



Kahan Residence

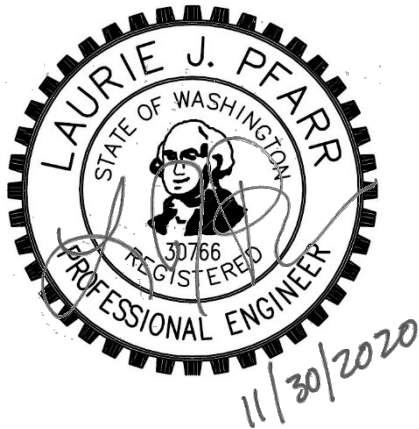
8163 W Mercer Way

Mercer Island, WA 98040

Stormwater Site Plan

November 30, 2020

The information contained in this report was prepared by and under the direct supervision of the undersigned:



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**KAHAN RESIDENCE
8163 W MERCER WAY
STORMWATER SITE PLAN
NOVEMBER 30, 2020**

PROJECT OVERVIEW

General Project Description

This storm drainage report is for the construction of a new single-family residence at 8163 W Mercer Way in Mercer Island, Washington. The project site is located in Section 36, Township 24 North, Range 4 East, Willamette Meridian. Refer to Figure 1 – Vicinity Map for site location. The project includes the construction of a new two-story residence as well as an attached garage building, and other site improvements.

Based upon the City of Mercer Island Municipal Code (MIMC) Section 15.09.050, the drainage analysis will be assessed using the Department of Ecology (DOE) 2014 Stormwater Manual of Western Washington (SWMWW). Refer to the Minimum Requirements section of this report for the project classification and the minimum requirements that are applicable to the project area.

Existing Conditions

The property (Parcel #3358500387) is undeveloped and has a total area of approximately 17,955 square feet (0.412 acres). According to the City of Mercer Island GIS Portal, the site is zoned R-15, Residential. The adjacent property to the southwest (Parcel #3358500385 and addressed 8167 W Mercer Way) is developed with a single-family residence. The approach driveway to this developed property extends through the project. The new two-story with basement residence will be constructed on the undeveloped property and is not expected to impact the developed driveway. The site is bounded by single-family residences on all sides with an access easement to W Mercer Way to the northeast.

Topography for the site is steep, falling from approximately elevation 130 feet in the northeast corner to elevation 40 feet at the southwest corner. The steepest slopes on the site are approximately 67%.

Per the 2014 DOE Manual, if the existing lot coverage is less than 35% impervious, then the project is to be classified as a new development. The site was found to have impervious coverage of approximately 24.0%, and therefore this project's minimum requirements were determined based on the new development flow chart (Figure 2.4.1 of Volume I of the 2014 DOE Manual). Refer to Figure 2 – Existing Impervious Coverage & Conditions and the Minimum Requirements section of this report.



Per the King County iMap, the project is within the Lake Washington drainage Basin. Runoff from the site is generally collected in catch basins and conveyed southwest to a discharge point into Lake Washington. Stormwater is within a piped system to the receiving water. For more information on the downstream drainage course, see the Offsite Analysis section of this report. King County critical areas mapping indicates that the entire site is located in a designated Erosion Hazard area. Other environmental critical area (ECA) maps available from the City of Mercer Island indicate that the majority of the site is a protected slope area with Steep Slope Hazards. Other ECAs include both Potential Slide and Seismic Hazards.

Per the Natural Resources Conservation Service Web Soil Survey, the entire site is underlain with Kitsap silt loam, 2 to 8 percent slopes (KpD). Refer to Figure 3 – Soils Map. A geotechnical report has been prepared by Geotech Consultants Inc., dated October 6, 2020. The subsurface explorations on the site revealed soil conditions characterized by low permeability. In some areas, conducting test borings was a challenge due to the presence of dense or cobbly subsurface soil conditions. As a result of this, drainage BMPs such as on-site infiltration and dispersion were determined to be infeasible. This will be further discussed in the Permanent Stormwater Control Plan section of this report. The geotechnical report is included in Appendix D.

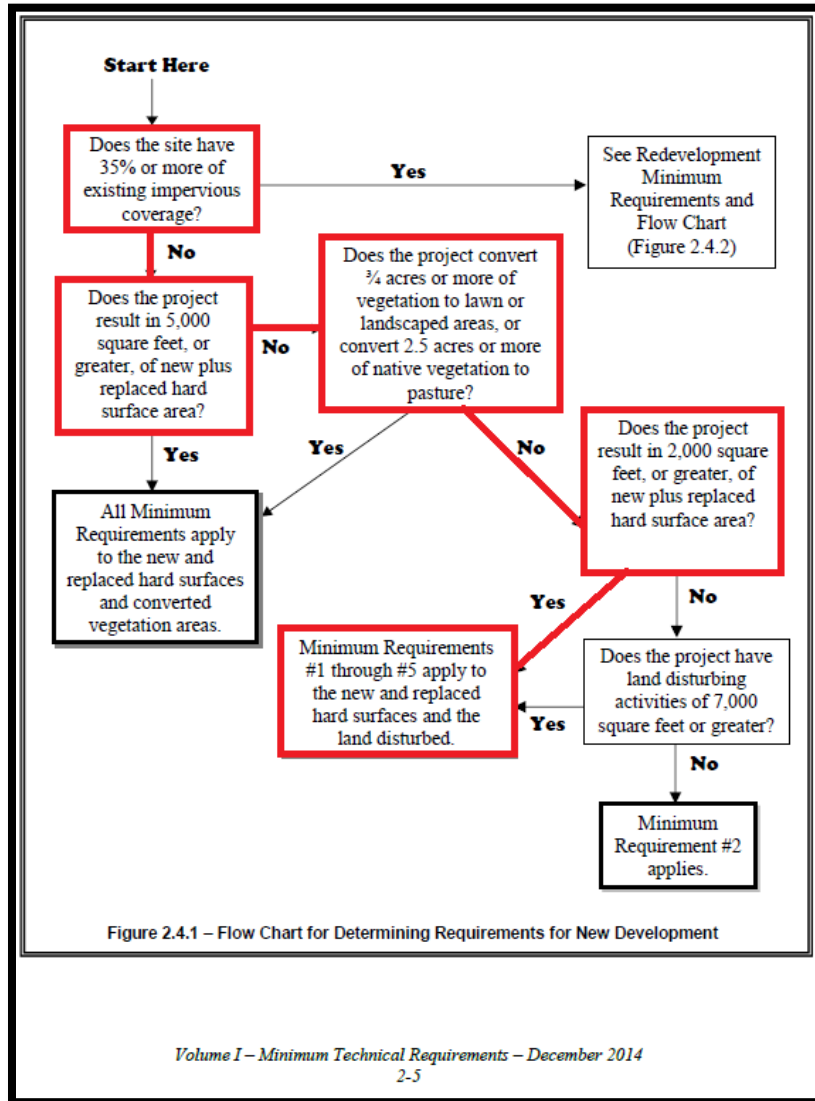
Proposed Conditions

The proposed project will include the construction of a new single-family residence on the undeveloped parcel, including a basement as well as attached garage, and a new driveway court. Shoring walls will be utilized for the excavation. There are no permanent stormwater facilities proposed as part of this project other than piped connections. Refer to the Permanent Stormwater Control Plan section of this report for additional details.

