to occur. If this is a concern, waterproofing should be specified.

For permanent walls constructed in open cut areas, positive drainage should be provided behind cast-in-place and modular block retaining walls by placing a minimum 2-foot-wide zone of Gravel Backfill for Walls,

Section 9-03.12(2) of the WSDOT Standard Specifications. A perforated or slotted drainpipe should be placed near the base of the retaining wall to provide drainage. The drainpipe should be surrounded by at least 6 inches of WSDOT Gravel Backfill for Drains, Section 9-03.12(4) or an alternative approved by GeoEngineers. The drainage 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.

6.5. Pavement Recommendations

6.5.1. General

Pavement subgrades should be prepared in accordance with Section 7.0 of this report. If the subgrade soils are excessively loose or soft, it may be necessary to excavate localized areas and replace them with additional gravel borrow or gravel base material. Pavement subgrade conditions should be observed and proof-rolled during construction and prior to placing the subbase materials in order to properly evaluate the presence of unsuitable subgrade soils and the need for over excavation and placement of a geotextile separator.

Our pavement recommendations assume that traffic at the site will consist of occasional truck traffic and passenger cars. We do not have specific information on the frequency and type of vehicles that will use the area; however, we have based our design analysis on traffic consisting of two heavy trucks per day to account for delivery- and service-type vehicles and passenger car traffic for the heavy-duty pavement sections, and passenger car traffic only for the light-duty pavement sections. In addition, we have provided pavement sections for typical local access and collector streets from Lynwood Washington Public Works.

6.5.2. Dynamic Cone Penetrometer (DCP) Testing

In order to estimate subgrade resilient modulus (M_R) for the upper weathered till material, we conducted DCP tests in general accordance with ASTM D 6951 at the two locations where we encountered sandy gravel weathered till (GEI-10 and GEI-11). We recorded penetration depth of the cone versus hammer blow count and terminated testing after penetrating depths of approximately 17.5 inches (DCP-1) and 24.5 inches (DCP-2).

We plotted depth of penetration versus blow count and visually assessed regions where slopes of the data were relatively constant to estimate the moduli. Table 3 lists our estimate of the subgrade resilient modulus at each test location based on data obtained in the upper 18 inches below the existing ground surface.

For areas where exposed subgrade consists of native weathered till, the estimated M_R from Table 3 are appropriate. For fill placed over native subgrade as part of site grading (compacted as recommended for structural fill in this report) an M_R of 5,500 pounds per square inch (psi) was used for design of pavement sections.

TABLE 3. ESTIMATED SUBGRADE RESILIENT MODULI BASED ON DCP TESTING

Boring Number	Estimated Resilient Modulus (psi)
DCP-1	8,100
DCP-2	9,200

6.5.3. Pavement Drainage

Long-term performance of pavements is influenced significantly by drainage conditions beneath the pavement section. Positive drainage can be accomplished by crowning the subgrade with a minimum 2 percent cross slope and establishing grades to promote drainage.

6.5.4. AASHTO Input Parameters

Input parameters used in pavement thickness design were selected based on review of typical values found in the AASHTO Design Guide. The following parameters were used:

- On-site soil subgrade below proposed fill placed to raise site grades or below aggregate base sections has been prepared as described in Section 7.0 of this report, and observations indicate that subgrade is in a firm and unyielding condition.
- Fill placed to raise site grades should be compacted as recommended for structural fill in this report, placed in lifts and compacted to a minimum of 95 percent of MDD per ASTM D 1557 (modified proctor).
- A resilient modulus of 20,000 psi was estimated for base rock prepared and compacted as recommended.
- A resilient modulus of 5,500 psi was estimated for firm in-place soils or structural fill placed on firm native soils for consistency.
- Initial and terminal serviceability indices of 4.2 and 2.5, respectively.
- Reliability and standard deviations of 85 percent and 0.45, respectively.
- Structural coefficients of 0.41 and 0.10 for the asphalt and base rock, respectively.
- A 20-year design life.
- Truck traffic consists of an even distribution of two-axle service trucks/vans and large, four-axle trucks per day.

6.6. Asphalt Concrete (AC) Pavement Sections

If any of the noted assumptions vary from project design use, our office should be contacted with the appropriate information so that the pavement designs can be revised or confirmed adequate.

It is our understanding that the majority of the project paving will consist of surface parking lots and drive aisles on site and will remain private. However, some improvements may need to meet City Standards for typical Roadway Section Arterials and Neighborhood Street. Recommended minimum pavement sections are provided in Table 4 below.

TABLE 4. RECOMMENDED PAVEMENT SECTIONS

Street Type	Thickness Wearing Course ¹	Thickness HMA ²	Thickness of crushed surfacing base course CSBC ³	Design Standard
Automobile Parking	3 inches	-	4 inches	
Heavy Duty Pavement (truck traffic and delivery areas)	4 inches	-	6 inches	
Typical Roadway Section Neighborhood Street	-	4 inches	4 inches	Lynnwood Washington Public Works, STD3-3
Typical Roadway Section Arterials	-	6 inches	4 inches	Lynnwood Washington Public Works, STD3-2

Notes:

- ¹ ½-inch hot mix asphalt (HMA) (PG 58-22) per WSDOT Standard Specification Section 5-04 and 9-03.
- ² 1-inch HMA (PG 5822) per WSDOT Standard Specification Section 5-04 and 9-03.
- ³ Crushed surfacing base course (CSBC) per WSDOT Standard Specification Section 9-03.9(3).

The base course should be compacted to at least 95 percent of the MDD (ASTM D 1557). We recommend that a proof-roll of the compacted base course be observed by a representative from our firm prior to paving. Soft or yielding areas observed during proof-rolling may require overexcavation and replacement with compacted structural fill.

Crushed surfacing base course should conform to applicable sections of 4-04 and 9-03.9(3) of the WSDOT Standard Specifications.

6.6.1. New Hot Mix Asphalt (HMA) Pavement

HMA should conform to applicable sections of 5-04, 9-02 and 9-03 of the WSDOT Standard Specifications. The AC binder should be PG 64-22 grade meeting WSDOT Standard Specifications. AC pavement should be compacted to 91.0 percent at Maximum Theoretical Unit Weight (Rice Gravity) of AASHTO T-209.

The recommended pavement sections assume that final improvements surrounding the pavement will be designed and constructed such that stormwater or excess irrigation water from landscape areas does not infiltrate below the pavement section into the crushed base.

6.6.2. Portland Cement Concrete (PCC) Pavement

The recommend PCC pavement section shall consist of 6 to 8 inches of PCC over a minimum of 6 inches of CSBC. The base course should be compacted to at least 95 percent MDD.

We recommend PCC pavements incorporate construction joints and/or crack control joints spaced maximum distances of 12 feet apart, center-to-center, in both the longitudinal and transverse directions. Crack control joints may be created by placing an insert or groove into the fresh concrete surface during finishing, or by sawcutting the concrete after it has initially set-up. We recommend the depth of the crack control joints be approximately one-fourth the thickness of the concrete; or 1½ and 2 inches deep for the

recommended concrete thickness of 6 and 8 inches, respectively. We also recommend the crack control joints be sealed with an appropriate sealant to help restrict water infiltration into the joints.

6.7. Seismic Parameters

6.7.1. Seismicity

The Puget Sound region is located at the convergent continental boundary known as the Cascadia Subduction Zone (CSZ), which extends from mid-Vancouver Island to Northern California. The CSZ is the zone where the westward advancing North American Plate is overriding the subducting Juan de Fuca Plate. The interaction of these two plates results in three potential seismic source zones: (1) a shallow crustal source zone; (2) the Benioff source zone; and (3) the CSZ interplate source zone.

The shallow crustal source zone is used to characterize shallow crustal earthquake activity within the North American Plate at depths ranging from 3 to 19 miles below the ground surface. The closest known fault is the South Whidbey Island Fault, mapped approximately 2 miles north of the site.

The Benioff source zone is used to characterize intraplate, intraslab or deep subcrustal earthquakes. Benioff source zone earthquakes occur within the subducting Juan de Fuca Plate at depths between 20 and 40 miles. In recent years, three large Benioff source zone earthquakes occurred that resulted in some liquefaction in loose alluvial deposits and significant damage to some structures. The first earthquake, which was centered in the Olympia area, occurred in 1949 and had a Richter magnitude of 7.1. The second earthquake, which was centered between Seattle and Tacoma, occurred in 1965 and had a Richter magnitude of 6.5. The third earthquake, which was located in the Nisqually valley north of Olympia, occurred in 2001 and had a Richter magnitude of 6.8.

The CSZ interplate source zone is used to characterize rupture of the convergent boundary between the subducting Juan de Fuca Plate and the overriding North American Plate. The depth of CSZ earthquakes is greater than 40 miles. No earthquakes on the CSZ have been instrumentally recorded; however, through the geologic record and historical records of tsunamis in Japan, it is believed that the most recent CSZ event occurred in 1700.

6.7.2. Geologic Hazards

Based on our review of the City's critical areas code (Chapter 17.10) and Snohomish County Geologic Hazards Landslide Hazard Areas map, the site is not located in a geologic hazard area, except for areas where slopes are greater than 40 percent as discussed in Section 5.2.2 of this report. Those areas will be regraded as part of site development.

Based on our review of the borings, the site soils have a low risk of liquefaction, lateral spread, or seismically induced landslide. Additionally, due to the distance to the closest mapped fault (South Whidbey Fault), the site has a low risk of fault rupture.

6.7.3. 2018 IBC Seismic Design Information

The 2018 IBC is the current building code. The 2018 IBC references the 2016 Minimum Design Loads for Buildings and Other Structures (American Society of Civil Engineers [ASCE] 7-16). We recommend that the site be classified as Site Class C – Very Dense Soil and Soft Rock. Our recommended seismic design parameters are presented in Table 5 below.

TABLE 5. MAPPED 2018 IBC SEISMIC DESIGN PARAMETERS

Seismic Design Parameters	Recommended Value ^{1, 2}
Site Class	C
Mapped Spectral Response Acceleration at Short Period (S_s)	1.303g
Mapped Spectral Response Acceleration at 1 Second Period (S_1)	0.51g
Site Modified Peak Ground Acceleration (PGA_M)	0.534g
Site Amplification Factor at 0.2 second period (F_a) ²	1.0
Site Amplification Factor at 1.0 second period (F_v) ²	1.3
Design Spectral Acceleration at 0.2 second period (S_{DS}) ²	0.869g
Design Spectral Acceleration at 1.0 second period (S_{D1}) ²	0.442g

Notes:

¹ Parameters developed based on Latitude N47.8287302° and Longitude -122.309308° using the ATC Hazards online tool.

7.0 EARTHWORK RECOMMENDATIONS

7.1. Site Preparation

In general, site development will require demolition of any existing structures, concrete sidewalks and surface pavement, new foundation construction, and installation of subsurface utilities. The existing surficial soils consist primarily of silty sand and contain high fines (silt) content such that repeated construction traffic will result in considerable disturbance during wet weather construction. If wet weather construction occurs, it may be necessary to provide a layer of quarry spalls, crushed rock or pit run sand and gravel if the on-site soils become wet and disturbed. Additional wet weather considerations are included below.

7.1.1. Demolition

All existing structural elements should be excavated and removed from proposed structural areas. If present, existing utilities that will be abandoned on site should be identified prior to project construction. Abandoned utility lines larger than 4 inches in diameter that are located beneath proposed structural areas should be completely removed or filled with grout if abandoned and left in place in order to reduce potential settlement or caving in the future. Materials generated during demolition of existing structural improvements should be transported off site for disposal.

Previously developed sites often have remnant buried features from previous uses such as fuel storage or other types of buried tanks, cisterns, former basements or storages, or other remnant debris from foundations and slabs, and some of those elements may be present on this site. During demolition and site grading, such buried features may be encountered and should be excavated and removed within proposed development areas.

Materials generated during demolition of existing improvements should be transported off site for disposal. Existing voids and new depressions created during site preparation, and resulting from removal of existing utilities or other subsurface elements, should be cleaned of loose soil or debris down to firm soil and backfilled with compacted structural fill. Disturbance to a greater depth should be expected if site preparation and earthwork are conducted during periods of wet weather.

7.1.2. Stripping

In landscape areas or areas of wild vegetative growth stripping of surface organics and roots will be required. In general upper organics should be stripped to depths of 6 to 8 inches with increased depths in areas of thicker vegetation. Greater stripping depths may be required to remove localized zones of loose or organic soil. The actual stripping depth should be based on field observations at the time of construction. Stripped material should be transported off site for disposal unless otherwise allowed by project specifications for other uses such as landscaping. Clearing and grubbing recommendations provided below should be used in areas where moderate to heavy vegetation are present, or where surface disturbance from prior use has occurred.

Where thicker vegetation is present, more extensive site clearing will be required to remove site vegetation, including thick grass, shrubs and trees. Following clearing, grubbing and excavations up to several feet may be required to remove the root zones of thick shrubs and trees. Deeper excavations, up to 5 or 6 feet may be required to remove the root zones of large trees. Roots larger than ½ inch in diameter should be removed. Excavations to remove root zones should be done with a smooth bucket to minimize subgrade disturbance. Portions of the site are heavily vegetated and previously buried roots may be present, even in the current grassy areas of the site. Grubbed materials should be hauled off site and properly disposed unless otherwise allowed by the project specifications for other uses such as landscaping, stockpiling or on-site burning.

Existing voids and new depressions created during demolition, clearing, grubbing or other site preparation activities, should be excavated to firm soil and backfilled with Imported Select Structural Fill. Greater depths of disturbance should be expected if site preparation and earthwork are conducted during periods of wet weather.

7.1.3. Subgrade Improvement

In areas where additional fill is to be placed to raise site grades the subgrade should be compacted in place prior to fill placement. After demolition and in areas that have been stripped of the root zone and organics, and where some upper disturbed material remains in-place, we recommend that the upper soil be improved by compaction. Subgrade improvement can be accomplished by removing and replacing or scarifying and recompacting the upper 18 inches of in place fill soil prior to placing site grading fill or base rock materials. Scarification is typically performed by ripping with agricultural discs and aerating the soils to dry. This is best performed during the dry season when rain is less likely to occur. Considerable soil processing, including moisture conditioning (likely drying), should be expected at most times of the year in order to adequately compact the on-site silty soil. If the soil cannot be properly moisture conditioned (dried-back), the subgrade should be removed down to firm material and replaced with granular fill.

7.2. Subgrade Preparation and Evaluation

Upon completion of site preparation activities, exposed subgrades should be proof-rolled with a fully loaded dump truck or similar heavy rubber-tired construction equipment where space allows to identify soft, loose or unsuitable areas. Probing may be used for evaluating smaller areas or where proof-rolling is not practical. Proof-rolling and probing should be conducted prior to placing fill, and should be performed by a representative of GeoEngineers who will evaluate the suitability of the subgrade and identify areas of yielding that are indicative of soft or loose soil. If soft or loose zones are identified during proof-rolling or

probing, these areas should be excavated to the extent indicated by our representative and replaced with structural fill.

During wet weather, or when the exposed subgrade is wet or unsuitable for proof-rolling, the prepared subgrade should be evaluated by observing excavation activity and probing with a steel foundation probe. Observations, probing and compaction testing should be performed by a member of our staff. Wet soil that has been disturbed due to site preparation activities or soft or loose zones identified during probing should be removed and replaced with compacted structural fill.

7.3. Footing and Basement Excavations

Following footing excavation, we recommend that exposed subgrade be evaluated by a representative from our firm to assess the adequacy of the subgrade conditions and to confirm subsurface soils as are anticipated. Any disturbed or otherwise unsuitable areas identified should be re-compacted, if practical or removed.

Excavations are anticipated during construction in relation to spread footings, permanent below-grade walls and underground utilities. We anticipate portions of the excavations can likely be made as temporary open cut slopes depending on the site constraints. Where temporary cut slopes are not feasible, temporary shoring will be required. The stability of open cut slopes is a function of soil type, groundwater seepage, slope inclination, slope height and nearby surface/surcharge loads. The use of inadequately designed open cuts could impact the stability of adjacent work areas, existing utilities and endanger personnel.

The contractor performing the work has the primary responsibility for protection of workmen and adjacent improvements. In our opinion, the contractor will be the in the best position to observe subsurface conditions continuously through the construction process and to respond to variable soil and groundwater conditions. Therefore, the contractor should have the primary responsibility for deciding whether or not to use open cut slopes for much of the excavation 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 the temporary shoring is most appropriately left up to the contractor proposing to complete the installation. Temporary cut slopes and shoring must comply with the provisions of Title 296-155 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring."

7.4. Utility Trenches

Trench excavations, pipe bedding and trench backfilling should be completed using the general procedures described in the 2020 WSDOT Standard Specifications or other suitable procedures specified by the project civil engineer. The native glacial deposits and fill soils encountered at the site are generally low corrosivity, based on our experience in the Puget Sound region.

Utility trench backfill should consist of structural fill and should be placed in lifts of 6 inches or less (loose thickness) if hand-operated compaction equipment is utilized. Imported backfill, containing less than 5 percent fines, may be compacted in loose lifts not exceeding 12 inches, depending on the compaction equipment used. Each lift must be compacted prior to placing the subsequent lift. Prior to compaction, the backfill should be moisture-conditioned to within 3 percent of the optimum moisture content, if necessary.

The backfill should be compacted in accordance with the criteria discussed in the “Fill Placement and Compaction Criteria” Section 7.6.3 below.

7.5. Slopes

7.5.1. Temporary Cut Slopes

For planning purposes, temporary unsupported cut slopes more than 4 feet high may be inclined at 1½H:1V or flatter within the fill or recent deposits. Flatter slopes may be necessary if seepage is present on the face of the cut slopes or if localized sloughing occurs. 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 one-half the slope height from the top of the cut.
- 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.
- The general condition of the slopes be observed periodically by the geotechnical engineer to confirm adequate stability.

More restrictive requirements may apply depending on specific site conditions, which should be continuously assessed by the contractor.

If temporary sloping is not feasible based on site spatial constraints, excavations could be supported by internally braced shoring systems, such as a trench box or other temporary shoring. There are a variety of options available. We recommend that the contractor be responsible for selecting the type of shoring system to apply.

Because the contractor has control of the construction operations, the contractor should be made responsible for the stability of cut slopes, as well as the safety of the excavations. Shoring and temporary slopes must conform to applicable local, state and federal safety regulations.

7.5.2. Permanent Cut and Fill Slopes

Permanent slopes may be constructed at inclinations of 2H:1V or flatter. Fill to create permanent slopes should be compacted to at least 95 percent of MDD. To achieve uniform compaction, we recommend that fill slopes be slightly overbuilt and cut back to expose well-compacted fill.

To reduce erosion, newly constructed slopes and disturbed existing slopes should be planted or hydroseeded shortly after completion of grading. Until the vegetation is established, some sloughing and raveling of the slopes should be expected. This may necessitate localized repairs and reseeded. Temporary covering, such as clear heavy plastic sheeting, or erosion control blankets (such as American Excelsior Curlex 1 or North American Green SC150) could be used to protect the slopes during periods of rainfall.

7.5.3. Slope Drainage

If seepage is encountered at the face of permanent or temporary slopes, it will be necessary to flatten the slopes or install a subdrain to collect the water. We should be contacted to evaluate such conditions on a case-by-case basis.

7.6. Structural Fill and Backfill

Structural areas include areas beneath foundations, floor slabs, pavements, and any other areas intended to support structures or within the influence zone of structures should generally meet the criteria for structural fill presented below. All structural fill soils should be free of debris, clay balls, roots, organic matter, frozen soil, man-made contaminants, particles with greatest dimension exceeding 4 inches (3-inch maximum particle size in building footprints), and other deleterious materials. The suitability of soil for use as structural fill will depend on the gradation and moisture content of the soil. As the amount of fines in the soil matrix increases, the soil becomes increasingly more sensitive to small changes in moisture content and achieving the required degree of compaction becomes more difficult or impossible. Recommendations for suitable fill material are provided in the following sections.

7.6.1. Materials

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

- Structural fill used to support buildings, roadways, utilities, and hardscapes may contain an increased fines content during dry weather provided it can be moisture conditioned and compacted to the minimum standard. Fill placed during the wet season should consist of Gravel Borrow, WSDOT Standard Specification 9-03.14(1) with the added restriction that it contains less than 5 percent passing the U.S. No. 200 sieve.
- Structural fill placed as capillary break material should meet the requirements of WSDOT Standard Specification 9-03.1(4)C, Grading No. 57.
- Structural fill placed behind retaining walls should meet the requirements of Gravel Backfill for Walls, WSDOT Specification 9-03.12(2).
- Structural fill placed around perimeter footing drains, underslab drains and cast-in-place wall drains should meet the requirements of Gravel Backfill for Drains, 9-03.12(4).
- Structural fill placed as CSBC below pavements and sidewalks should meet the requirements of Crushed Surfacing Base Course, WSDOT Specification 9-03.9(3).

7.6.2. On-site Soils

The on-site soils are moisture sensitive and generally have natural moisture contents higher than the anticipated optimum moisture content for compaction. As a result, the on-site soils will likely 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 fill soils required for this project have specific gradation requirements, and the on-site soils do not meet these gradation requirements. If the contractor wants to use on-site soils for structural fill, GeoEngineers can evaluate the on-site soils for suitability as structural fill following site preparation when these materials are exposed.

7.6.3. 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 not exceeding 1 foot in thickness. 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 (supporting foundations, slab-on-grade floors or structural slabs) and in pavement and sidewalk areas (including utility trench backfill) should be compacted to at least 95 percent of the 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 overcompaction 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.

7.7. 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 percentage points above the optimum moisture content, these soils become muddy and unstable, and operation of equipment on these soils is difficult. 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 be sloped so that surface water is directed to a sump or discharge location. 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 unsuitable.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with materials not susceptible to wet weather disturbance (as described in previous sections).
- Construction activities should be scheduled so that the length of time the soils are left exposed to moisture is reduced to the extent practicable.

7.8. Construction Dewatering

Based on the site explorations, the proposed excavation depths are not anticipated to require active dewatering using wells or well points. Passive dewatering systems using gravel-lined ditches routed to sumps and pumps are anticipated to be sufficient for the planned site excavations.

In addition to groundwater seepage and upward confining flow, surface water inflow to the excavations during the wet season can be problematic. Provisions for surface water control during earthwork and excavations should be included in the project plans and should be installed prior to commencing earthwork.

A contingency should be carried in the budget for earthwork that may occur during periods of wet weather. Wet weather will result in delays and difficulty in achieving compaction of fill soils. Additionally, if wet weather occurs during any overexcavation work, pumps may need to run overnight and on weekends to keep any open excavations from filling.

7.9. Recommended Additional Geotechnical Services

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 soldier piles and tiebacks, evaluate the suitability of the foundation subgrades, observe installation of subsurface drainage measures, evaluate structural backfill, observe 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 as described in Appendix C, Report Limitations and Guidelines for Use.

8.0 LIMITATIONS

We have prepared this report for the exclusive use of Holman Auto and their authorized agents for the Lynnwood Auto Dealership 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.

Please refer to Appendix C titled "Report Limitations and Guidelines for Use" for additional information pertaining to the use of this report.

9.0 REFERENCES

ATC Hazards by Location. "18624 Hwy 99, Lynnwood, WA 98037, USA", <https://hazards.atcouncil.org/#/>

City of Lynnwood Municipal Code, Chapter 17.10, "Environmentally Critical Areas",
[Chapter 17.10 ENVIRONMENTALLY CRITICAL AREAS \(codepublishing.com\)](http://codepublishing.com)

Federal Highway Administration (FAA). 1999. Geotechnical Engineering Circular No. 4.

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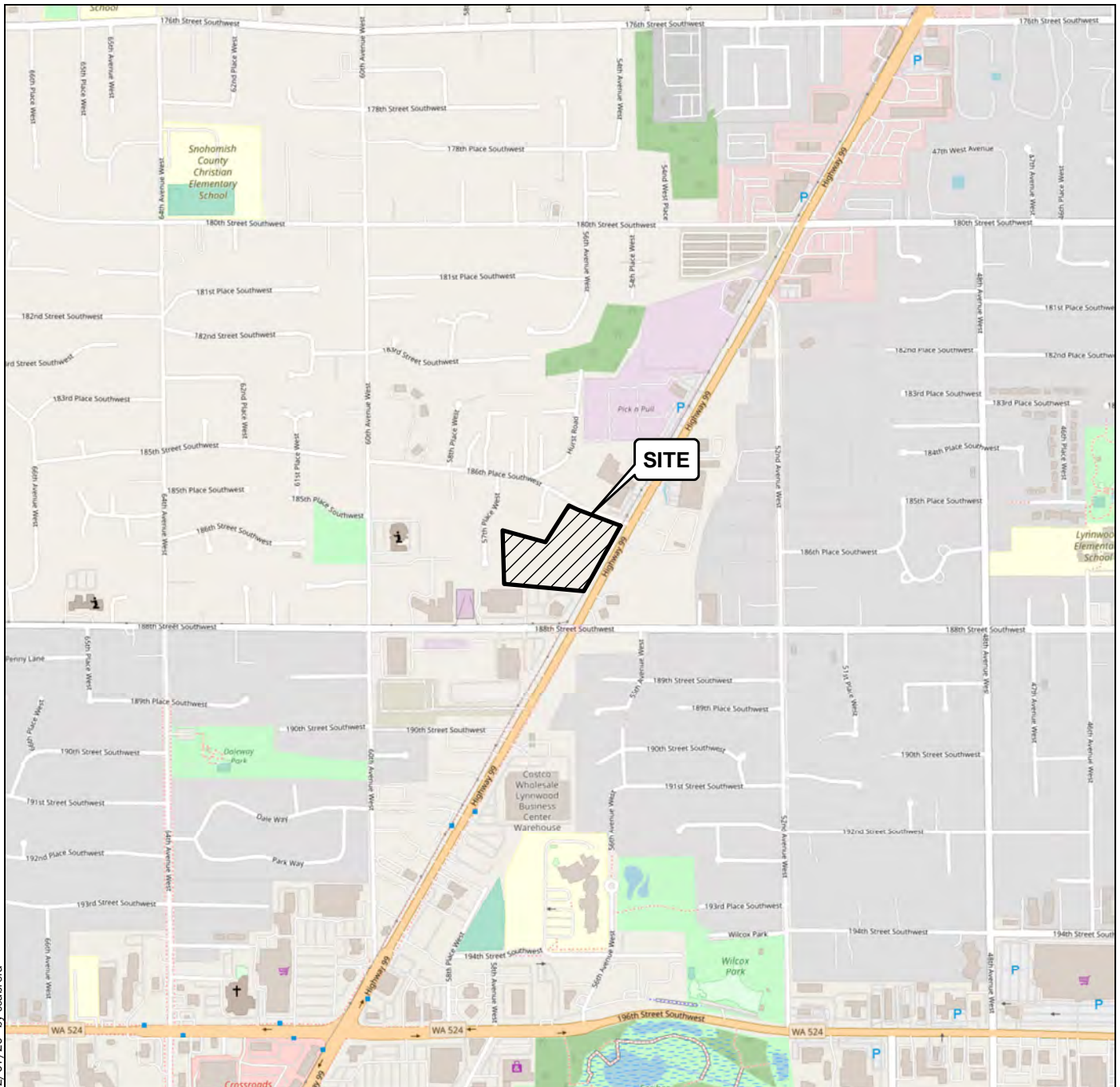
Minard, James P. "Geologic Map of the Edmonds East and Part of the Edmonds West Quadrangles, Washington". 1983. United States Geological Survey.

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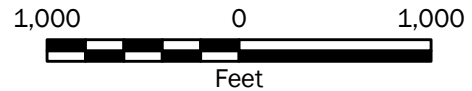
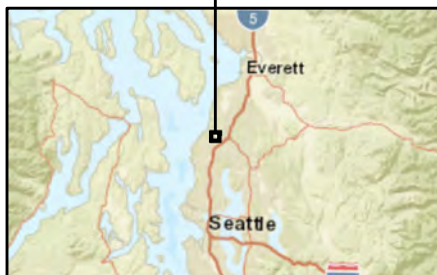
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Vicinity Map

Lynnwood Auto Dealer
Lynnwood, Washington



Figure 1

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Mapbox Open Street Map, 2016

Projection: NAD 1983 UTM Zone 10N

P:\24\24789001\CAD\00\GeoTech\Report\24789001_F02-F05_Site Plan & Sections.dwg TAB:2478900100_F02A Existing Conditions Site and Exploration Plan Date Exported: 12/18/20 - 11:18 by mklm.tmp



Legend

GEI-01 Boring by GeoEngineers, Inc., 2020

A A' Cross Section Location

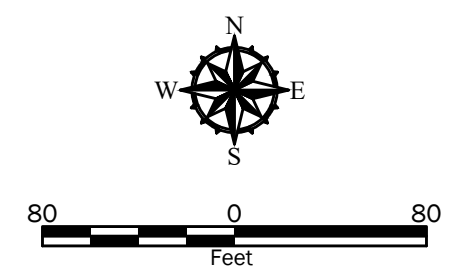
Area with Slope Greater than 40%

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Background from 3J Consulting dated 12/07/2020.

Projection: WA State Plane, North Zone, NAD83, US Foot





Existing Conditions Site and Exploration Plan	
Lynnwood Auto Dealership Lynnwood, Washington	
	Figure 2A

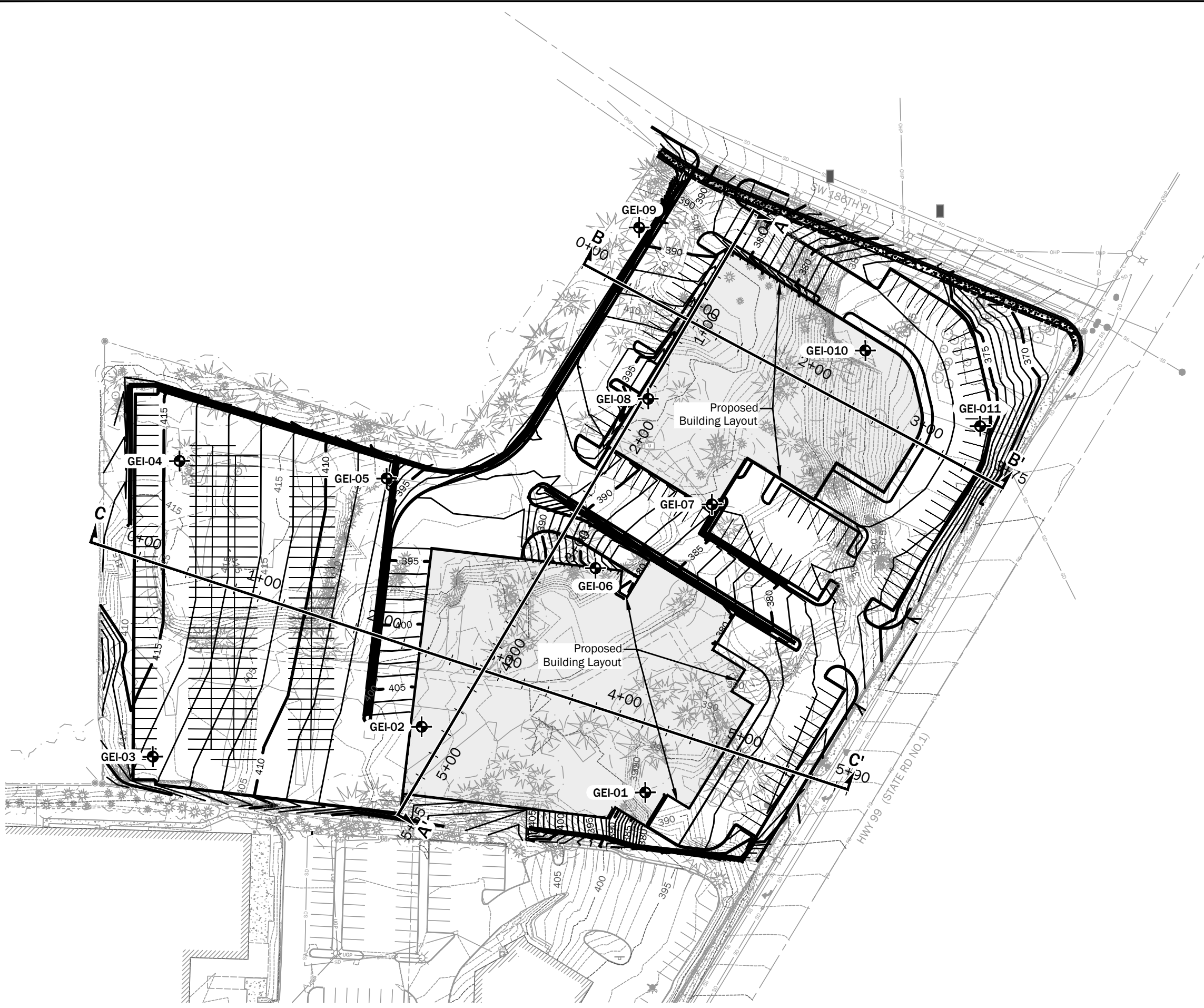
WWW.GEOENGINEERS.COM

P:\24\24789001\CAD\00\GeoTech\Report\24789001_F02-F05_Site Plan & Sections.dwg TAB:2478900100_F02B Proposed Conditions Site and Exploration Plan Date Exported: 12/18/20 - 11:18 by mklm:tmp

Legend

GEI-01  Boring by GeoEngineers, Inc., 2020

A  A' Cross Section Location

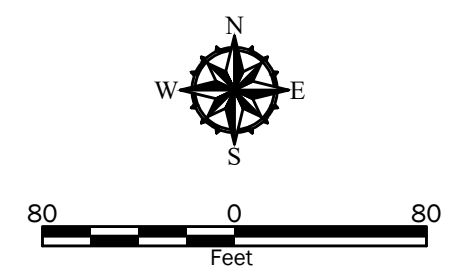



Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

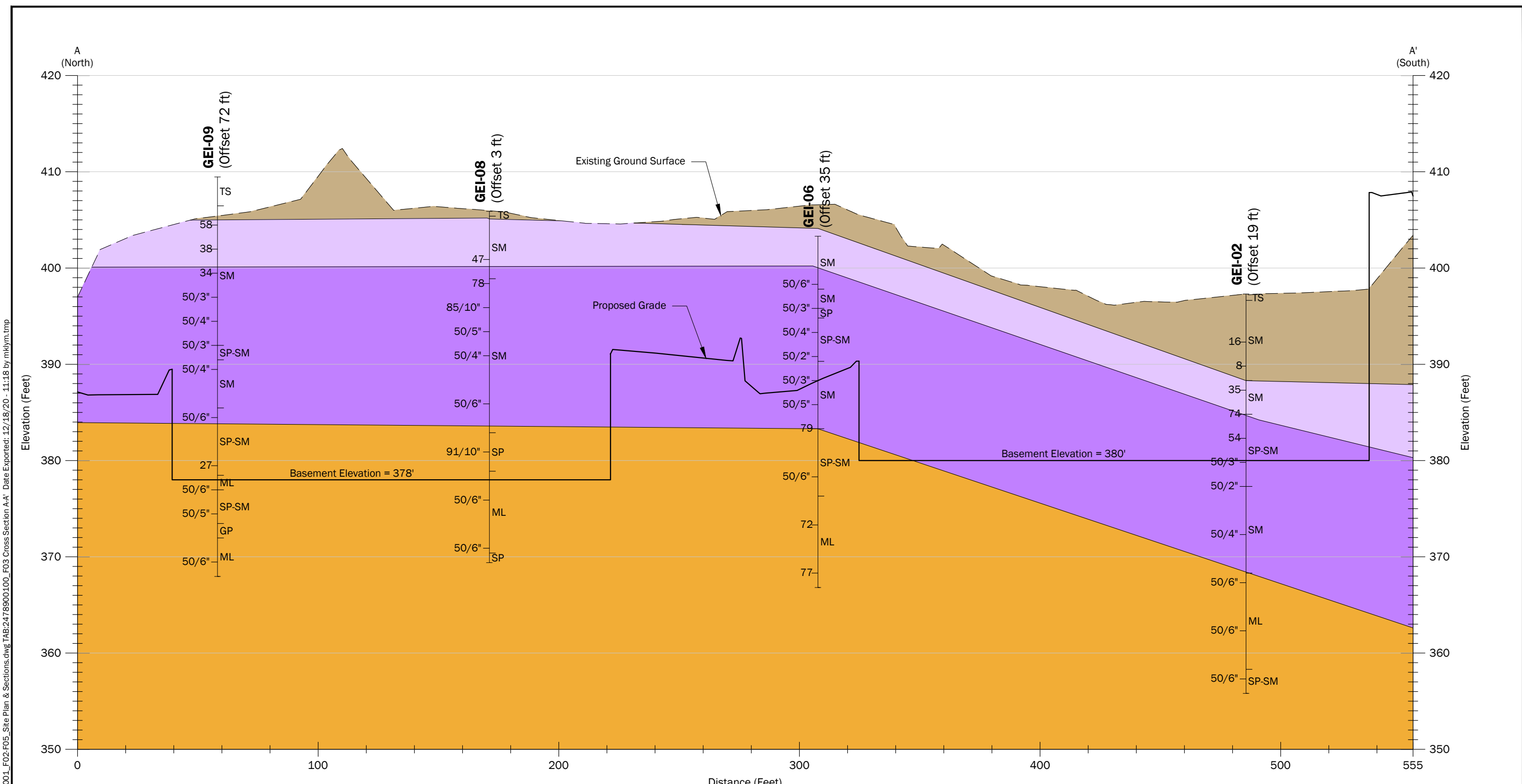
Data Source: Background from 3J Consulting dated 12/07/2020.