MINIMUM REQUIREMENTS

Per the previous discussion, the site is considered a new development if there is less than 35% existing impervious coverage. The existing impervious surface coverage for the entire property was determined to be approximately 24.0%, and therefore minimum requirements will be dictated by Figure 2.4.1 of the 2014 DOE Manual, which is shown below. There will be less than 5,000 square feet of new plus replaced impervious surface. Therefore, based upon Figure 2.4.1 (see below) of the 2014 DOE Stormwater Management Manual for Western Washington, Minimum Requirements #1 through 5 will apply to **new plus replaced impervious surfaces** and **disturbed land** for the project area.

Figure 2.4.1 of the 2014 DOE Stormwater Management Manual for Western Washington



Below is description of each of the minimum requirements for the project and how this project addresses them:

Minimum Requirement #1 – Preparation of Stormwater Site Plans (MR1): This document is the Stormwater Site Plan. It outlines the existing and proposed site and drainage conditions and presents the stormwater analysis.

Minimum Requirement #2 – Construction Stormwater Pollution Prevention Plan (SWPPP) (MR2): The construction SWPPP narrative is included in Appendix C of this report.



Minimum Requirement #3 – Source Control of Pollution (MR3): This project proposes less than 5,000 SF of pollution-generating hard surface (PGHS); therefore, source controls will not be required.

Minimum Requirement #4 – Preservation of Natural Drainage Systems and Outfalls (MR4): The proposed conditions will not alter the general drainage path. In the existing conditions, runoff is collected in catch basins and is conveyed to the southwest where it is discharged into Lake Washington at the property boundary. In the proposed conditions, stormwater will continue to follow this drainage path. Refer to the Offsite Analysis section of this report for a further description of the downstream drainage path and the Permanent Stormwater Control Plan section of this report for the proposed drainage system description.

Minimum Requirement #5 – On-Site Stormwater Management (MR5): This project will evaluate on-site stormwater management per List #1, Section 2.5.5 of Volume I of the 2014 DOE Manual. Due to high groundwater and steep slopes, very few BMPs are feasible. Only compost amended soils (BMP T5.13) can be utilized for disturbed pervious areas. See the Permanent Stormwater Control Plan for further information.

OFFSITE ANALYSIS

Task 1 – Define and Map Study Area

The topographical field survey was supplemented by City of Mercer Island GIS drainage information, aerial mapping, and the King County iMap to further define and map the study area in order to prepare the offsite analysis.

Task 2 – Information Review

As previously indicated, the site is within the Lake Washington drainage basin. Based upon King County iMap and City of Mercer Island GIS, there are several environmentally sensitive areas in or near the project site. These include an Erosion Hazard Area, a Potential Slide Area, and a Seismic Hazard Area. According to the Washington State Department of Ecology flood hazard maps, the project area is not located within a Floodway or 100-year Floodplain.

Task 3 – Field Inspection

The project area consists of an undeveloped lot, containing a stub driveway and several trees. To the southwest the Kahan-owned property continues in another lot developed with a single-family residence and parking area. However, the site improvements associated with this project will take place solely on the undeveloped lot.

Upstream Basin

Based on the City of Mercer Island GIS and the King County iMap, as well as the site survey, there is not a significant amount of upstream drainage that will affect the project. There is another property directly uphill from the undeveloped lot, and runoff from that property is collected by several catch basins located along the approach driveway. These flows combine downstream with the runoff from the project site, but will not impede the drainage course.

Task 4 – Drainage System Description and Problem Descriptions

The downstream drainage path was determined based on City of Mercer Island GIS storm drainage maps, and the site survey. Runoff from the undeveloped lot sheet flows to catch basins along the approach driveway, toward the south side of the project parcel. From here, the downstream drainage path is as follows:

1. Stormwater is conveyed via a 12-inch PVC system in the southwest direction.
2. After approximately 260 feet, stormwater leaves the site (Kahan-owned property) and discharges directly to Lake Washington.

Refer to Figure 4 – Downstream Drainage Map for a visual representation of the downstream drainage path. There are no known issues with the downstream path at this time.

PERMANENT STORMWATER CONTROL PLAN

As noted above, the project is required to address Minimum Requirements #1 – 5 for the **new and replaced hard surfaces** and **disturbed land**. The following table describes the new plus replaced surfaces associated with the project. All roof and standard pavement surfaces are hard surfaces.

Table 1 – New Plus Replaced Hard Surface

	Square Feet	Acres
Building Roof	2,503	0.057
Concrete Driveway (PGHS)	987	0.023
Deck Stairs (NPGHS)	347	0.008
Total New Plus Replaced Hard Surface	<u>3,837</u>	<u>0.088</u>

Pre-developed Site Hydrology

Refer to the offsite analysis section of this report for a detailed description of the existing drainage conditions. In general, stormwater is collected in catch basins and conveyed southwest to discharge into Lake Washington.

Proposed Site Hydrology

In the proposed conditions, stormwater from the roof surface will be collected via downspouts and routed southwest of the house to the discharge point. The underslab/shored wall drainage system will also convey water to this point. The piped discharge will be directional drilled down the hill and connect to the storm system downstream, still on the property. The driveway drainage will sheet flow northwest toward the main access driveway and will be collected in the onsite catch basin and pipe system within the main driveway that conveys flow down the driveway ultimately discharging into Lake Washington.

On-Site Stormwater Management

Since the project triggers Minimum Requirements #1-5, the project must provide on-site stormwater management in accordance with Section 2.5.5 of Volume I of the 2014 DOE Manual.



Since the project is exempt from flow control, the LID Performance Standard is not required to be evaluated. See Table 2 below for a feasibility evaluation on the on-site stormwater management BMPs.

Table 2 – On-site Stormwater Management BMP Evaluation

BMP	Feasibility	Explanation
<u>Lawn/Landscaped Areas</u>		
Post-Construction Soil Quality and Depth	Yes	Post-Construction Soil Quality and Depth per BMP T5.13 will be utilized for all disturbed pervious areas that will be restored with lawn or grass.
<u>Roof</u>		
Full Dispersion	No	A 65 to 10 ratio of forested or native vegetation area to impervious area cannot be achieved.
Bioretention	No	Bioretention would not be feasible due to poor fill and slide material observed during the geotechnical investigation. The Geotechnical report clearly states that no uncontrolled stormwater shall be discharged on the slope.
Downspout Dispersion Systems	No	Due to steep slopes downstream of the roof downspouts, it will not be feasible to utilize the adjacent area as a viable vegetated flow path. The Geotechnical report clearly states that no uncontrolled stormwater shall be discharged on the slope.
Perforated Stub-Out Connection	No	Per the geotechnical report, poor fill and slide material were observed during the geotechnical investigation. The Geotechnical report clearly states that no uncontrolled stormwater shall be discharged on the slope, thus no infiltration BMPs would not be feasible.
<u>Other Hard Surfaces</u>		
Full Dispersion	No	A 65 to 10 ratio of forested or native vegetation area to impervious area cannot be achieved.
Permeable Pavement	No	Per the geotechnical report, poor fill and slide material were observed during the geotechnical investigation. The Geotechnical report clearly states that no uncontrolled stormwater shall be discharged on the slope, thus infiltration BMPs would not be feasible.
Sheet Flow Dispersion	No	The deck and stairs cannot be dispersed due to being elevated from ground level. The concrete driveway cannot be dispersed because it is surrounded by a shoring wall and there is no viable dispersion path available. Additionally, the Geotechnical report clearly states that no uncontrolled stormwater shall be discharged on the slope.

Conveyance System Analysis and Design

An analysis of the onsite conveyance system was performed for the southwest outlet pipe that will be connected to the downstream storm system via directional drilling. Only the roof drainage system will be tributary to the pipe, along with the shored wall footing drain and under-slab drainage, but groundwater will be negligible. Refer to the Conveyance Analysis Spreadsheet in Appendix B. The 2014 DOE manual only requires analysis for the 25-year peak storm for new conveyance systems. However, each pipe analyzed will be compared to the 100-year peak runoff rate as well. These peak flows will be determined using MGS Flood with 15-minute time steps. This was compared to the full-flow capacity of the conveyance pipe, which was determined using Manning’s equation.



For the site outlet, the full-flow capacity per Manning's Equation for the 4-inch pipe ($n=0.011$) at a minimum 2.0% slope (actual slope will be much steeper) is 0.32 cubic feet per second (cfs). The 25-year and 100-year peak flows from MGS Flood were determined to be 0.039 cfs and 0.058 cfs, respectively. Based on comparing these peak flows to the full-flow capacity, this pipe will have adequate conveyance capacity.

CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

The SWPPP narrative for this project can be found in Appendix C of this report. The SWPPP is based on Volume II of the 2014 DOE Stormwater Manual requirements. An NPDES permit from the Washington State Department of Ecology will not be required for the project because the disturbance area is less than one acre.

The TESC plans can be found in Appendix A. Due to the large excavations associated with this project, a sediment settling tank will be utilized. A minimum volume was calculated using the methodology from the 2014 DOE manual, with the 2-year developed flow rate from MGS Flood. A volume of an equivalent sediment trap was calculated to find the necessary volumes for a sediment tank for this project. A copy of the Sediment Facility Sizing Calculations worksheet used for this exercise is attached in Appendix B. TESC elements in the project include the following:

- Temporary Stabilized Construction Entrance, per BMP C105
- Sediment Settling Tank
- Catch Basin Inserts (inlet protection), per BMP C220
- Silt Fence, per BMP C233

The TESC elements shown are intended to be the minimum allowable. The NPDES permit will require periodic inspection of the TESC elements to confirm they are holding up and continuing to function as intended. During construction, the contractor is responsible for upgrading these facilities as necessary. The implementation of the TESC plan and construction maintenance, replacement, and upgrading of the TESC facilities are the responsibility of the contractor, per the contract documents. The TESC facilities will be constructed prior to and in conjunction with all clearing and grading activity and in a manner in which sediment or sediment laden water does not leave the project site, enter the drainage system, or violate applicable water quality standards.

FIGURES

Figure 1: Vicinity Map

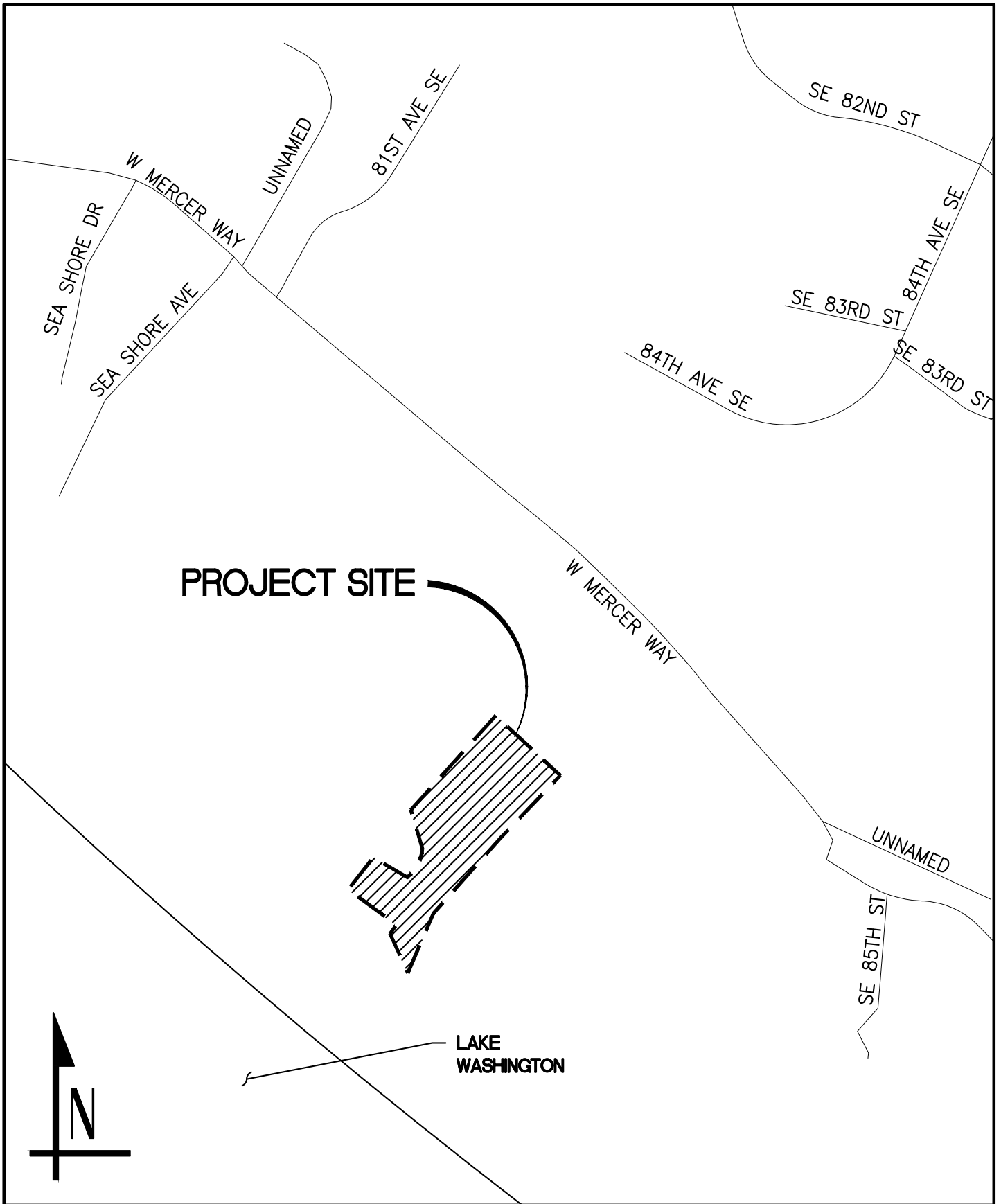
Figure 2: Existing Impervious Coverage & Conditions