Projection: WA State Plane, North Zone, NAD83, US Foot



Proposed Conditions Site and Exploration Plan	
Lynnwood Auto Dealership Lynnwood, Washington	
	Figure 2B

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Boring ID (Offset)

SM Soil Classification

▼ Groundwater Measured in Piezometer

20 Blow Count

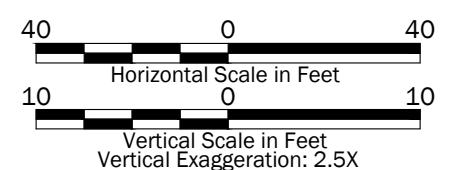
Legend

Fill Material/Topsoil

Weathered Till

Glacial Till

Advanced Outwash



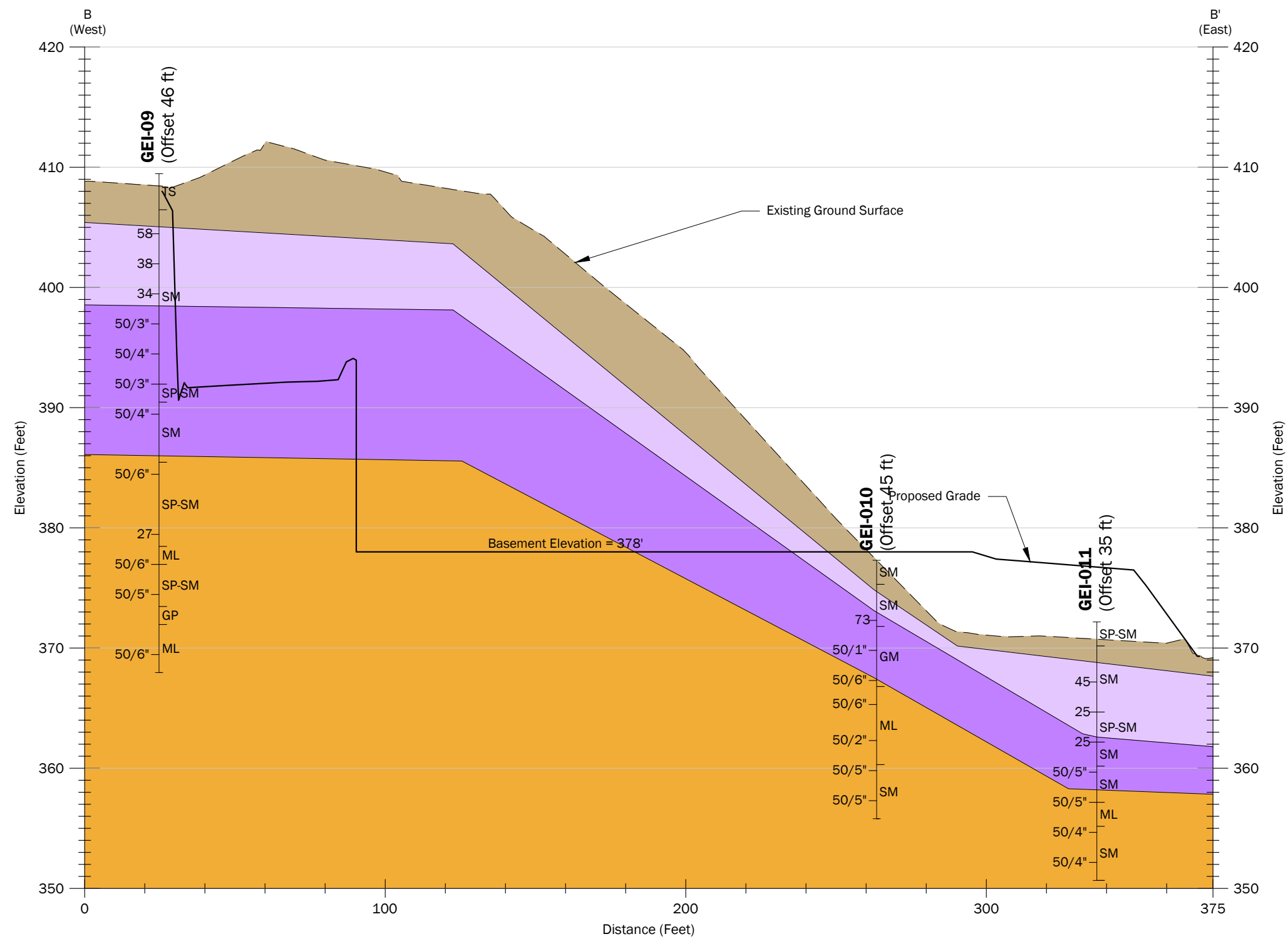
Cross Section A-A'

Lynnwood Auto Dealership
Lynnwood, Washington

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Figure 3

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- Notes:**
- The locations of all features shown are approximate.
 - This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Background based on survey created by 3J Consultants dated 12/07/2020
 Projection: WA State Plane, North Zone, NAD83, US Foot

Legend

- Boring
- Soil Classification
- Groundwater Measured in Piezometer
- Blow Count

- Fill Material/Topsoil
- Weathered Till
- Glacial Till
- Advanced Outwash

40 0 40
 Horizontal Scale in Feet

10 0 10
 Vertical Scale in Feet
 Vertical Exaggeration: 2.5X

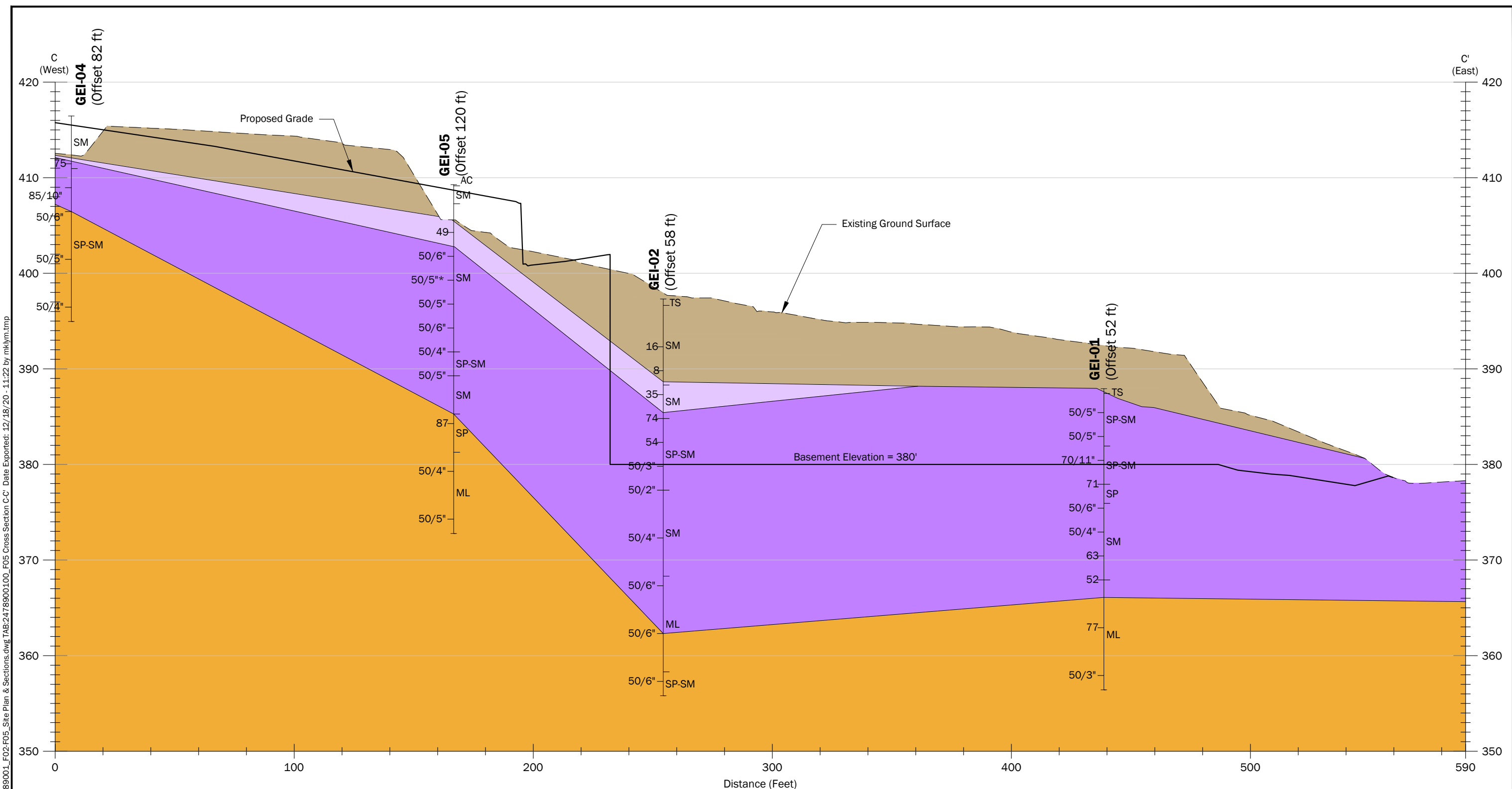
Cross Section B-B'

Lynnwood Auto Dealership
 Lynnwood, Washington

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Figure 4

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Boring ID (Offset)

SM Soil Classification

▼ Groundwater Measured in Piezometer

20 Blow Count

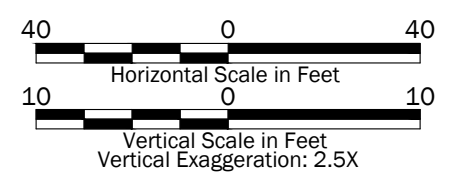
Legend

Fill Material/Topsoil

Weathered Till

Glacial Till

Advanced Outwash



Cross Section C-C'

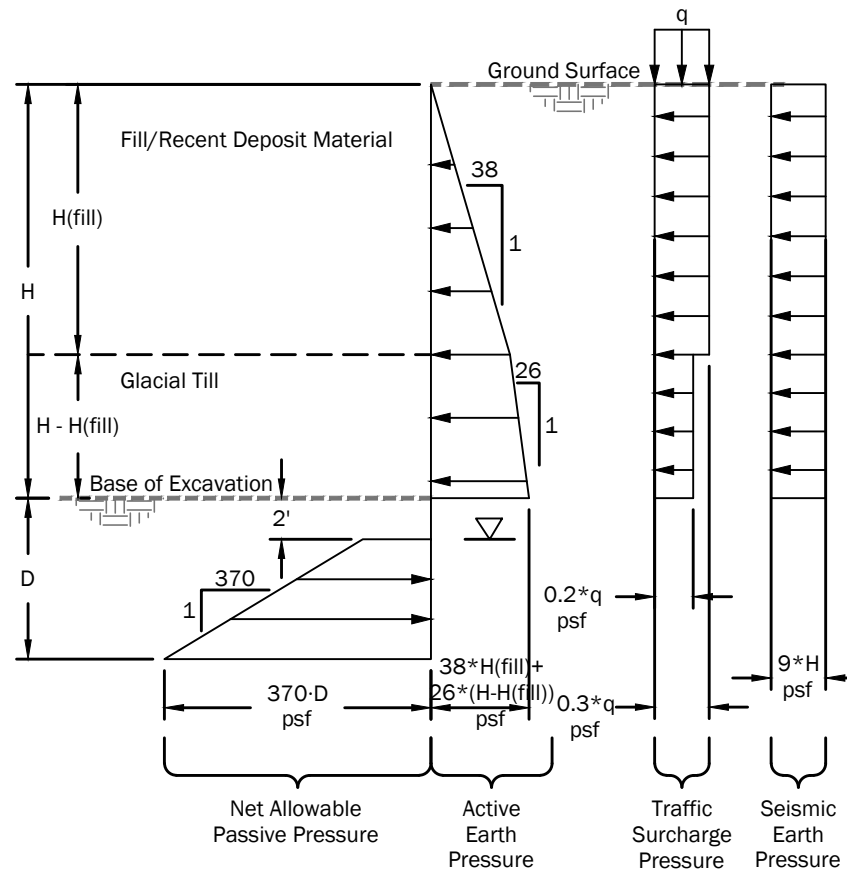
Lynnwood Auto Dealership
Lynnwood, Washington