Figure 3: Soil Map

Figure 4: Downstream Drainage Map

Figure 5: Proposed Conditions

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KAHAN RESIDENCE



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DESCRIPTION

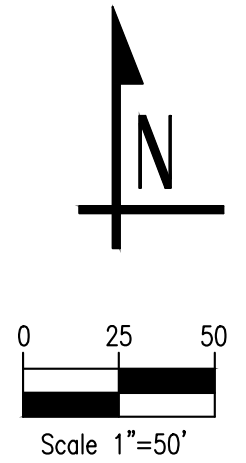
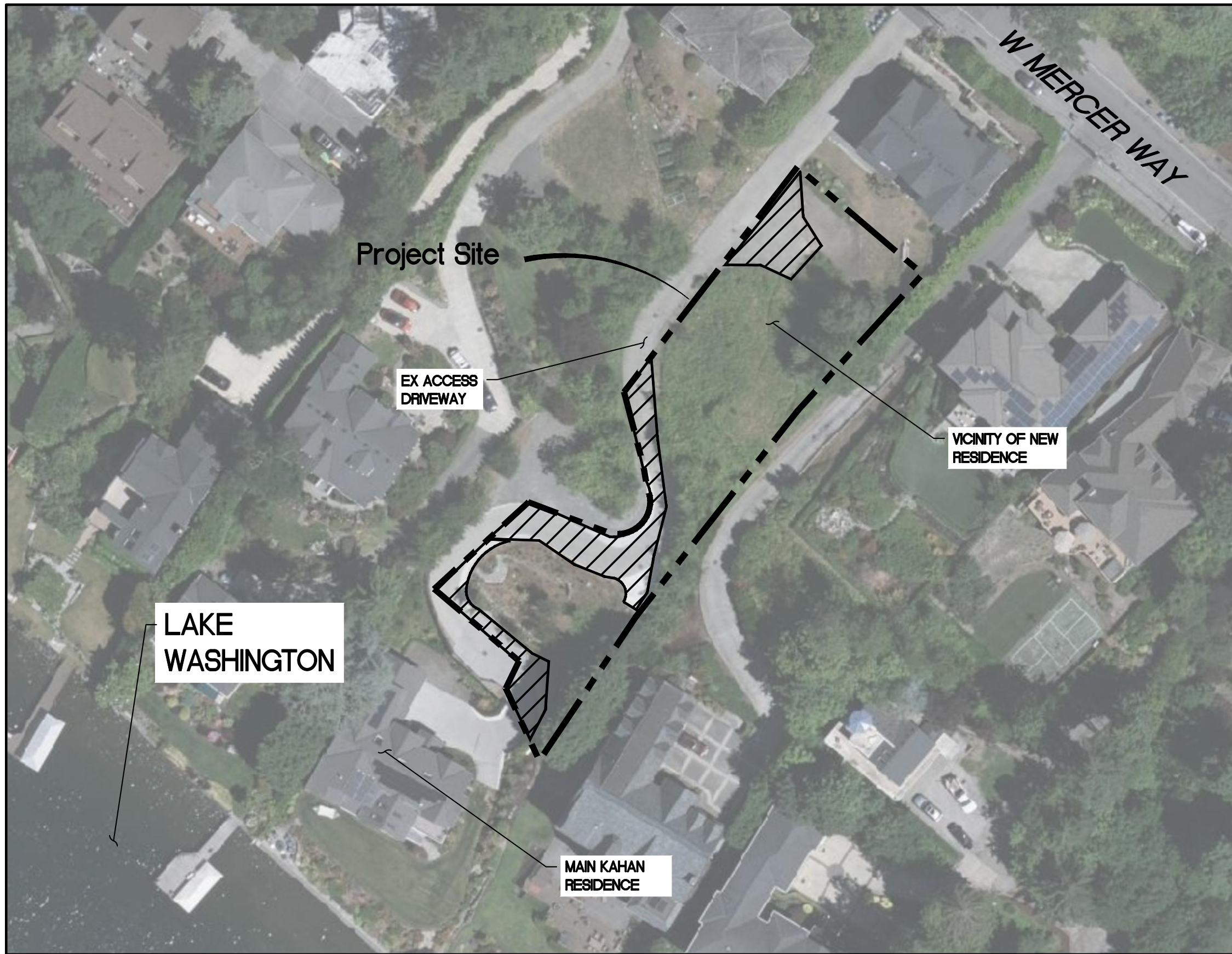
VICINITY MAP


NOVEMBER 30, 2020

FIGURE

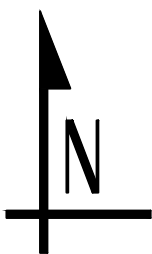
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EXISTING IMPERVIOUS AREA		
	Ex Impervious	0.099 AC
Total Site Area		0.412 AC
Percentage of Site Impervious		24.0%

KAHAN RESIDENCE



KING COUNTY AREA, WASHINGTON (WA633)

MAP UNIT SYMBOL	MAP UNIT NAME
KpD	Kitsap silt loam, 15% to 30% slopes
AmC	Arents, Alderwood Material, 6% to 15% slopes
EwC	Everett-Alderwood gravelly sandy loams, 6% to 15% slopes

KAHAN RESIDENCE

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DESCRIPTION

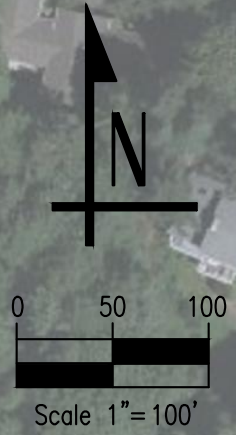
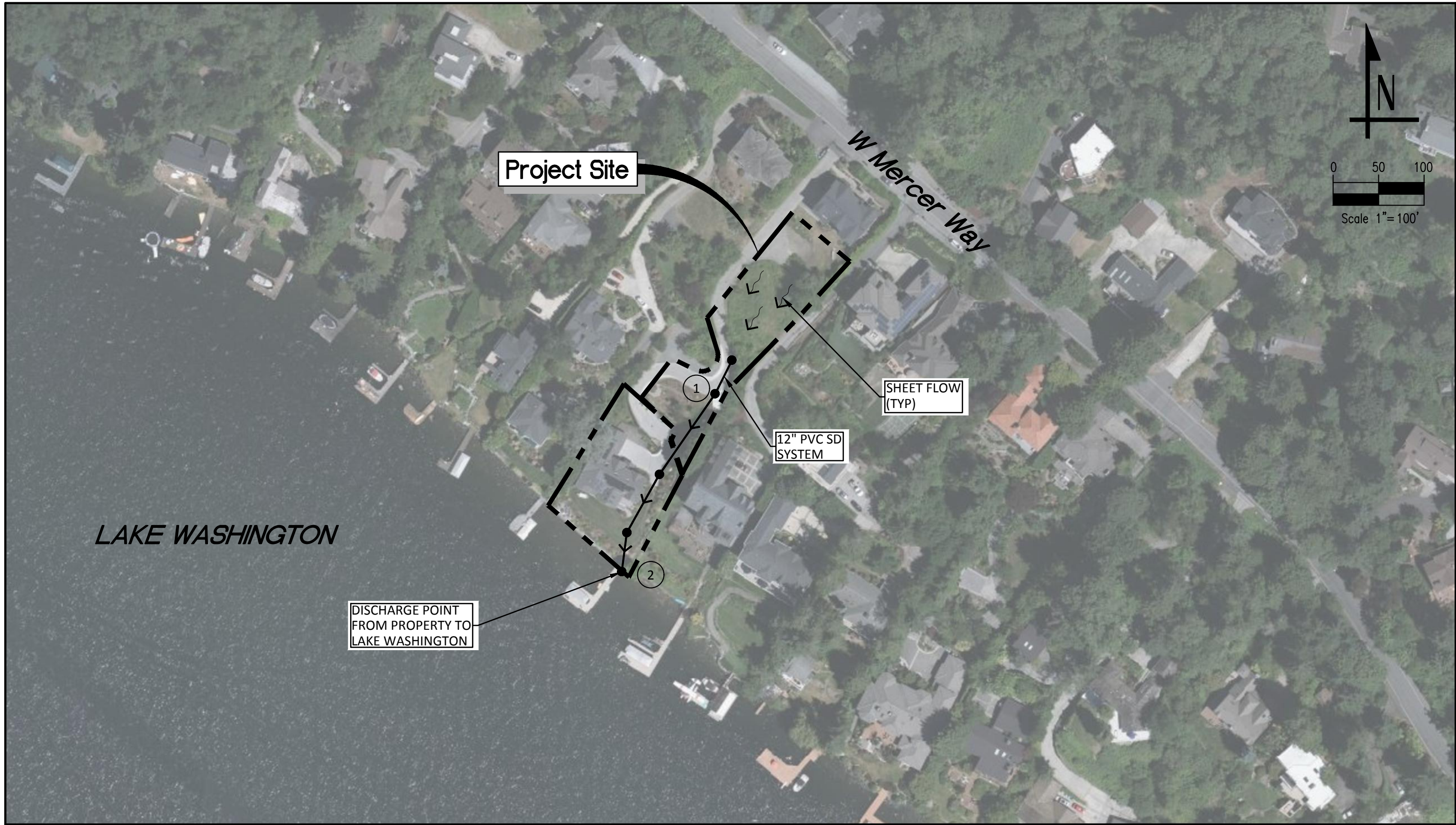
SOILS MAP

NOVEMBER 30, 2020

FIGURE

3

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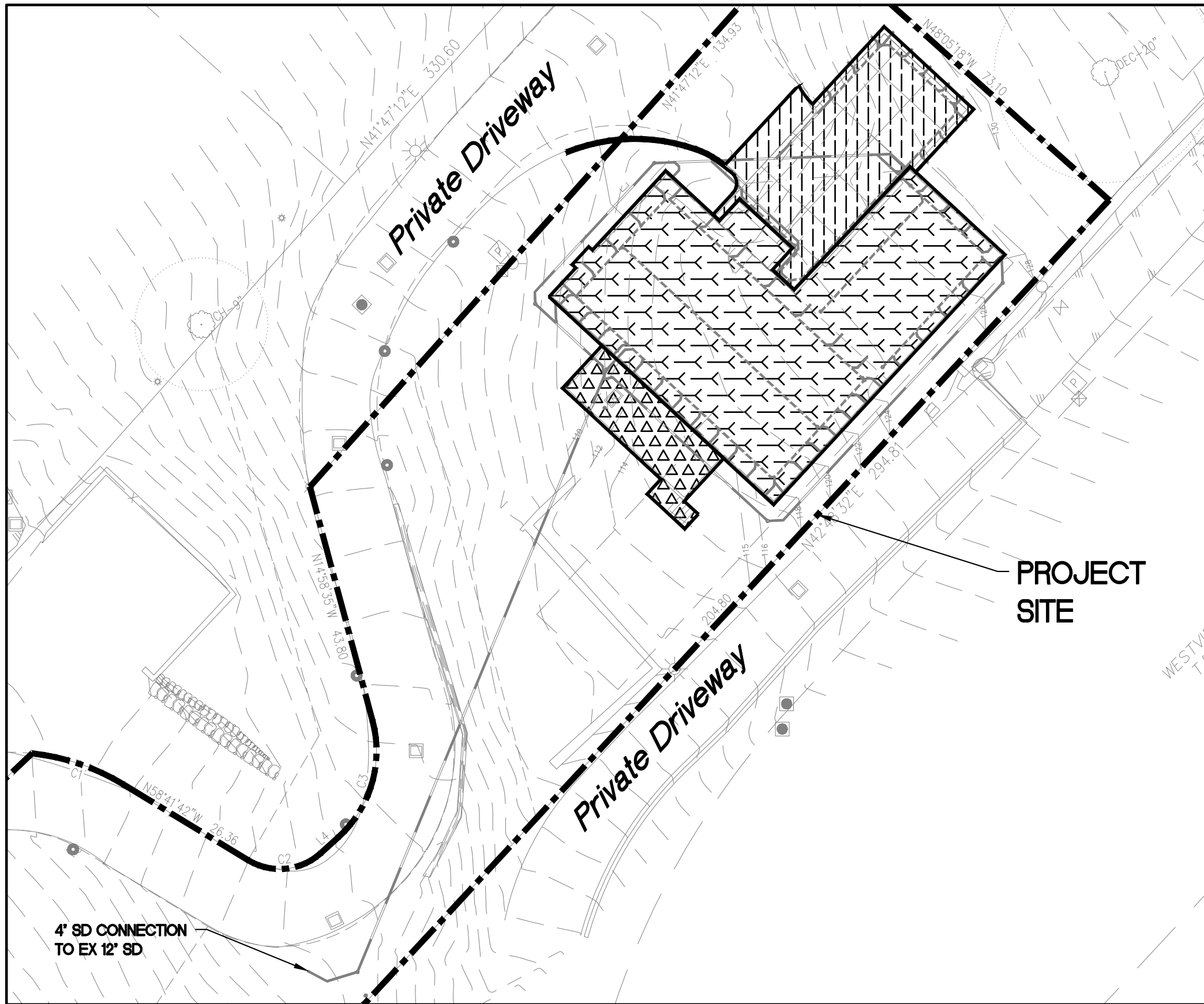
KAHAN RESIDENCE