GEOENGINEERS

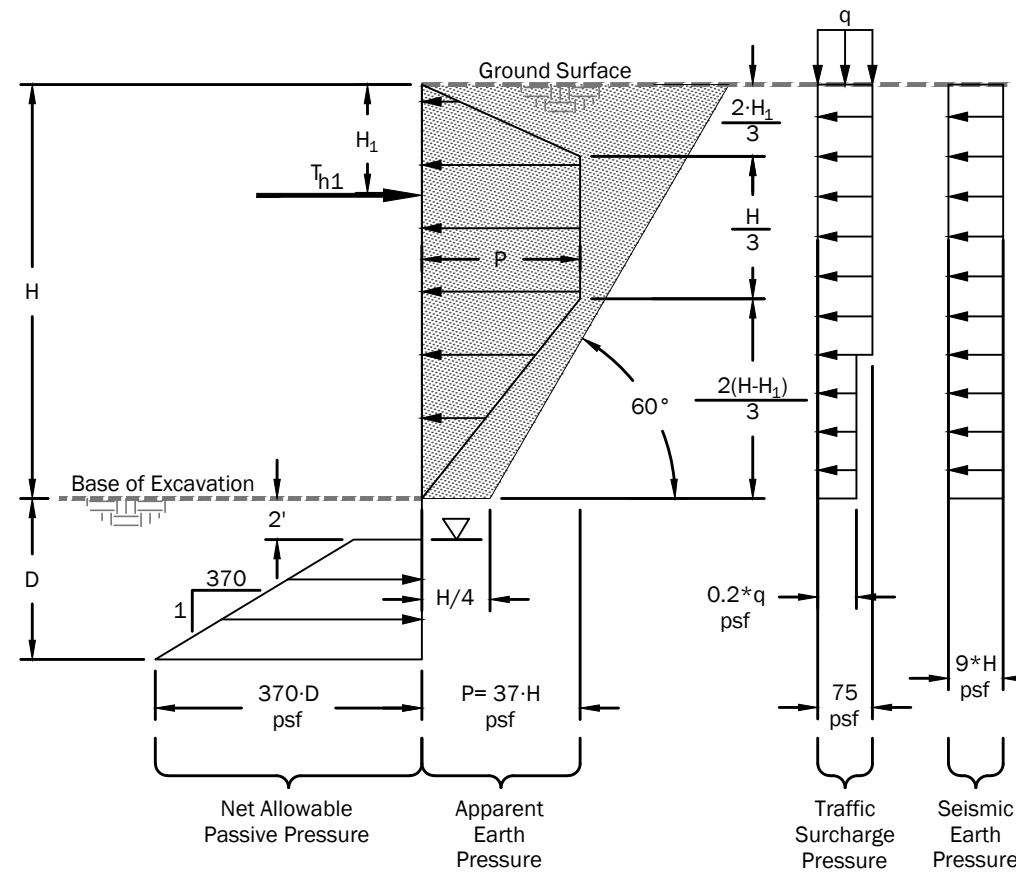
Figure 5

WWW.GEOENGINEERS.COM

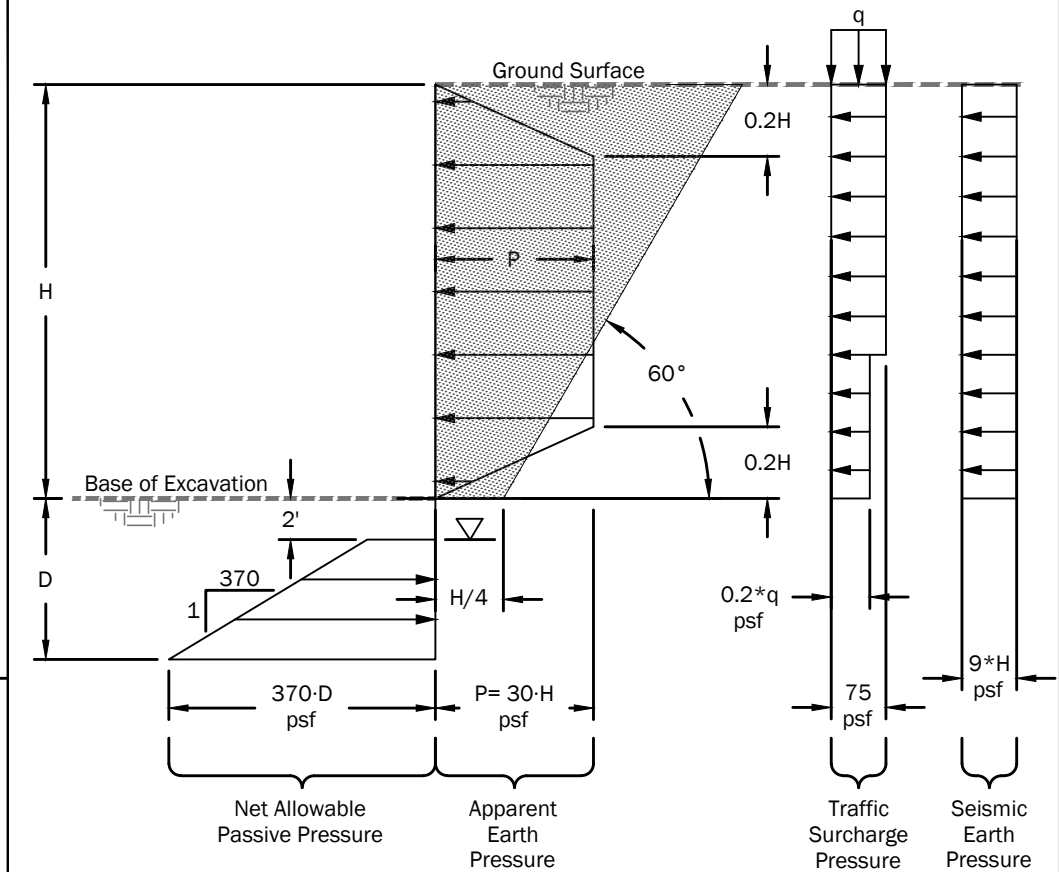
Cantilever Soldier Pile



Conventional Soldier Pile Wall with One Level of Tiebacks



Conventional Soldier Pile Wall with Multiple Levels of Tiebacks



Notes:

1. The static earth pressures do not include a factor of safety.
2. Active/apparent earth pressure and traffic surcharge pressure act over the pile spacing above the base of the excavation.
3. Passive earth pressure acts over 2.5 times the concreted diameter of the soldier pile, or the pile spacing, whichever is less.
4. Passive pressure includes a factor of safety of 1.5
5. Additional surcharge from footings of adjacent buildings should be included in accordance with recommendations provided on Figure 8.
6. 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.
7. Seismic Earth Pressures do not need to be considered for temporary walls.

Legend

- No Load Zone
- H = Height of Excavation, Feet
- D = Soldier Pile Embedment Depth, Feet
- H₁ = Distance From Ground Surface to Uppermost Tieback, Feet
- H(fill) = Fill/Recent Deposits thickness behind wall
- T_{h1} = Horizontal Load in Uppermost Ground Anchor
- p = Maximum Apparent Earth Pressure, Pounds per Square Foot
- q = Traffic Surcharge
- Design Groundwater Elevation for Drained Walls/ Passive Resistance Design

Not To Scale

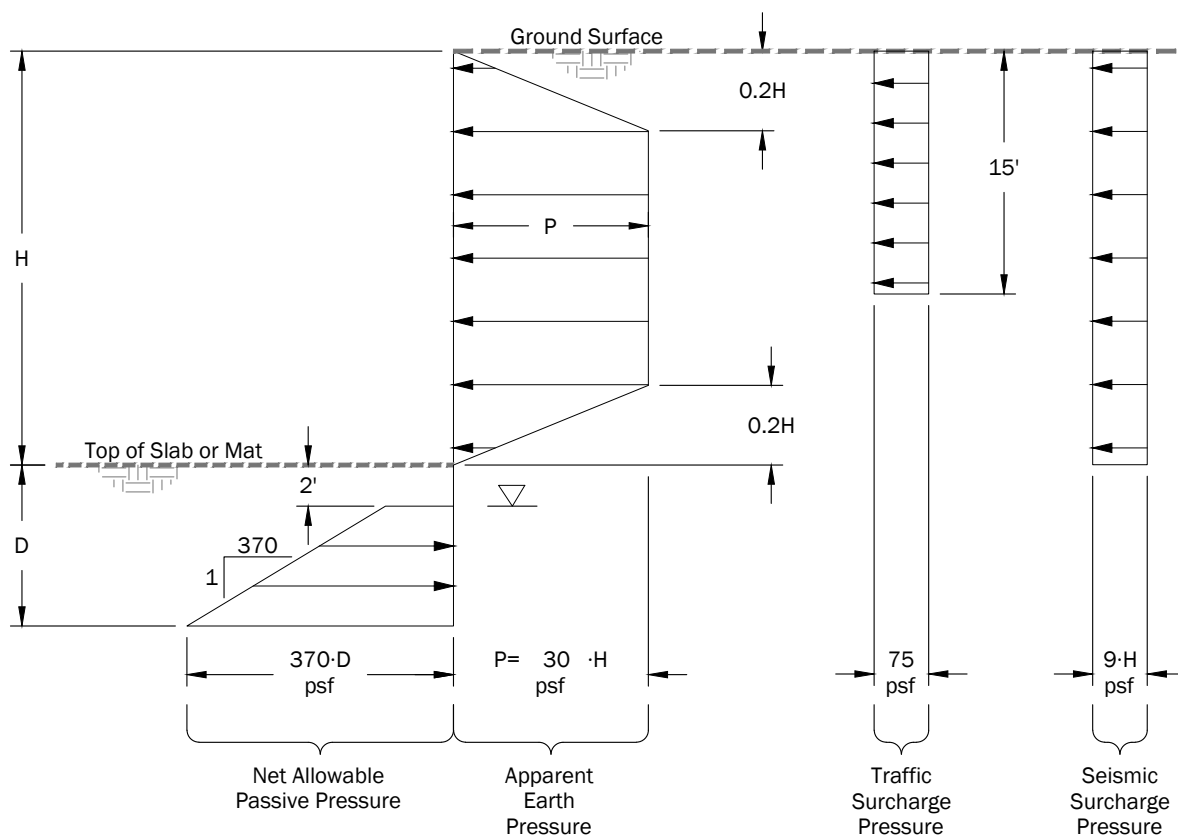
Earth Pressure Diagrams -
Soldier Pile & Tieback Wall

Lynnwood Auto Dealership
Lynnwood, Washington



Figure 6

Permanent Basement Wall Against Temporary Shoring



Legend

- H = Height of Basement Wall, Feet
- D = Foundation Embedment Depth, Feet
- P = Maximum Apparent 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 from footings of adjacent buildings should be included in accordance with recommendations provided on Figure 8.
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 static earth pressure does not include a factor of safety and represents the actual anticipated static earth pressure.

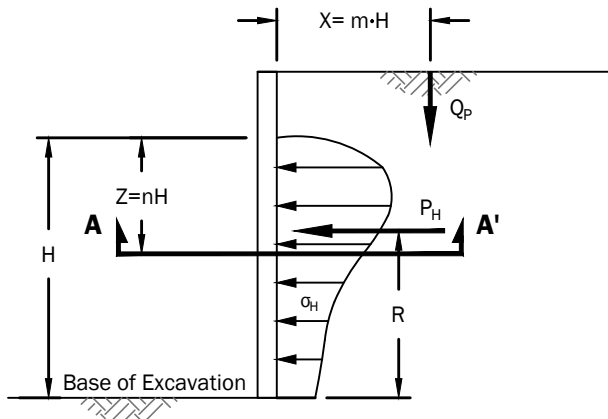
Earth Pressure Diagram Permanent Below Grade Walls

Lynnwood Auto Dealer
Lynnwood, Washington



Figure 7

Lateral Earth Pressure from Point Load, Q_p
(Spread Footing)

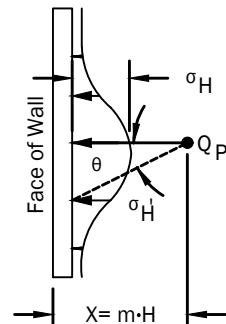


For $m \leq 0.4$ For $m > 0.4$ $\sigma_H = \sigma \cos^2 (1.1\theta)$

$$\sigma_H = \frac{0.28Q_p n^2}{H^2(0.16+n^2)^3}$$

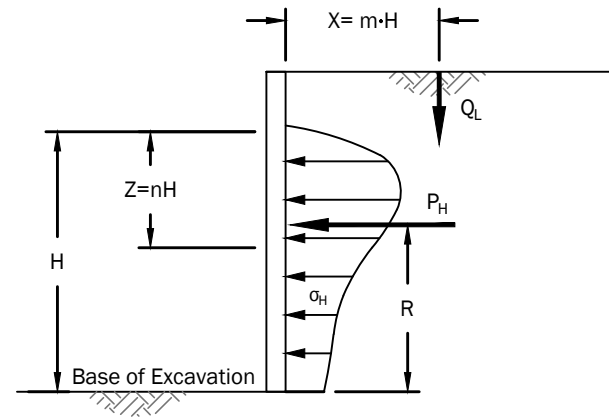
$$\sigma_H = \frac{1.77Q_p m^2 n^2}{H^2(m^2+n^2)^3}$$

m	$P_H \left(\frac{H}{Q_p} \right)$	R
0.2	0.78	0.59H
0.4	0.78	0.59H
0.6	0.45	0.48H



Section A-A'
Pressures from Point Load Q_p

Lateral Earth Pressure from Line Load, Q_L
(Continuous Wall Footing)



For $m \leq 0.4$

$$\sigma_H = \frac{0.2n \cdot Q_L}{H(0.16+n^2)^2}$$

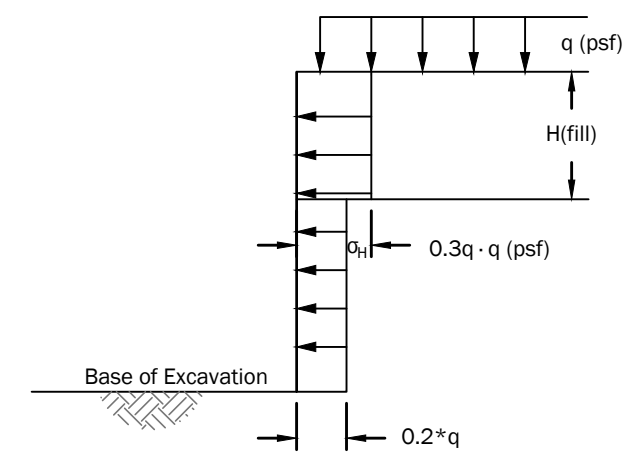
For $m > 0.4$

$$\sigma_H = \frac{1.28m^2 n Q_L}{H(m^2+n^2)^2}$$

Resultant $P_H = \frac{0.64Q_L}{(m^2+1)}$

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)



σ_H = Lateral Surcharge Pressure from Uniform Surcharge

Definitions:

- Q_p = Point load in pounds
- Q_L = Line load in pounds/foot
- H = Excavation height below footing, feet
- H(fill) = Fill/recent deposits thickness behind wall
- 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

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 6 and 7.
3. See report text for where surcharge pressures are appropriate.

Not To Scale

Recommended Surcharge Pressure

Lynnwood Auto Dealership
Lynnwood, Washington



Figure 8

APPENDIX A
Field Explorations and Laboratory Testing

APPENDIX A

FIELD EXPLORATIONS AND LABORATORY TESTING

Field Explorations

Subsurface conditions at the site were evaluated by drilling 11 boring (GEI-01 through GEI-11) to depths ranging from approximately 21½- to 41½-feet below existing grades. The borings were completed by Boretect1, Inc. on November 30 through December 2, 2020.

The locations of the explorations were recorded in the field using a handheld global positioning system (GPS) unit. The approximate exploration locations are shown on Figures 2A and 2B.

Borings

The borings were completed using track-mounted, continuous-flight, hollow-stem auger (HSA) drilling equipment. The borings were continuously monitored by a geotechnical engineer 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 (O.D.) split-barrel standard penetration test sampler. The disturbed samples were obtained by driving the sampler 18 inches into the soil with a 140-pound hammer free falling 30 inches. The number of blows for each 6-inch increment of penetration was recorded. The blow count (“N-value”) of the soil was calculated as the number of blows required for the second and third 6-inch intervals. 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 drive at least 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, Key to Exploration Logs. 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-12, which 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 judgement 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.

Dynamic cone penetrometer (DCP) soundings were performed by a staff geotechnical engineer from our office who recorded blow count versus cumulative penetration depth. This penetration resistance data was compared to the adjacent explorations where a detailed log of subsurface explorations was maintained, the soils encountered were visually classified and representative soil samples from the borings were obtained.

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, grain-size distribution (sieve analysis) and percent fines (material passing the U.S. No. 200 sieve). The tests were performed in general accordance with test methods of ASTM International (ASTM) or other applicable procedures.

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 in Appendix A at the depths at which the samples were obtained.

Sieve Analysis (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 soils greater than the US No. 200 mesh sieve. The results of the sieve analyses were plotted, were classified in general accordance with the Unified Classification System (USCS) and are presented in Figure A-13.

It should be noted that the sieve analyses were performed on soils obtained from samplers that have an opening size of 1½ inches, so larger sized particles cannot be obtained by the samplers. Therefore, the sieve results do not account for soil particles that are larger than 1½ inches. Soils with larger sized materials are described in this report qualitatively based on visual observations and experience on projects where excavations were made into similar formations.

Percent Passing US No. 200 Sieve (%F)

Selected samples were "washed" through the US No. 200 mesh sieve to estimate the relative percentages of course- and fine-grained particles in the soil. The percent passing value represents the percentage by weight of sample finer than the US 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 in Appendix A at the respective sample depths.

SOIL CLASSIFICATION CHART

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

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.

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS		TYPICAL DESCRIPTIONS
GRAPH	LETTER	
	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 load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

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

Key to Exploration Logs



Figure A-1

Start Drilled	11/30/2020	End	11/30/2020	Total Depth (ft)	31.5	Logged By	CAH	Checked By	CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	388 NAVD88			Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted drill rig EC95				
Easting (X) Northing (Y)	1277994 305935			System Datum	WA State Plane North NAD83 (feet)			See "Remarks" section for groundwater observed					
Notes:													

Elevation (feet)	Depth (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing						
0						TS	Vegetated surface (low grass, blackberry vines) with approximately 6 inches of topsoil				
388	7	50/5"	1			SP-SM	Brown fine to coarse sand with silt and gravel (very dense, moist) (weathered till)				
5	9	50/5"	2								
380	17	70/11"	3	%F		SM	Gray silty fine to coarse sand with gravel (very dense, moist) (glacial till)	9	35		
10	14.5	71	4			SP	Gray fine to medium sand (very dense, moist)				
375	5	50/6"	5	MC		SM	Gray silty fine to coarse sand with gravel (very dense, moist)	11			
15	4.5	50/4"	6								
370	17.5	63	7								
20	17	52	8			ML	Gray sandy silt (hard, wet) (advanced outwash)			Water bearing at 21 feet	
365	18	77	9							Water bearing at 23 to 23½ feet	
360	11	50/3"	10				Grades to silt with sand, becomes moist			Groundwater observed at approximately 25 feet below ground surface during drilling	

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.

Log of Boring GEI-01



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24-24789-001\GINT\2478900-100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017.GLB\GEB_GEOTECH_STANDARD_SF_NO_GW

Start Drilled	11/30/2020	End	11/30/2020	Total Depth (ft)	41.5	Logged By	CAH	Checked By	CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	397 NAVD88			Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted drill rig EC95				
Easting (X) Northing (Y)	1277817 305987			System Datum	WA State Plane North NAD83 (feet)			See "Remarks" section for groundwater observed					
Notes:													

Elevation (feet)	FIELD DATA					Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing						
395	0					TS	Vegetated surface (low grass and bramble) with approximately 8 inches of topsoil				
						SM	Brown fine to coarse sand with organic matter (medium dense, moist) (fill material)				
	5	7	16		1		Organic matter grades out				
390		11	8		2						
	10	13.5	35		3	SM	Brown silty fine to coarse sand with gravel (dense, moist) (weathered till)	11	28		
385		17	74		4	SPSM	Brown fine to medium sand with silt (very dense, moist) (glacial till)				
	15	17	54		5		Grades to fine sand, becomes gray and moist to wet	17			Increase in moisture at 16½ feet
380		11	50/3"		6		Grades to fine to coarse sand				
	20	2	50/2"		7	SM	Gray silty fine to coarse sand (very dense, moist to wet)				
375											
	25	2	50/4"		8						Groundwater observed at approximately 26½ feet below ground surface during drilling
370											
	30	11	50/6"		9	ML	Gray sandy silt (hard, wet) (advanced outwash)				Fractured rock at approximately 30 feet
365											
	35										

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.