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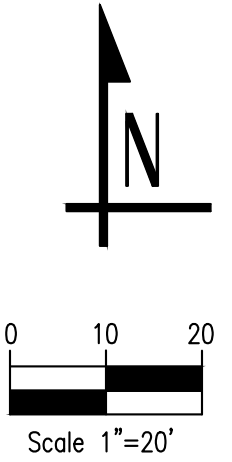
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DOWNSTREAM DRAINAGE MAP		4

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Hard Surface Summary

	BUILDING ROOF	2,503 SF (0.057 AC)
	CONCRETE DRIVEWAY (PGHS)	987 SF (0.023 AC)
	DECK/STAIRS (NPGHS)	347 SF (0.008 AC)
TOTAL NEW PLUS REPLACED HARD SURFACE		3,837 SF (0.088 AC)



KAHAN RESIDENCE

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DESCRIPTION

PROPOSED CONDITIONS

NOVEMBER 30, 2020

FIGURE

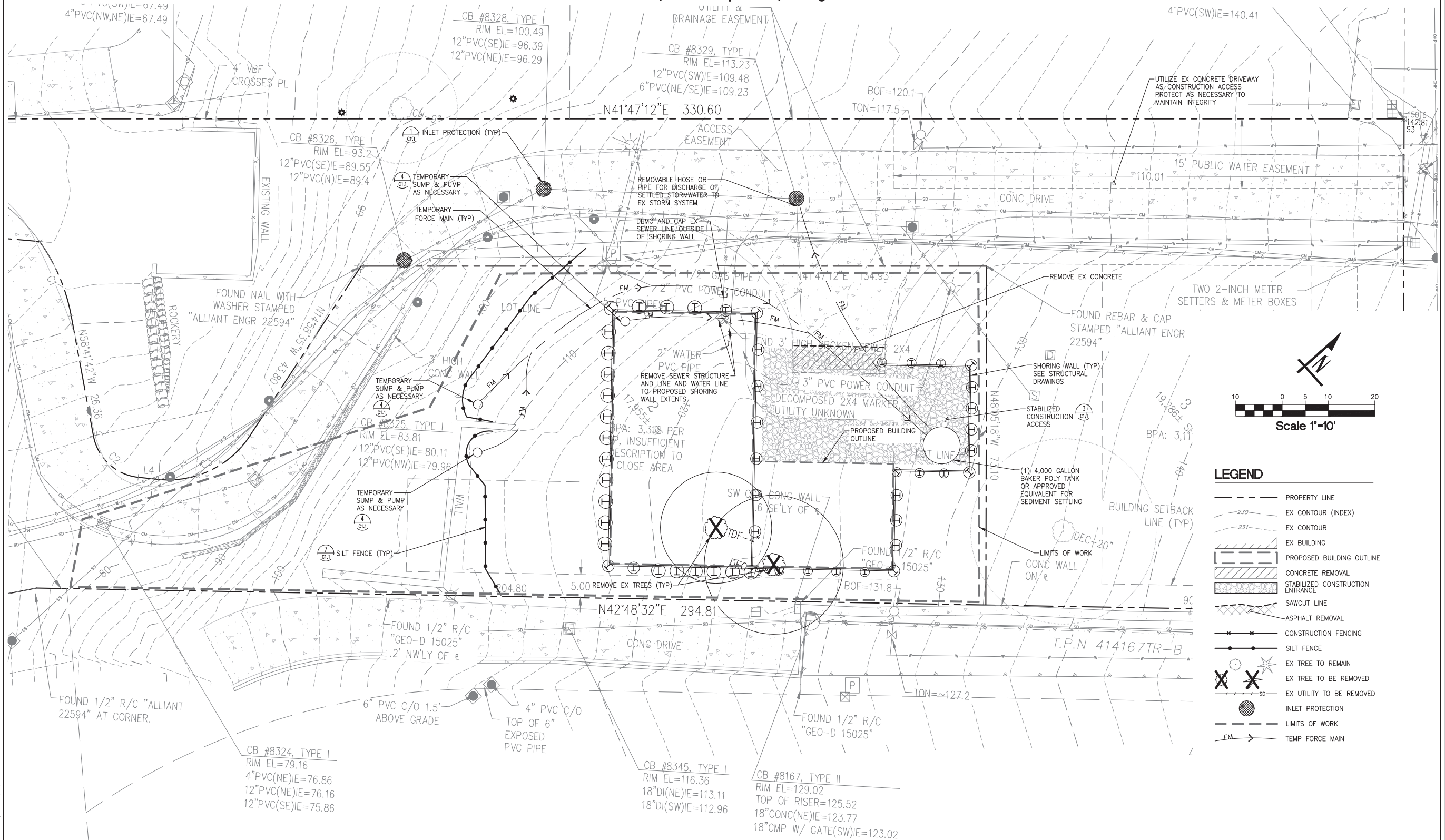
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APPENDIX A

Design Drawings

Section 36, Township 24N, Range 4E W.M.