Log of Boring GEI-02



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017\GLB\GER_GEO TECH_STANDARD_SF_NO_GW

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017.GLB\GEB8_GEO TECH_STANDARD_SF_NO_GW

Elevation (feet)	FIELD DATA					MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing				
35	35 1/2	11	50/6"		S10		22	68	Groundwater observed at approximately 35 1/2 feet below ground surface during drilling
40	40	0	50/6"		11		SP-SM		Gray silty fine to coarse sand (very dense, moist)

Log of Boring GEI-02 (continued)



Project: Lynnwood Auto Dealership
 Project Location: Lynnwood, Washington
 Project Number: 24789-001-00

Start Drilled	11/30/2020	End	11/30/2020	Total Depth (ft)	20.5	Logged By	CAH	Checked By	CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft)	409			Hammer Data	Rope & Cathead			140 (lbs) / 30 (in) Drop		Drilling Equipment	Track-mounted drill rig EC95		
Vertical Datum	NAVD88			System Datum	WA State Plane North			NAD83 (feet)		Groundwater not observed at time of exploration			
Easting (X)	1277604			Notes:									
Northing (Y)	305963												

Elevation (feet)	FIELD DATA					Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing						
0						TS	Vegetated with approximately 4 to 6 inches of topsoil				
						SP-SM	Brown fine to coarse sand with silt and gravel (fill material)				
405											
5	10.5	50/5"		1	%F	SP-SM	Gray fine to coarse sand with silt and gravel (very dense, moist) (glacial till)	4			
	8	50/6"		2							
400											
10	9	50/4"		3		SM	Gray silty fine to coarse sand with gravel (very dense, moist)				
	4	50/3"		4							
395											
15											
390											
20	4.5	50/3"		5							

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.

Log of Boring GEI-03



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017.GLB\GER8_GEOTECH_STANDARD_%I_NO_GW

Start Drilled	11/30/2020	End	11/30/2020	Total Depth (ft)	21.5	Logged By	CAH	Checked By	CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	416 NAVD88			Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted drill rig EC95				
Easting (X) Northing (Y)	1277626 306197			System Datum	WA State Plane North NAD83 (feet)			Groundwater not observed at time of exploration					
Notes:													

Elevation (feet)	Depth (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing						
415	0					SM	Brown silty fine to coarse sand with gravel (weathered till)				
410	5	12	75		1	SPSM	Gray fine to coarse sand with silt and gravel (very dense, moist) (advance outwash)				
		13.5	85/10"		2						
405	10	2	50/6"		3						
400	15	12	50/5"		4						
395	20	5.5	50/4"		5 MC						

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Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.

Log of Boring GEI-04



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Drilled	Start 12/1/2020	End 12/1/2020	Total Depth (ft)	36.5	Logged By Checked By	CAH CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	409 NAVD88			Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted drill rig EC95	
Easting (X) Northing (Y)	1277789 306183			System Datum	WA State Plane North NAD83 (feet)			See "Remarks" section for groundwater observed		
Notes:										

Elevation (feet)	FIELD DATA					Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing						
0						AC	Approximately 1½ inches of asphalt concrete pavement				
						SM	Brown silty fine to coarse sand with gravel (fill material)				
						SM	Gray silty fine to coarse sand with gravel (dense, moist) (glacial till)				
405											
5		11	49		1 MC			8			
							Becomes very dense				
400											
		4	50/6"		2						
10											
		4	50/5"*		3						*Blow counts potentially overstated Rock at 10 feet fractured in sampler
		13	50/5"		4 %F			8	36		
395											
		8	50/6"		5						
		7	50/4"		6 MC	SP-SM	Gray fine to coarse sand with silt (very dense, moist)	7			
390											
		7	50/5"		7	SM	Gray silty fine to coarse sand with gravel (very dense, moist)				
		18	87		8	SP	Gray fine to medium sand (very dense, moist) (advanced outwash)				
385											
380											
		11	50/4"		9	ML	Gray sandy silt (hard, moist to wet)				
375											
35											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.

Log of Boring GEI-05



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017.GLB\GEB_GEOTECH_STANDARD_SF_NO_GW

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017.GLB\GEB8_GEO TECH_STANDARD_SF_NO_8W

Elevation (feet)	FIELD DATA					MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing				
35	35	12	50/5"		10		20	83	Grades to silt with sand, becomes moist to wet Groundwater observed at approximately 35 feet below ground surface during drilling

Log of Boring GEI-05 (continued)



Project: Lynnwood Auto Dealership
 Project Location: Lynnwood, Washington
 Project Number: 24789-001-00

Drilled	Start 12/1/2020	End 12/1/2020	Total Depth (ft)	36.5	Logged By Checked By	CAH CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	403 NAVD88			Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted drill rig EC95	
Easting (X) Northing (Y)	1277955 306113			System Datum	WA State Plane North NAD83 (feet)			See "Remarks" section for groundwater observed		
Notes:										

Elevation (feet)	FIELD DATA					Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing						
0							SM	Brown silty fine to coarse sand with gravel (weathered till)			
400											
5		10.5	50/6"		1		SM	Gray silty fine to coarse sand with gravel (very dense, moist) (glacial till)			
395		18	50/3"		2		SP	Gray fine to medium sand with gravel (very dense, moist)			
10		0	50/4"		3		SP-SM	Gray fine to coarse sand with silt and gravel (very dense, moist)			
390		0	50/2"		4						
15		10	50/3"		5		SM	Gray silty fine to coarse sand (very dense, moist)			
385		9.5	50/5"		6						
20		13	79		7		SP-SM	Gray fine to coarse sand with silt (very dense, moist) (advanced outwash)			
380		7	50/6"		8			Grades to with gravel			Increase in moisture, generally coarse
375							ML	Gray sandy silt (hard, moist to wet)			
30		18	72		9				22		Groundwater observed at approximately 30 feet below ground surface during drilling
370											
35											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.

Log of Boring GEI-06



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017.GLB\GEB_GEOTECH_STANDARD_SF_NO_GW

Drilled	Start 12/1/2020	End 12/1/2020	Total Depth (ft)	36.5	Logged By Checked By	CAH CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	400 NAVD88			Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted drill rig EC95	
Easting (X) Northing (Y)	1278047 306163			System Datum	WA State Plane North NAD83 (feet)			See "Remarks" section for groundwater observed		
Notes:										

Elevation (feet)	FIELD DATA					Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/ foot	Collected Sample	Sample Name Testing						
0							SM	Gray silty fine to coarse sand with gravel (dense, moist) (weathered till)			
5		4	48*		1						Gravel piece in sampler tip; *blow counts potentially overstated
10		13.5	80/11"		2	MC	SM	Gray silty fine to coarse sand with gravel (very dense, moist) (glacial till)	9		Driller noted gravel
15		5	50/6"		3		GP-GM	Gravel with silt and sand (very dense, moist)			
20		8	50/4"		4		SM	Gray silty fine to coarse sand with gravel (very dense, moist)			
25		7	50/6"		5	%F			6	23	
30		8	50/2"		6			Grades to fine to medium sand with occasional gravel			Gradation change
35		6	50/5"		7			Grades to fine to coarse sand with gravel			
37.5		17	80		8	MC	ML	Gray sandy silt (hard, moist to wet) (advanced outwash)	19		Smooth drilling action
39		16	83		9	SA			20	60	Groundwater observed at approximately 30 feet below ground surface during drilling
39.5								Becomes dark gray			

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.


Log of Boring GEI-07



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017\GLB\GER_GEO TECH_STANDARD_SF_NO_GW

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017.GLB\GEB8_GEOTECH_STANDARD_SF_NO_SW

Elevation (feet)	FIELD DATA					MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing				
	85	18	85		10		SP		Dark gray fine to medium sand (very dense, moist to wet)

Log of Boring GEI-07 (continued)



Project: Lynnwood Auto Dealership
 Project Location: Lynnwood, Washington
 Project Number: 24789-001-00

Drilled	Start 12/1/2020	End 12/1/2020	Total Depth (ft)	36.5	Logged By Checked By	CAH CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	406 NAVD88			Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted drill rig EC95	
Easting (X) Northing (Y)	1277996 306246			System Datum	WA State Plane North NAD83 (feet)			Groundwater not observed at time of exploration		
Notes:										

Elevation (feet)	FIELD DATA					Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing						
405	0					TS	Vegetation, topsoil and gravel				
						SM	Brown silty fine to coarse sand with gravel (dense, moist) (weathered till)				
400	5	14.5	47		1		Grades to with occasional gravel				
		16	78		2	SM	Gray silty fine to coarse sand with gravel (very dense, moist) (glacial till)				
395	10	16	85/10"		3		Grades to fine to medium sand with occasional gravel				
		6	50/5"		4	%F	Grades to fine to coarse sand	29	22		
390	15	5.5	50/4"		5		Grades to with gravel				
		0			6						
385	20	6	50/6"		7						
											Smoother drilling; chatter subsides
380	25	16	91/10"		8	MC	Gray fine to coarse sand (very dense, moist to wet) (advanced outwash)	15			
375	30	18	50/6"		9		Gray sandy silt (hard, moist to wet)				Wet sampler
35											

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.

Log of Boring GEI-08



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017\GLB\GER_GEOTECH_STANDARD_SF_NO_GW

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF STD_US_JUNE_2017.GLB\GE8_GEOTECH_STANDARD_SF_NO_8W

Elevation (feet)	Depth (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing						
37.0	38	14	50/6"	10		SP	Gray fine sand (very dense, wet)			Lower 9 inches water bearing	

Log of Boring GEI-08 (continued)



Project: Lynnwood Auto Dealership
 Project Location: Lynnwood, Washington
 Project Number: 24789-001-00

Drilled	Start 12/2/2020	End 12/2/2020	Total Depth (ft)	41.5	Logged By Checked By	CAH CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	409 NAVD88			Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted drill rig EC95	
Easting (X) Northing (Y)	1277989 306382			System Datum	WA State Plane North NAD83 (feet)			Groundwater not observed at time of exploration		
Notes:										

Elevation (feet)	Depth (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Interval Recovered (in)	Blows/ foot	Collected Sample	Sample Name Testing						
0						TS	Brown silty fine to coarse sand with organic matter (roots) (topsoil)				
405						SM	Light gray silty fine to coarse sand with gravel (very dense, moist) (weathered till)				
5	10.3	58		1							
	8.5	38		2				7	33		
400											
10	8	34		3							
	9.5	50/3"		4		SM	Gray silty fine to coarse sand with gravel (very dense, moist) (glacial till)				
395											
15	6	50/4"		5		MC		7			
	4.5	50/3"		6		SP-SM	Gray fine to coarse sand with silt (very dense, moist)				
390											
20	13.5	50/4"		7		SM	Gray silty fine to medium sand (very dense, moist)				
385											
25	4.5	50/6"		8		MC	Gray fine to coarse sand with silt and gravel (very dense, moist) (advance outwash)	3			
380											
30	15.5	27		9		ML	Gray sandy silt (hard, wet)				
375											
35	16	50/6"		10		SP-SM	Gray fine to coarse sand with silt and gravel (very dense, moist to wet)				

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.

Water bearing at 31½ feet
Driller noted denser at 32 feet

Log of Boring GEI-09



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017\GLB\GER_GEOTECH_STANDARD_SF_NO_GW

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017.GLB\GEB8_GEO TECH_STANDARD_SF_NO_GW

Elevation (feet)	FIELD DATA					Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing						
35	15.5	50/5"		11		GP	Gravel with silt and sand (very dense, moist to wet)				
37.0						ML	Gray sandy silt (hard, moist to wet)				
40	16	50/6"		12							

Log of Boring GEI-09 (continued)



Project: Lynnwood Auto Dealership
 Project Location: Lynnwood, Washington
 Project Number: 24789-001-00

Drilled	Start 12/2/2020	End 12/2/2020	Total Depth (ft)	21.5	Logged By Checked By	CAH CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	377 NAVD88			Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted drill rig EC95	
Easting (X) Northing (Y)	1278168 306285			System Datum	WA State Plane North NAD83 (feet)			Groundwater not observed at time of exploration		
Notes:										

Elevation (feet)	FIELD DATA					Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	Depth (feet)	Interval Recovered (in)	Blows/ foot	Collected Sample	Sample Name Testing						
375	0					SM	Brown silty sand with organic matter (roots and wood) and gravel (fill material)				
						SM	Brown silty sand with gravel (very dense, moist) (weathered till)				
	5	6	73		1	GM	Silty gravel with sand (very dense, moist) (glacial till)				
		7.5	50/1"		2						Driller notes feels like concrete but able to advance auger
	10	14	50/6"		3A 3B 3C	ML	Gray sandy silt (hard, moist) (advanced outwash)	11	63		Drilling action smooths out at 10 feet Gravel grades out 10½ to 11½ feet
		11.5	50/6"		4						
	15	16	50/2"		5						
		6	50/5"		6 MC	SM	Gray silty fine to medium sand with gravel (very dense, moist)	8			
	20	10	50/5"		7						

Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.

Log of Boring GEI-10



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017.GLB\GEB_GEO TECH_STANDARD_SF_NO_BW

Start Drilled	12/12/2020	End	12/12/2020	Total Depth (ft)	21.5	Logged By	CAH	Checked By	CL	Driller	Borettec 1, Inc.	Drilling Method	Hollow-stem Auger
Surface Elevation (ft) Vertical Datum	372 NAVD88			Hammer Data	Rope & Cathead 140 (lbs) / 30 (in) Drop			Drilling Equipment	Track-mounted drill rig EC95				
Easting (X) Northing (Y)	1278259 306225			System Datum	WA State Plane North NAD83 (feet)			See "Remarks" section for groundwater observed					
Notes:													

Elevation (feet)	Depth (feet)	FIELD DATA				Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
		Interval Recovered (in)	Blows/foot	Collected Sample	Sample Name Testing						
370	0					SP-SM	Brown fine to coarse sand with silt and gravel (fill material)			Groundwater observed at approximately 8 feet below ground surface during drilling	
						SM	Brown silty fine to coarse sand with gravel (dense, moist to wet) (weathered till)				
365	5	12	45		1						
		18	25		2	SP-SM	Brown fine to coarse sand with silt (medium dense, moist to wet) (glacial till)				
360	10	18	25		3	SM	Brown silty fine to coarse sand with gravel (medium dense, moist to wet)	11			
		5	50/5"		4	SM	Gray silty fine to coarse sand with gravel (very dense, moist)				
355	15	10	50/5"		5	ML	Gray sandy silt (hard, moist to wet) (advanced outwash)	13	55		
		4	50/4"		6	SM	Gray silty fine to coarse sand with occasional gravel (very dense, moist to wet)				
	20	4	50/4"		7						

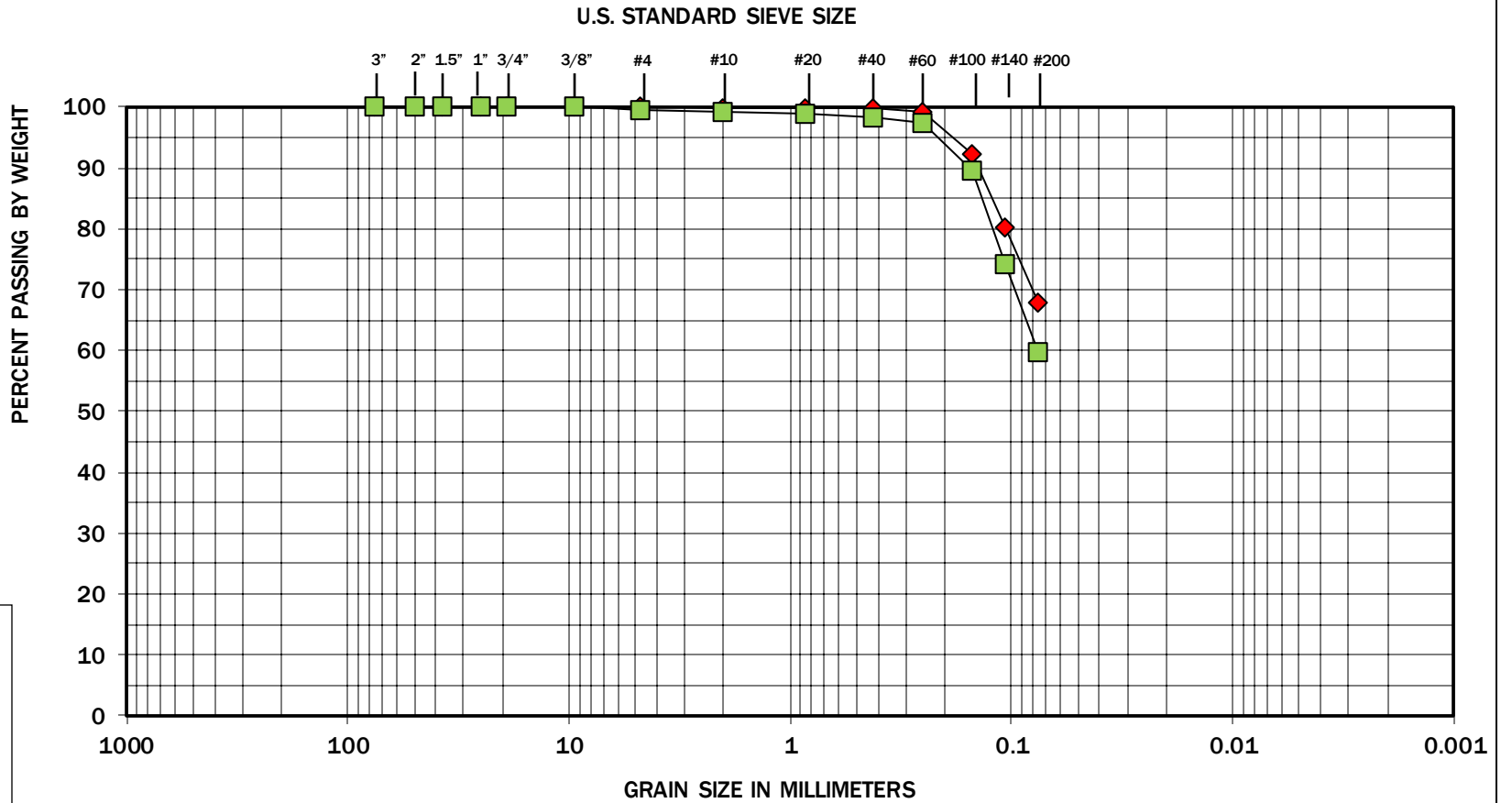
Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Smartphone/Tablet (NA). Vertical approximated based on Topographic Survey.