LEGEND

	PROPERTY LINE
	EX CONTOUR (INDEX)
	EX CONTOUR
	EX BUILDING
	PROPOSED BUILDING OUTLINE
	CONCRETE REMOVAL
	STABILIZED CONSTRUCTION ENTRANCE
	SAWCUT LINE
	ASPHALT REMOVAL
	CONSTRUCTION FENCING
	SILT FENCE
	EX TREE TO REMAIN
	EX TREE TO BE REMOVED
	EX UTILITY TO BE REMOVED
	INLET PROTECTION
	LIMITS OF WORK
	TEMP FORCE MAIN



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No.	Revisions	Date

Project Name

**KAHAN RESIDENCE
8163 W MERCER WAY**

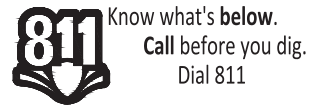
City of Mercer Island, Washington

Project No.	272-20-01
Issue Date	11/30/2020
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Designed	ACW
Checked	LJP
Drawn	KES
Approved	LJP

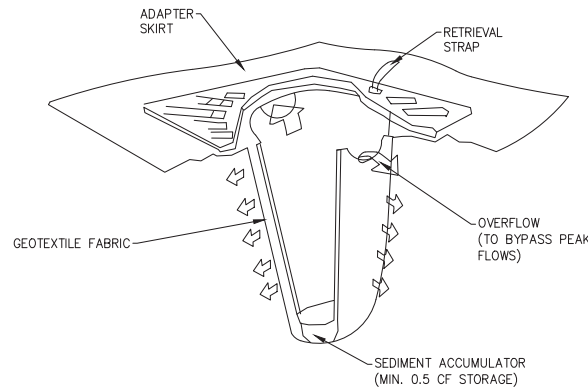
Description
TESC & DEMOLITION

Sheet
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WESTVIEW VENTURES LLC
T.P.N. 414167-0270



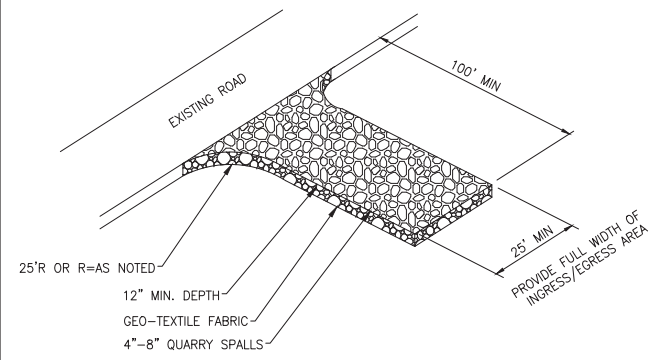
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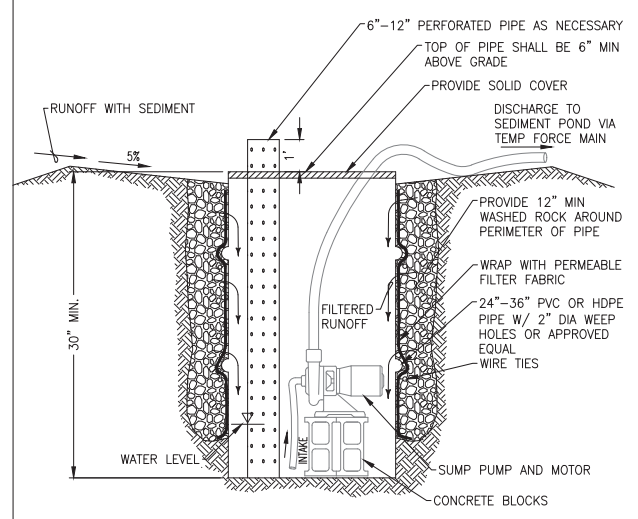
SCHEMATIC DETAIL

PROVIDE "STREAMGUARD SEDIMENT CATCH BASIN INSERT" OR APPROVED EQUAL MANUFACTURER'S NAME: BOWHEAD ENVIRONMENTAL & SAFETY
 ADDRESS: P.O. BOX 375 PRESTON, WA 98050
 TELEPHONE: FOR INFORMATION: (800) 909-3677
 WWW.SHOPBOWHEAD.COM