Log of Boring GEI-11



Project: Lynnwood Auto Dealership
Project Location: Lynnwood, Washington
Project Number: 24789-001-00

Date: 12/17/20 Path: \\GEOENGINEERS.COM\WAN\PROJECTS\24\24789001\GINT\2478900100.GPJ DBLibrary\Library\GEOENGINEERS_DF_STD_US_JUNE_2017\GLB\GER_GEOTECH_STANDARD_SF_NO_GW



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	GEI-02	35	22	Sandy silt (ML)
■	GEI-07	30	20	Sandy silt (ML)

GEOENGINEERS



Figure A-13

Lynwood Auto Dealership
Lynwood, WA

Sieve Analysis Results



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

APPENDIX B
Ground Anchor Load Testing Program

APPENDIX B

GROUND ANCHOR LOAD TESTING 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 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 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 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 tieback installation, at least two tiebacks for each soil type shall be tested to validate the design pullout value. All test 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 tiebacks used for the verification tests may be used as production tiebacks if approved by the Engineer.

Tieback design test loads should be the design load specified on the shoring drawings. Verification test 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
1.0DL	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 should be completed on each production tieback.

The allowable tieback load should not exceed 80 percent of the steel ultimate strength.

Tieback design test loads should be the design load specified on the shoring drawings. Proof test tiebacks should 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
1.33DL	10 minutes

The alignment load should be the minimum load required to align the testing apparatus and should exceed 5 percent of the design load. The dial gauge should be zeroed after the alignment load is applied.

APPENDIX C
Report Limitations and Guidelines for Use

APPENDIX C

REPORT LIMITATIONS AND GUIDELINES FOR USE¹

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 Holman Automotive Group, Inc. c/o 3J Consulting and other project team members for the Project specifically identified in the report. 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 Lynnwood Auto Dealership 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, it is important not to 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.

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

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Environmental Concerns Are Not Covered

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

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 man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

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 the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

Geotechnical Engineering Report Recommendations Are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions.

If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and 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. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and
- encourages contractors to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

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 adjacent properties.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more 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.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized.

Infiltration Test Results

From: Carl Longton <clongton@geoengineers.com>
Sent: Tuesday, November 1, 2022 2:36 PM
To: Kathleen Freeman; Jim Schmitt
Cc: Julio C. Vela; Brian Feeney; Bridget August; Cody R. Gibson
Subject: RE: Infiltration testing Results
Attachments: Infiltration test location.pdf

Hi Jim and Kathleen,

GeoEngineers performed a pilot infiltration test (PIT) test at the Holman Auto site in Lynwood on 10/19. Test location shown on attached site plan was performed at approximately elevation 366 feet (2-feet below ADS subgrade). The contractor fully excavated the test location to subgrade elevation (El 368) prior to our arrival on site, therefore we had to perform the test below the subgrade elevation. We observed the bottom of the test pit to be wet. Please note, Table 1 from GeoEngineers Geotechnical report dated March 3, 2021 reports the observed groundwater to range between 364 to 378 at the time of exploration.

Results: We did not observe any measurable infiltration. ~0 in/hr. We believe this is a combination of both the dense till like soil and the possibility of shallow groundwater below the designed Stormtech subgrade.

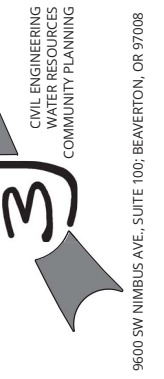
Thanks,
Carl Longton



Jan 26 2022 11:14 PM DocuSign

PUBLISH DATE
01/26/2022
ISSUED FOR
PERMIT SET
REVISIONS

SANITARY & WATER PLAN
PORSCH SEATTLE NORTH
18624 HWY 99
HOLMAN LYNNWOOD RED, LLC
LYNNWOOD, WA



PROJECT INFORMATION
3J PROJECT # | 20650
TAX LOT(S) | 00374300500201
LAND USE # | TBD
DESIGNED BY | JJS
CHECKED BY | BEF

SHEET NUMBER
C305

- LEGEND**
- SD PROPOSED STORM PIPE
 - SS PROPOSED SANITARY PIPE
 - FW PROPOSED FIRE WATER SERVICE
 - DW PROPOSED DOMESTIC WATER SERVICE
 - PROPOSED TREATMENT CATCH BASIN
 - PROPOSED TRAPPED CATCH BASIN
 - PIPE CONTINUATION
 - PROPOSED DCDA
 - PROPOSED RPBA
 - PROPOSED WATER METER
 - PROPOSED HYDRANT
 - FIRE DPT. CONNECTION
 - POST INDICATOR VALVE
 - PROPOSED SEWER MANHOLE
 - PROPOSED SEWER CLEANOUT
 - PROPOSED STORM MANHOLE
 - PROPOSED STORM CLEANOUT
 - PROPOSED UNDERGROUND DETENTION SYSTEM

SANITARY SEWER KEY NOTES

- 1 CONSTRUCT ASTM D3034 PVC (SDR 35) SANITARY SEWER PIPE TO ALIGNMENT AS SHOWN; SIZE, SLOPE, AND LENGTH AS NOTED.
- 2 CONSTRUCT SANITARY CLEANOUT PER CITY OF LYNNWOOD DETAIL STD6-3 ON SHEET C420. SEE STRUCTURE DATA TABLE FOR ELEVATION DATA, THIS SHEET.
- 3 INSTALL SIDE SEWER LATERAL PER CITY OF LYNNWOOD DWG. STD6-2, SHEET C420. CONNECT TO EXISTING SANITARY MAIN WITH SADDLE TEE WITH GASKET AND CLAMPS.
- 4 CONSTRUCT SANITARY CLEANOUT PER CITY OF LYNNWOOD DETAIL STD6-3 ON SHEET C420. SEE STRUCTURE DATA TABLE FOR ELEVATION DATA, THIS SHEET. INSTALL UPSTREAM SEWER BACKWATER VALVE PER CITY OF LYNNWOOD DETAIL STD6-5 ON SHEET C420. SEE PLUMBING PLANS FOR CONTINUATION.
- 5 LATERAL FOR FUTURE PHASE CONNECTION. CAP LATERAL WITH WATER TIGHT CAP UNTIL FUTURE PHASE CONSTRUCTION IS COMPLETE.

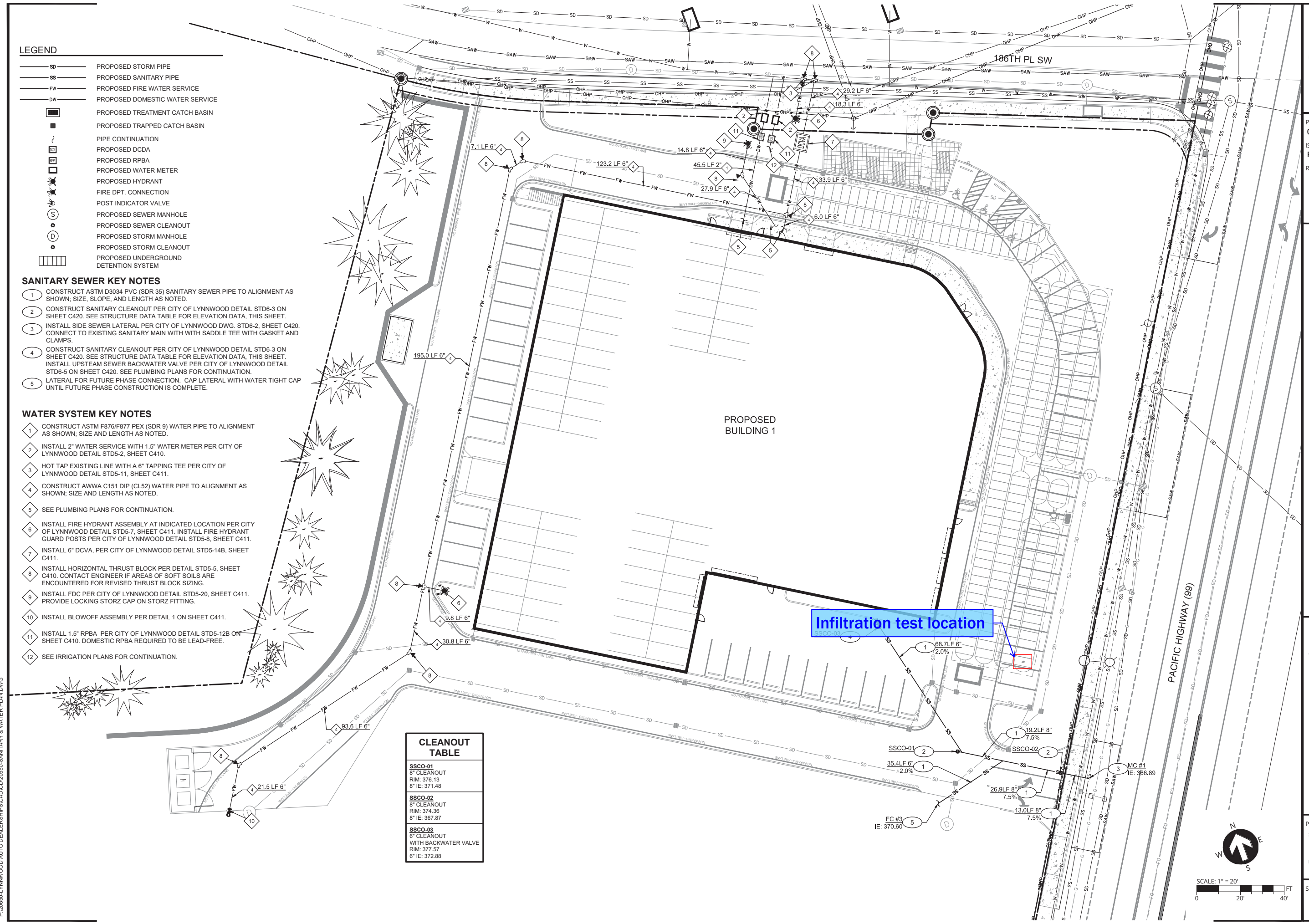
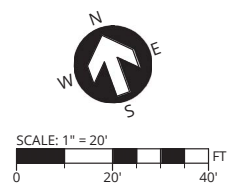
WATER SYSTEM KEY NOTES

- 1 CONSTRUCT ASTM F876/F877 PEX (SDR 9) WATER PIPE TO ALIGNMENT AS SHOWN; SIZE AND LENGTH AS NOTED.
- 2 INSTALL 2" WATER SERVICE WITH 1.5" WATER METER PER CITY OF LYNNWOOD DETAIL STD5-2, SHEET C410.
- 3 HOT TAP EXISTING LINE WITH A 6" TAPPING TEE PER CITY OF LYNNWOOD DETAIL STD5-11, SHEET C411.
- 4 CONSTRUCT AWWA C151 DIP (CL52) WATER PIPE TO ALIGNMENT AS SHOWN; SIZE AND LENGTH AS NOTED.
- 5 SEE PLUMBING PLANS FOR CONTINUATION.
- 6 INSTALL FIRE HYDRANT ASSEMBLY AT INDICATED LOCATION PER CITY OF LYNNWOOD DETAIL STD5-7, SHEET C411. INSTALL FIRE HYDRANT GUARD POSTS PER CITY OF LYNNWOOD DETAIL STD5-8, SHEET C411.
- 7 INSTALL 6" DCVA, PER CITY OF LYNNWOOD DETAIL STD5-14B, SHEET C411.
- 8 INSTALL HORIZONTAL THRUST BLOCK PER DETAIL STD5-5, SHEET C410. CONTACT ENGINEER IF AREAS OF SOFT SOILS ARE ENCOUNTERED FOR REVISED THRUST BLOCK SIZING.
- 9 INSTALL FDC PER CITY OF LYNNWOOD DETAIL STD5-20, SHEET C411. PROVIDE LOCKING STORZ CAP ON STORZ FITTING.
- 10 INSTALL BLOWOFF ASSEMBLY PER DETAIL 1 ON SHEET C411.
- 11 INSTALL 1.5" RPBA PER CITY OF LYNNWOOD DETAIL STD5-12B ON SHEET C410. DOMESTIC RPBA REQUIRED TO BE LEAD-FREE.
- 12 SEE IRRIGATION PLANS FOR CONTINUATION.

CLEANOUT TABLE	
SSCO-01	8" CLEANOUT RIM: 376.13 8" IE: 371.48
SSCO-02	8" CLEANOUT RIM: 374.36 8" IE: 367.87
SSCO-03	6" CLEANOUT WITH BACKWATER VALVE RIM: 377.57 6" IE: 372.88

Infiltration test location

P:\20650-LYNNWOOD AUTO DEALERSHIPS\CAD\20650-SANITARY & WATER PLAN.DWG





Soil Map may not be valid at this scale.

Map Scale: 1:1,810 if printed on A landscape (11" x 8.5") sheet.




Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84






MAP LEGEND

Area of Interest (AOI)




 Area of Interest (AOI)

Soils



Soil Rating Polygons


-  Alderwood-Urban land complex, 2 to 8 percent slopes
-  Alderwood-Urban land complex, 8 to 15 percent slopes
-  Not rated or not available

Soil Rating Lines

-  Alderwood-Urban land complex, 2 to 8 percent slopes
-  Alderwood-Urban land complex, 8 to 15 percent slopes
-  Not rated or not available

Soil Rating Points






-  Alderwood-Urban land complex, 2 to 8 percent slopes
-  Alderwood-Urban land complex, 8 to 15 percent slopes

 Not rated or not available

Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Snohomish County Area, Washington
 Survey Area Data: Version 24, Sep 8, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 31, 2022—Aug 8, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Name

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
5	Alderwood-Urban land complex, 2 to 8 percent slopes	Alderwood-Urban land complex, 2 to 8 percent slopes	9.1	64.8%
6	Alderwood-Urban land complex, 8 to 15 percent slopes	Alderwood-Urban land complex, 8 to 15 percent slopes	5.0	35.2%
Totals for Area of Interest			14.1	100.0%

Description

A soil map unit is a collection of soil areas or nonsoil areas (miscellaneous areas) delineated in a soil survey. Each map unit is given a name that uniquely identifies the unit in a particular soil survey area.

Rating Options

Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Table III-2.4: Hydrologic Soil Series for Selected Soils in Washington State

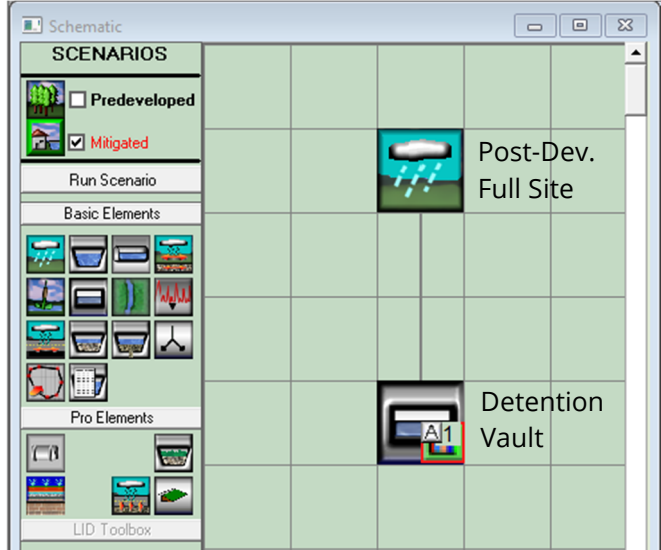
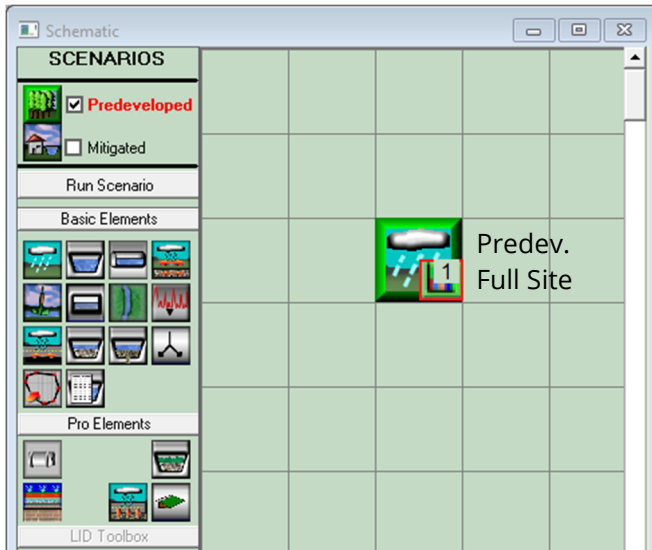
Soil Type	Hydrologic Soil Group	Soil Type	Hydrologic Soil Group	Soil Type	Hydrologic Soil Group
Agnew	C	Hoogdal	C	Raught	B
Ahl	B	Hoypus	A	Reed	D
Aits	C	Huel	A	Reed, Drained or Protected	C
Alderwood	C	Indianoloa	A	Renton	D
Arents, Alderwood	B	Jonas	B	Republic	B
Arents, Everett	B	Jumpe	B	Riverwash	variable
Ashoe	B	Kalaloch	C	Rober	C
Baldhill	B	Kapowsin	C/D	Salal	C
Barneston	C	Kilchis	C	Salkum	B
Baumgard	B	Kitsap	C	Sammamish	D
Beausite	B	Klaus	C	San Juan	A
Belfast	C	Klone	B	Scamman	D
Bellingham	D	Lates	C	Schneider	B
Bellingham variant	C	Lebam	B	Seattle	D
Boistfort	B	Lummi	D	Sekiu	D
Bow	D	Lynwood	A	Semiahmoo	D
Bristcot	D	Lystair	B	Shalcar	D
Buckley	C	Mal	C	Shano	B
Bunker	B	Manley	B	Shelton	C
Cagey	C	Mashel	B	Si	C
Carlsborg	A	Maytown	C	Sinclair	C
Casey	D	McKenna	D	Skipopa	D
Cassolary	C	McMurray	D	Skykomish	B
Cathcard	B	Melbourne	B	Snahopish	B
Centralia	B	Menzel	B	Snohomish	D
Chehalis	B	Mized Alluvial	variable	Solduc	B
Chesaw	A	Molson	B	Solleks	C

APPENDIX D

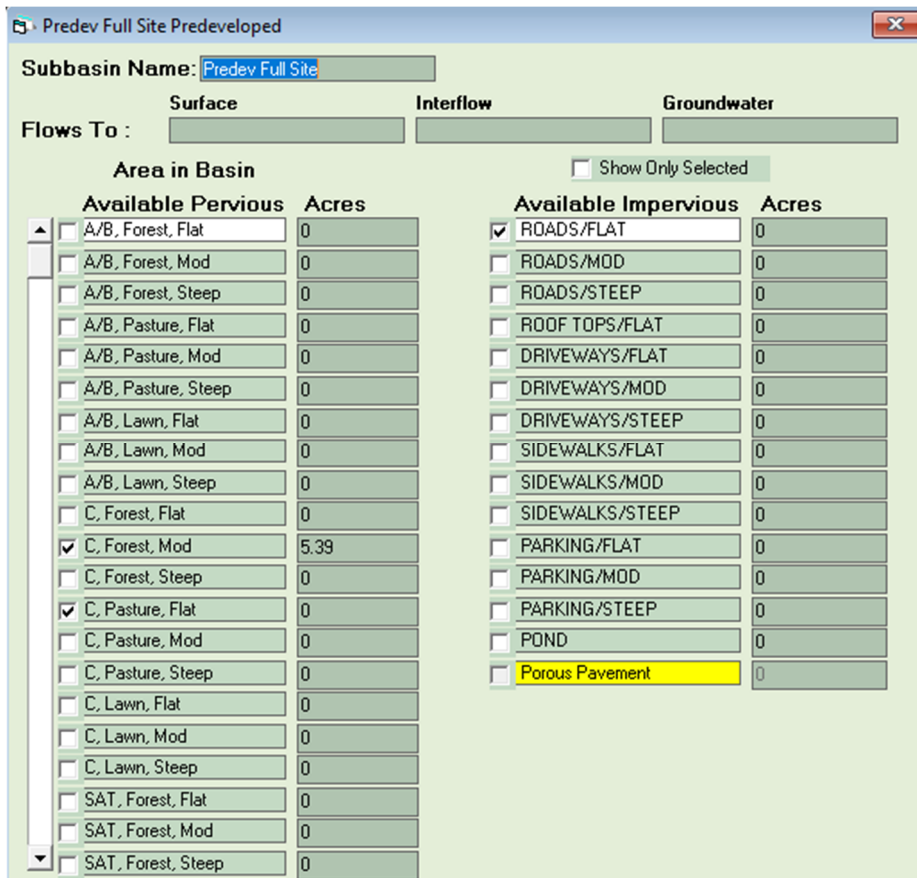
WWHM Reports

WWHM Results - Detention Sizing

Model Overview



Predeveloped Basin Areas



Post-Developed Basin Areas

Post-Dev Full Site Mitigated

Subbasin Name: Designate as Bypass for POC:

Flows To :

Area in Basin Show Only Selected

Available Pervious		Acres	Available Impervious		Acres
<input type="checkbox"/> A/B, Forest, Flat		0	<input checked="" type="checkbox"/> ROADS/FLAT		4.2
<input type="checkbox"/> A/B, Forest, Mod		0	<input type="checkbox"/> ROADS/MOD		0
<input type="checkbox"/> A/B, Forest, Steep		0	<input type="checkbox"/> ROADS/STEEP		0
<input type="checkbox"/> A/B, Pasture, Flat		0	<input type="checkbox"/> ROOF TOPS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Mod		0	<input type="checkbox"/> DRIVEWAYS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Steep		0	<input type="checkbox"/> DRIVEWAYS/MOD		0
<input type="checkbox"/> A/B, Lawn, Flat		0	<input type="checkbox"/> DRIVEWAYS/STEEP		0
<input type="checkbox"/> A/B, Lawn, Mod		0	<input type="checkbox"/> SIDEWALKS/FLAT		0
<input type="checkbox"/> A/B, Lawn, Steep		0	<input type="checkbox"/> SIDEWALKS/MOD		0
<input type="checkbox"/> C, Forest, Flat		0	<input type="checkbox"/> SIDEWALKS/STEEP		0
<input type="checkbox"/> C, Forest, Mod		0	<input type="checkbox"/> PARKING/FLAT		0
<input type="checkbox"/> C, Forest, Steep		0	<input type="checkbox"/> PARKING/MOD		0
<input checked="" type="checkbox"/> C, Pasture, Flat		1.19	<input type="checkbox"/> PARKING/STEEP		0
<input type="checkbox"/> C, Pasture, Mod		0	<input type="checkbox"/> POND		0
<input type="checkbox"/> C, Pasture, Steep		0	<input type="checkbox"/> Porous Pavement		0
<input type="checkbox"/> C, Lawn, Flat		0			
<input type="checkbox"/> C, Lawn, Mod		0			
<input type="checkbox"/> C, Lawn, Steep		0			
<input type="checkbox"/> SAT, Forest, Flat		0			
<input type="checkbox"/> SAT, Forest, Mod		0			
<input type="checkbox"/> SAT, Forest, Steep		0			

Proposed Detention Vault

Vault Mitigated

Facility Name:

Outlet 1: Outlet 2: Outlet 3:

Downstream Connection: Precipitation Applied to Facility Evaporation Applied to Facility

Outlet 2:

Fixed Width For Auto Vault

Facility Dimensions

Length (ft): Width (ft): Effective Depth (ft):

Outlet Structure Data

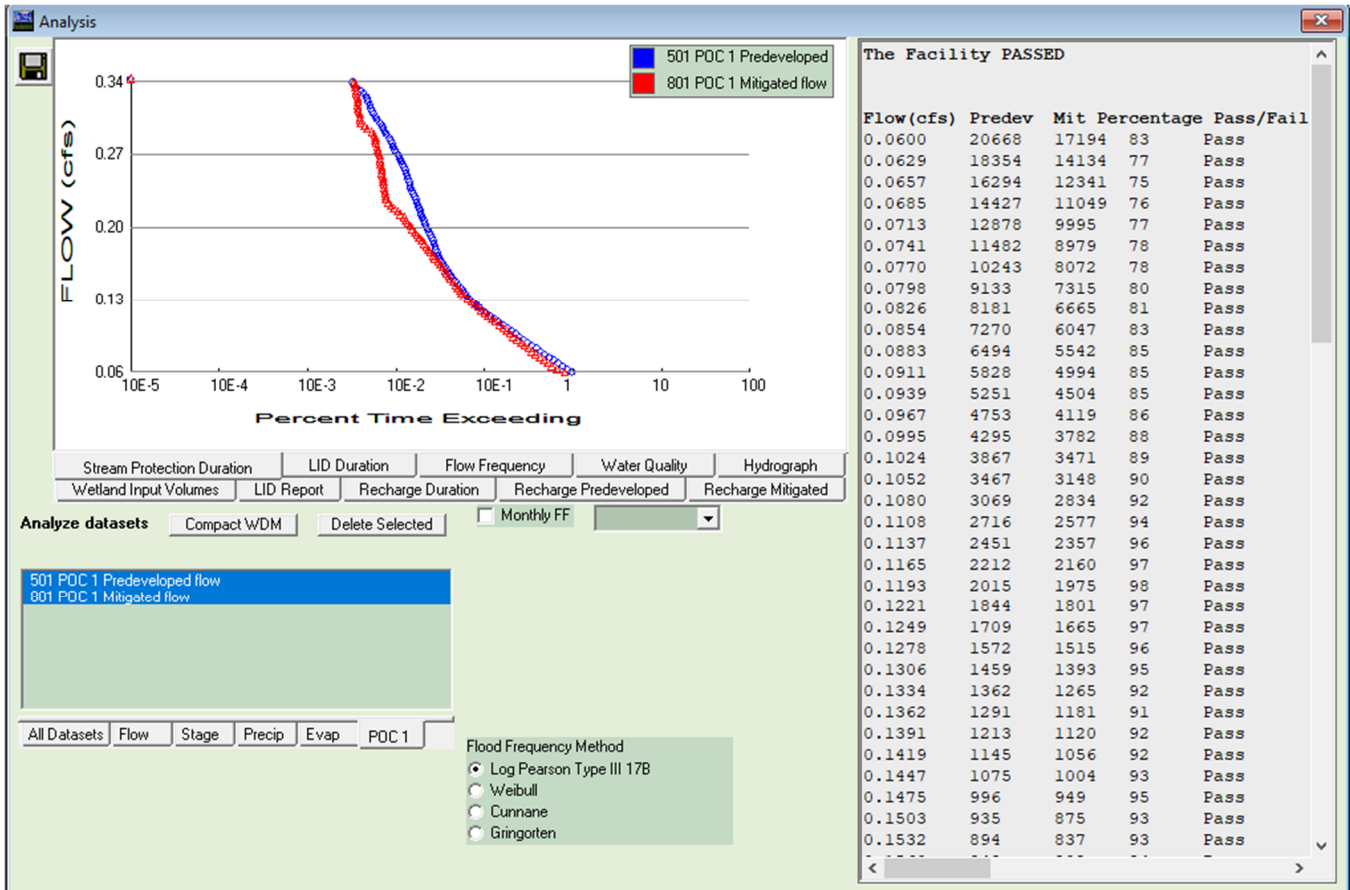
Riser Height (ft): Riser Diameter (in): Riser Type: Notch Type: Notch Height (ft): Notch Width (ft):

Infiltration:

Orifice Number	Diameter (in)	Height (ft)
1	<input type="text" value="1.182"/>	<input type="text" value="0"/>
2	<input type="text" value="0"/>	<input type="text" value="0"/>
3	<input type="text" value="0"/>	<input type="text" value="0"/>

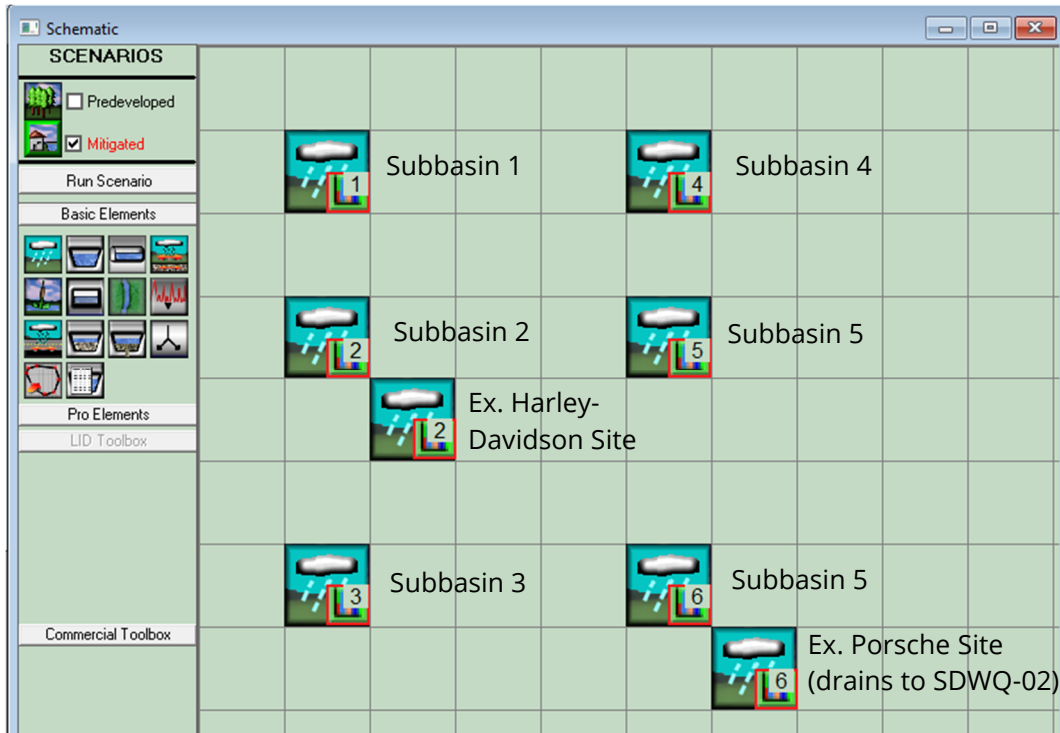
Vault Volume at Riser Head (ac-ft): 1.559

Flow Control Duration Curves (Stream Protection)



WWHM Results - Water Quality Sizing

Model Overview



Subbasin 1

Subbasin 1 Areas

Post-Dev Subbasin 1 Mitigated

Subbasin Name: Designate as Bypass for POC:

Flows To: Surface Interflow Groundwater

Show Only Selected

Area in Basin		Available Pervious		Acres		Available Impervious		Acres	
<input type="checkbox"/>	A/B, Forest, Flat	<input type="checkbox"/>		0		<input checked="" type="checkbox"/>	ROADS/FLAT	1.11	
<input type="checkbox"/>	A/B, Forest, Mod	<input type="checkbox"/>		0		<input checked="" type="checkbox"/>	ROADS/MOD	0	
<input type="checkbox"/>	A/B, Forest, Steep	<input type="checkbox"/>		0		<input type="checkbox"/>	ROADS/STEEP	0	
<input type="checkbox"/>	A/B, Pasture, Flat	<input type="checkbox"/>		0		<input type="checkbox"/>	ROOF TOPS/FLAT	0	
<input type="checkbox"/>	A/B, Pasture, Mod	<input type="checkbox"/>		0		<input type="checkbox"/>	DRIVEWAYS/FLAT	0	
<input type="checkbox"/>	A/B, Pasture, Steep	<input type="checkbox"/>		0		<input type="checkbox"/>	DRIVEWAYS/MOD	0	
<input type="checkbox"/>	A/B, Lawn, Flat	<input type="checkbox"/>		0		<input type="checkbox"/>	DRIVEWAYS/STEEP	0	
<input type="checkbox"/>	A/B, Lawn, Mod	<input type="checkbox"/>		0		<input type="checkbox"/>	SIDEWALKS/FLAT	0	
<input type="checkbox"/>	A/B, Lawn, Steep	<input type="checkbox"/>		0		<input type="checkbox"/>	SIDEWALKS/MOD	0	
<input type="checkbox"/>	C, Forest, Flat	<input type="checkbox"/>		0		<input type="checkbox"/>	SIDEWALKS/STEEP	0	
<input type="checkbox"/>	C, Forest, Mod	<input type="checkbox"/>		0		<input type="checkbox"/>	PARKING/FLAT	0	
<input type="checkbox"/>	C, Forest, Steep	<input type="checkbox"/>		0		<input type="checkbox"/>	PARKING/MOD	0	
<input checked="" type="checkbox"/>	C, Pasture, Flat	<input type="checkbox"/>		.42		<input type="checkbox"/>	PARKING/STEEP	0	
<input type="checkbox"/>	C, Pasture, Mod	<input type="checkbox"/>		0		<input type="checkbox"/>	POND	0	
<input type="checkbox"/>	C, Pasture, Steep	<input type="checkbox"/>		0		<input type="checkbox"/>	Porous Pavement	0	
<input checked="" type="checkbox"/>	C, Lawn, Flat	<input type="checkbox"/>		0					
<input type="checkbox"/>	C, Lawn, Mod	<input type="checkbox"/>		0					
<input type="checkbox"/>	C, Lawn, Steep	<input type="checkbox"/>		0					
<input type="checkbox"/>	SAT, Forest, Flat	<input type="checkbox"/>		0					
<input type="checkbox"/>	SAT, Forest, Mod	<input type="checkbox"/>		0					
<input type="checkbox"/>	SAT, Forest, Steep	<input type="checkbox"/>		0					

Required WQ Flow Rates

Analysis

Water Quality

On-Line BMP

24 hour Volume (ac-ft)

Standard Flow Rate (cfs)

Off-Line BMP

Standard Flow Rate (cfs)

Subbasin 2 + Existing Harley-Davidson Site

Subbasin 2 Areas

Post-Dev Subbasin 2 Mitigated

Subbasin Name: Designate as Bypass for POC:

Flows To : Surface Interflow Groundwater

Area in Basin Show Only Selected

Available Pervious		Acres	Available Impervious		Acres
<input type="checkbox"/>	A/B, Forest, Flat	0	<input checked="" type="checkbox"/>	ROADS/FLAT	1.48
<input type="checkbox"/>	A/B, Forest, Mod	0	<input type="checkbox"/>	ROADS/MOD	0
<input type="checkbox"/>	A/B, Forest, Steep	0	<input type="checkbox"/>	ROADS/STEEP	0
<input type="checkbox"/>	A/B, Pasture, Flat	0	<input type="checkbox"/>	ROOF TOPS/FLAT	0
<input type="checkbox"/>	A/B, Pasture, Mod	0	<input type="checkbox"/>	DRIVEWAYS/FLAT	0
<input type="checkbox"/>	A/B, Pasture, Steep	0	<input type="checkbox"/>	DRIVEWAYS/MOD	0
<input type="checkbox"/>	A/B, Lawn, Flat	0	<input type="checkbox"/>	DRIVEWAYS/STEEP	0
<input type="checkbox"/>	A/B, Lawn, Mod	0	<input type="checkbox"/>	SIDEWALKS/FLAT	0
<input type="checkbox"/>	A/B, Lawn, Steep	0	<input type="checkbox"/>	SIDEWALKS/MOD	0
<input type="checkbox"/>	C, Forest, Flat	0	<input type="checkbox"/>	SIDEWALKS/STEEP	0
<input type="checkbox"/>	C, Forest, Mod	0	<input type="checkbox"/>	PARKING/FLAT	0
<input type="checkbox"/>	C, Forest, Steep	0	<input type="checkbox"/>	PARKING/MOD	0
<input checked="" type="checkbox"/>	C, Pasture, Flat	.22	<input type="checkbox"/>	PARKING/STEEP	0
<input type="checkbox"/>	C, Pasture, Mod	0	<input type="checkbox"/>	POND	0
<input type="checkbox"/>	C, Pasture, Steep	0	<input type="checkbox"/>	Porous Pavement	0
<input checked="" type="checkbox"/>	C, Lawn, Flat	0			
<input type="checkbox"/>	C, Lawn, Mod	0			
<input type="checkbox"/>	C, Lawn, Steep	0			
<input type="checkbox"/>	SAT, Forest, Flat	0			
<input type="checkbox"/>	SAT, Forest, Mod	0			
<input type="checkbox"/>	SAT, Forest, Steep	0			



Existing Harley-Davidson Site Areas

Ex HD Site Mitigated

Subbasin Name: Designate as Bypass for POC:

Flows To : Surface Interflow Groundwater

Area in Basin Show Only Selected

Available Pervious		Acres	Available Impervious		Acres
<input type="checkbox"/>	A/B, Forest, Flat	0	<input checked="" type="checkbox"/>	ROADS/FLAT	1.6
<input type="checkbox"/>	A/B, Forest, Mod	0	<input type="checkbox"/>	ROADS/MOD	0
<input type="checkbox"/>	A/B, Forest, Steep	0	<input type="checkbox"/>	ROADS/STEEP	0
<input type="checkbox"/>	A/B, Pasture, Flat	0	<input type="checkbox"/>	ROOF TOPS/FLAT	0
<input type="checkbox"/>	A/B, Pasture, Mod	0	<input type="checkbox"/>	DRIVEWAYS/FLAT	0
<input type="checkbox"/>	A/B, Pasture, Steep	0	<input type="checkbox"/>	DRIVEWAYS/MOD	0
<input type="checkbox"/>	A/B, Lawn, Flat	0	<input type="checkbox"/>	DRIVEWAYS/STEEP	0
<input type="checkbox"/>	A/B, Lawn, Mod	0	<input type="checkbox"/>	SIDEWALKS/FLAT	0
<input type="checkbox"/>	A/B, Lawn, Steep	0	<input type="checkbox"/>	SIDEWALKS/MOD	0
<input type="checkbox"/>	C, Forest, Flat	0	<input type="checkbox"/>	SIDEWALKS/STEEP	0
<input type="checkbox"/>	C, Forest, Mod	0	<input type="checkbox"/>	PARKING/FLAT	0
<input type="checkbox"/>	C, Forest, Steep	0	<input type="checkbox"/>	PARKING/MOD	0
<input checked="" type="checkbox"/>	C, Pasture, Flat	0	<input type="checkbox"/>	PARKING/STEEP	0
<input type="checkbox"/>	C, Pasture, Mod	0	<input type="checkbox"/>	POND	0
<input type="checkbox"/>	C, Pasture, Steep	0	<input type="checkbox"/>	Porous Pavement	0
<input checked="" type="checkbox"/>	C, Lawn, Flat	.43			
<input type="checkbox"/>	C, Lawn, Mod	0			
<input type="checkbox"/>	C, Lawn, Steep	0			
<input type="checkbox"/>	SAT, Forest, Flat	0			
<input type="checkbox"/>	SAT, Forest, Mod	0			
<input type="checkbox"/>	SAT, Forest, Steep	0			

Required WQ Flow Rates

Analysis

Water Quality

On-Line BMP		Off-Line BMP	
24 hour Volume (ac-ft)	<input type="text" value="0.3211"/>		
Standard Flow Rate (cfs)	<input type="text" value="0.4802"/>	Standard Flow Rate (cfs)	<input type="text" value="0.2722"/>

Subbasin 3

Subbasin 3 Areas

Post-Dev Subbasin 3 Mitigated

Subbasin Name: Designate as Bypass for POC:

Flows To: Surface Interflow Groundwater

Show Only Selected

Available Pervious		Acres	Available Impervious		Acres
<input type="checkbox"/> A/B, Forest, Flat		0	<input checked="" type="checkbox"/> ROADS/FLAT		1.31
<input type="checkbox"/> A/B, Forest, Mod		0	<input type="checkbox"/> ROADS/MOD		0
<input type="checkbox"/> A/B, Forest, Steep		0	<input type="checkbox"/> ROADS/STEEP		0
<input type="checkbox"/> A/B, Pasture, Flat		0	<input type="checkbox"/> ROOF TOPS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Mod		0	<input type="checkbox"/> DRIVEWAYS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Steep		0	<input type="checkbox"/> DRIVEWAYS/MOD		0
<input type="checkbox"/> A/B, Lawn, Flat		0	<input type="checkbox"/> DRIVEWAYS/STEEP		0
<input type="checkbox"/> A/B, Lawn, Mod		0	<input type="checkbox"/> SIDEWALKS/FLAT		0
<input type="checkbox"/> A/B, Lawn, Steep		0	<input type="checkbox"/> SIDEWALKS/MOD		0
<input type="checkbox"/> C, Forest, Flat		0	<input type="checkbox"/> SIDEWALKS/STEEP		0
<input type="checkbox"/> C, Forest, Mod		0	<input type="checkbox"/> PARKING/FLAT		0
<input type="checkbox"/> C, Forest, Steep		0	<input type="checkbox"/> PARKING/MOD		0
<input checked="" type="checkbox"/> C, Pasture, Flat		.44	<input type="checkbox"/> PARKING/STEEP		0
<input type="checkbox"/> C, Pasture, Mod		0	<input type="checkbox"/> POND		0
<input type="checkbox"/> C, Pasture, Steep		0	<input type="checkbox"/> Porous Pavement		0
<input checked="" type="checkbox"/> C, Lawn, Flat		0			
<input type="checkbox"/> C, Lawn, Mod		0			
<input type="checkbox"/> C, Lawn, Steep		0			
<input type="checkbox"/> SAT, Forest, Flat		0			
<input type="checkbox"/> SAT, Forest, Mod		0			
<input type="checkbox"/> SAT, Forest, Steep		0			

Required WQ Flow Rates

Analysis

Water Quality	
On-Line BMP	Off-Line BMP
24 hour Volume (ac-ft) <input type="text" value="0.1382"/>	
Standard Flow Rate (cfs) <input type="text" value="0.2036"/>	Standard Flow Rate (cfs) <input type="text" value="0.1153"/>



Subbasin 4

Subbasin 4 Areas

Post-Dev Subbasin 4 Mitigated

Subbasin Name: Designate as Bypass for POC:

Flows To : Surface Interflow Groundwater

Show Only Selected

Available Pervious		Acres	Available Impervious		Acres
<input type="checkbox"/> A/B, Forest, Flat		0	<input checked="" type="checkbox"/> ROADS/FLAT		.07
<input type="checkbox"/> A/B, Forest, Mod		0	<input type="checkbox"/> ROADS/MOD		0
<input type="checkbox"/> A/B, Forest, Steep		0	<input type="checkbox"/> ROADS/STEEP		0
<input type="checkbox"/> A/B, Pasture, Flat		0	<input type="checkbox"/> ROOF TOPS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Mod		0	<input type="checkbox"/> DRIVEWAYS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Steep		0	<input type="checkbox"/> DRIVEWAYS/MOD		0
<input type="checkbox"/> A/B, Lawn, Flat		0	<input type="checkbox"/> DRIVEWAYS/STEEP		0
<input type="checkbox"/> A/B, Lawn, Mod		0	<input type="checkbox"/> SIDEWALKS/FLAT		0
<input type="checkbox"/> A/B, Lawn, Steep		0	<input type="checkbox"/> SIDEWALKS/MOD		0
<input type="checkbox"/> C, Forest, Flat		0	<input type="checkbox"/> SIDEWALKS/STEEP		0
<input type="checkbox"/> C, Forest, Mod		0	<input type="checkbox"/> PARKING/FLAT		0
<input type="checkbox"/> C, Forest, Steep		0	<input type="checkbox"/> PARKING/MOD		0
<input checked="" type="checkbox"/> C, Pasture, Flat		.012	<input type="checkbox"/> PARKING/STEEP		0
<input type="checkbox"/> C, Pasture, Mod		0	<input type="checkbox"/> POND		0
<input type="checkbox"/> C, Pasture, Steep		0	<input type="checkbox"/> Porous Pavement		0
<input checked="" type="checkbox"/> C, Lawn, Flat		0			
<input type="checkbox"/> C, Lawn, Mod		0			
<input type="checkbox"/> C, Lawn, Steep		0			
<input type="checkbox"/> SAT, Forest, Flat		0			
<input type="checkbox"/> SAT, Forest, Mod		0			
<input type="checkbox"/> SAT, Forest, Steep		0			

Required WQ Flow Rates

Analysis

Water Quality	
On-Line BMP	Off-Line BMP
24 hour Volume (ac-ft) <input type="text" value="0.0072"/>	
Standard Flow Rate (cfs) <input type="text" value="0.0109"/>	Standard Flow Rate (cfs) <input type="text" value="0.0062"/>



Subbasin 5

Basin Areas

Post-Dev Subbasin 5 Mitigated

Subbasin Name: Designate as Bypass for POC:

Flows To : Surface Interflow Groundwater

Show Only Selected

Available Pervious		Acres	Available Impervious		Acres
<input type="checkbox"/> A/B, Forest, Flat		0	<input checked="" type="checkbox"/> ROADS/FLAT		.03
<input type="checkbox"/> A/B, Forest, Mod		0	<input type="checkbox"/> ROADS/MOD		0
<input type="checkbox"/> A/B, Forest, Steep		0	<input type="checkbox"/> ROADS/STEEP		0
<input type="checkbox"/> A/B, Pasture, Flat		0	<input type="checkbox"/> ROOF TOPS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Mod		0	<input type="checkbox"/> DRIVEWAYS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Steep		0	<input type="checkbox"/> DRIVEWAYS/MOD		0
<input type="checkbox"/> A/B, Lawn, Flat		0	<input type="checkbox"/> DRIVEWAYS/STEEP		0
<input type="checkbox"/> A/B, Lawn, Mod		0	<input type="checkbox"/> SIDEWALKS/FLAT		0
<input type="checkbox"/> A/B, Lawn, Steep		0	<input type="checkbox"/> SIDEWALKS/MOD		0
<input type="checkbox"/> C, Forest, Flat		0	<input type="checkbox"/> SIDEWALKS/STEEP		0
<input type="checkbox"/> C, Forest, Mod		0	<input type="checkbox"/> PARKING/FLAT		0
<input type="checkbox"/> C, Forest, Steep		0	<input type="checkbox"/> PARKING/MOD		0
<input checked="" type="checkbox"/> C, Pasture, Flat		.001	<input type="checkbox"/> PARKING/STEEP		0
<input type="checkbox"/> C, Pasture, Mod		0	<input type="checkbox"/> POND		0
<input type="checkbox"/> C, Pasture, Steep		0	<input type="checkbox"/> Porous Pavement		0
<input checked="" type="checkbox"/> C, Lawn, Flat		0			
<input type="checkbox"/> C, Lawn, Mod		0			
<input type="checkbox"/> C, Lawn, Steep		0			
<input type="checkbox"/> S&T, Forest, Flat		0			
<input type="checkbox"/> S&T, Forest, Mod		0			
<input type="checkbox"/> S&T, Forest, Steep		0			

Required WQ Flow Rates

Analysis

Water Quality	
On-Line BMP	Off-Line BMP
24 hour Volume (ac-ft) <input type="text" value="0.0030"/>	
Standard Flow Rate (cfs) <input type="text" value="0.0047"/>	Standard Flow Rate (cfs) <input type="text" value="0.0026"/>

Subbasin 6 + Existing Porsche Site (draining to SDWQ-02)

This analysis was conducted to check if the existing BMP, SDWQ-02 (6x12 BioPod Underground) constructed with the Porsche Seattle North dealership, is sufficiently sized to treat post-developed Subbasin 6 from this project.

Subbasin 6 Areas

Basin 7 Mitigated

Subbasin Name: Designate as Bypass for POC:

Flows To : Surface Interflow Groundwater

Area in Basin Show Only Selected

Available Pervious		Acres	Available Impervious		Acres
<input type="checkbox"/> A/B, Forest, Flat		0	<input checked="" type="checkbox"/> ROADS/FLAT		0.21
<input type="checkbox"/> A/B, Forest, Mod		0	<input checked="" type="checkbox"/> ROADS/MOD		0
<input type="checkbox"/> A/B, Forest, Steep		0	<input type="checkbox"/> ROADS/STEEP		0
<input type="checkbox"/> A/B, Pasture, Flat		0	<input type="checkbox"/> ROOF TOPS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Mod		0	<input type="checkbox"/> DRIVEWAYS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Steep		0	<input type="checkbox"/> DRIVEWAYS/MOD		0
<input type="checkbox"/> A/B, Lawn, Flat		0	<input type="checkbox"/> DRIVEWAYS/STEEP		0
<input type="checkbox"/> A/B, Lawn, Mod		0	<input type="checkbox"/> SIDEWALKS/FLAT		0
<input type="checkbox"/> A/B, Lawn, Steep		0	<input type="checkbox"/> SIDEWALKS/MOD		0
<input type="checkbox"/> C, Forest, Flat		0	<input type="checkbox"/> SIDEWALKS/STEEP		0
<input type="checkbox"/> C, Forest, Mod		0	<input type="checkbox"/> PARKING/FLAT		0
<input type="checkbox"/> C, Forest, Steep		0	<input type="checkbox"/> PARKING/MOD		0
<input checked="" type="checkbox"/> C, Pasture, Flat		0.16	<input type="checkbox"/> PARKING/STEEP		0
<input type="checkbox"/> C, Pasture, Mod		0	<input type="checkbox"/> POND		0
<input type="checkbox"/> C, Pasture, Steep		0	<input type="checkbox"/> Porous Pavement		0

Existing Porsche Site Areas (draining to Existing SDWQ-02 BMP)

Basin 8 Mitigated

Subbasin Name: Designate as Bypass for POC:

Flows To : Surface Interflow Groundwater

Area in Basin Show Only Selected

Available Pervious		Acres	Available Impervious		Acres
<input type="checkbox"/> A/B, Forest, Flat		0	<input checked="" type="checkbox"/> ROADS/FLAT		0.91
<input type="checkbox"/> A/B, Forest, Mod		0	<input checked="" type="checkbox"/> ROADS/MOD		0.18
<input type="checkbox"/> A/B, Forest, Steep		0	<input type="checkbox"/> ROADS/STEEP		0
<input type="checkbox"/> A/B, Pasture, Flat		0	<input type="checkbox"/> ROOF TOPS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Mod		0	<input type="checkbox"/> DRIVEWAYS/FLAT		0
<input type="checkbox"/> A/B, Pasture, Steep		0	<input type="checkbox"/> DRIVEWAYS/MOD		0
<input type="checkbox"/> A/B, Lawn, Flat		0	<input type="checkbox"/> DRIVEWAYS/STEEP		0
<input type="checkbox"/> A/B, Lawn, Mod		0	<input type="checkbox"/> SIDEWALKS/FLAT		0
<input type="checkbox"/> A/B, Lawn, Steep		0	<input type="checkbox"/> SIDEWALKS/MOD		0
<input type="checkbox"/> C, Forest, Flat		0	<input type="checkbox"/> SIDEWALKS/STEEP		0
<input type="checkbox"/> C, Forest, Mod		0	<input type="checkbox"/> PARKING/FLAT		0
<input type="checkbox"/> C, Forest, Steep		0	<input type="checkbox"/> PARKING/MOD		0
<input checked="" type="checkbox"/> C, Pasture, Flat		0.14	<input type="checkbox"/> PARKING/STEEP		0
<input type="checkbox"/> C, Pasture, Mod		0	<input type="checkbox"/> POND		0
<input type="checkbox"/> C, Pasture, Steep		0	<input type="checkbox"/> Porous Pavement		0

Required WQ Flow Rates

Analysis

Water Quality	
On-Line BMP	Off-Line BMP
24 hour Volume (ac-ft) <input type="text" value="0.1356"/>	
Standard Flow Rate (cfs) <input type="text" value="0.2056"/>	Standard Flow Rate (cfs) <input type="text" value="0.1166"/>