NTS
 INLET PROTECTION 1



NTS
 STABILIZED CONSTRUCTION ENTRANCE 3



NTS
 TEMPORARY SUMP & PUMP 4

EROSION AND SEDIMENTATION CONTROL NOTES

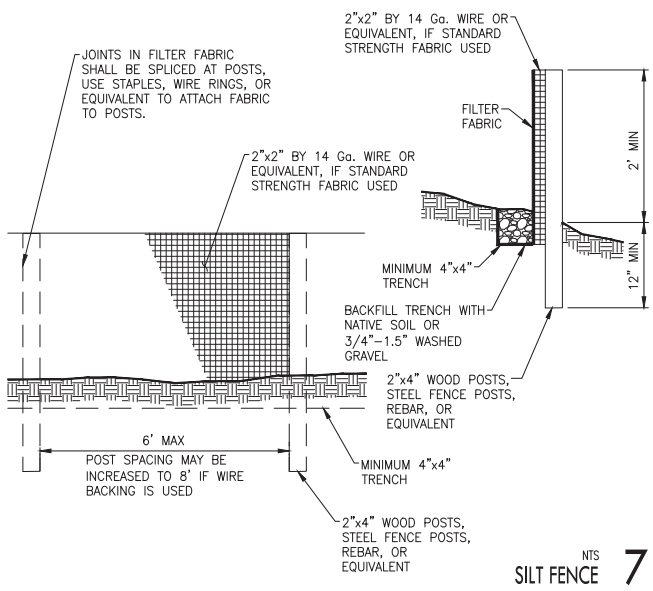
- THE IMPLEMENTATION OF THESE EROSION SEDIMENTATION CONTROL (ESC) PLANS AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS APPROVED.
- THE ESC FACILITIES SHOWN ON THIS PLAN MUST BE CONSTRUCTED IN CONJUNCTION WITH ALL CLEARING AND GRADING ACTIVITIES IN SUCH A MANNER AS TO INSURE THAT SEDIMENT-LADEN WATER DOES NOT ENTER THE DRAINAGE SYSTEM OR VIOLATE APPLICABLE WATER STANDARDS, AND MUST BE COMPLETED PRIOR TO ALL OTHER CONSTRUCTION.
- THE ESC FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, THESE ESC FACILITIES SHALL BE UPGRADED (E.G. ADDITIONAL SUMPS, RELOCATION OF DITCHES AND SILT FENCES), AS NEEDED FOR UNEXPECTED STORM EVENTS. ADDITIONALLY MORE ESC FACILITIES MAY BE REQUIRED TO ENSURE COMPLETE SILTATION CONTROL. THEREFORE, DURING THE COURSE OF CONSTRUCTION IT SHALL BE THE OBLIGATION AND RESPONSIBILITY OF THE CONTRACTOR TO ADDRESS ANY NEW CONDITIONS THAT MAY BE CREATED BY THEIR ACTIVITIES AND TO PROVIDE ADDITIONAL FACILITIES OVER AND ABOVE THE MINIMUM REQUIREMENTS AS MAY BE NEEDED.
- THE ESC FACILITIES SHALL BE INSPECTED DAILY DURING NON-RAINFALL PERIODS, EVERY HOUR (DAYLIGHT) DURING A RAINFALL EVENT AND AT THE END OF EVERY RAINFALL. BY THE PERMIT HOLDER/CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE THEIR CONTINUED FUNCTIONING. IN ADDITION, TEMP. SILTATION PONDS AND ALL TEMP. SILTATION CONTROLS SHALL BE MAINTAINED IN A SATISFACTORY CONDITION UNTIL SUCH TIME THAT CLEARING AND OR CONSTRUCTION IS COMPLETED, PERMANENT DRAINAGE FACILITIES ARE OPERATIONAL, AND THE POTENTIAL FOR EROSION HAS PASSED.
- ANY AREA STRIPPED OF VEGETATION, INCLUDING ROADWAY EMBANKMENTS WHERE NO FURTHER WORK IS ANTICIPATED FOR A PERIOD OF SEVEN (7) DAYS, SHALL BE IMMEDIATELY STABILIZED WITH THE APPROVED ESC METHODS (E.G. SEEDING, MULCHING, NETTING, EROSION, BLANKETS, ETC.)
- ANY AREAS NEEDING ESC MEASURES, NOT REQUIRING IMMEDIATE ATTENTION, SHALL BE ADDRESSED WITHIN SEVEN (7) DAYS.
- THE ESC FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN THE 48 HOURS FOLLOWING A STORM EVENT.
- AT NO TIME SHALL MORE THAN ONE FOOT OF SEDIMENT BE ALLOWED TO ACCUMULATE WITHIN A CATCH BASIN. ALL CATCH BASINS AND CONVEYANCE LINES SHALL BE CLEANED PRIOR TO PAVING. THE CLEANING OPERATION SHALL NOT FLUSH SEDIMENT LADEN WATER INTO DOWNSTREAM SYSTEM.
- WHERE SEEDING FOR TEMPORARY EROSION CONTROL IS REQUIRED, FAST GERMINATING GRASSES SHALL BE APPLIED AT AN APPROPRIATE RATE (E.G. ANNUAL OR PERENNIAL RYE APPLIED AT APPROXIMATELY 80 POUNDS PER ACRE).
- WHERE STRAW MULCH FOR TEMPORARY EROSION CONTROL IS REQUIRED, IT SHALL BE APPLIED AT A MINIMUM THICKNESS OF THREE INCHES.
- ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE CITY OF MERCER ISLAND STANDARDS AND SPECIFICATIONS.
- EROSION/SEDIMENTATION CONTROL FACILITIES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE DETAILS IN DEPARTMENT OF ECOLOGY STORMWATER MANAGEMENT MANUAL, UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
- A COPY OF THE APPROVED EROSION CONTROL PLANS MUST BE ON THE JOB SITE WHENEVER CONSTRUCTION IS IN PROGRESS.
- TEMPORARY EROSION/SEDIMENTATION CONTROLS SHALL BE INSTALLED & OPERATING PRIOR TO ANY GRADING OR LAND CLEARING.
- WHEREVER POSSIBLE, MAINTAIN NATURAL VEGETATION FOR SILT CONTROL.
- ALL CUT AND FILL SLOPES 5:1 (5 FEET HORIZONTAL TO 1 FOOT VERTICAL) OR STEEPER THAT WILL BE LEFT EXPOSED FOR MORE THAN 7 DAYS SHALL BE PROTECTED BY JUTE MATTING, PLASTIC SHEETING, MULCH, OR OTHER APPROVED STABILIZATION METHOD AND PROVIDED WITH ADEQUATE RUNOFF CONVEYANCE TO INTERCEPT RUNOFF AND CONVEY IT TO AN APPROVED STORM DRAIN.
- OFF-SITE STREETS MUST BE KEPT CLEAN AT ALL TIMES. IF DIRT IS DEPOSITED ON THE PUBLIC STREET, THE STREET SHALL BE CLEANED. ALL VEHICLES SHALL LEAVE THE SITE BY WAY OF THE CONSTRUCTION VEHICLE ENTRANCE AND SHALL BE CLEANED OF MUD PRIOR TO EXITING ONTO THE STREET. SILT SHALL BE CLEANED FROM ALL CATCH BASINS WHEN THE BOTTOM HALF BECOMES FILLED WITH SILT.
- ANY CATCH BASIN COLLECTING WATER FROM THE SITE, WHETHER THEY ARE ON OR OFF OF THE SITE, SHALL HAVE THEIR GRATES COVERED WITH FILTER FABRIC DURING CONSTRUCTION.
- IF ANY PORTION OF THE EROSION/SEDIMENTATION CONTROL ELEMENTS ARE DAMAGED OR NOT FUNCTIONING, OR IF THE CLEARING LIMIT BOUNDARY BECOMES NON-DEFINED, IT SHALL BE REPAIRED IMMEDIATELY.

NTS
 EROSION AND SEDIMENTATION CONTROL NOTES 9

CITY OF MERCER ISLAND NOTES

- ANY CHANGES TO THE APPROVED PLANS REQUIRES CITY APPROVAL THROUGH A REVISION.
- APPLICANT IS RESPONSIBLE FOR ANY DAMAGES TO UNDERGROUND UTILITIES CAUSED FROM THIS CONSTRUCTION.
- CATCH BASIN FILTERS SHOULD BE PROVIDED FOR ALL STORM DRAIN CATCH BASIN/INLETS DOWNSLOPE AND WITHIN 500 FEET OF THE CONSTRUCTION AREA. CATCH BASIN FILTERS SHOULD BE DESIGNED BY THE MANUFACTURER FOR USE AT CONSTRUCTION SITES AND APPROVED BY THE CITY INSPECTOR. CATCH BASIN FILTERS SHOULD BE INSPECTED FREQUENTLY, ESPECIALLY AFTER STORM EVENTS. IF THE FILTER BECOMES CLOGGED, IT SHOULD BE CLEANED OR REPLACED.
- CONTRACTORS SHALL VERIFY LOCATIONS AND DEPTHS OF UTILITIES.
- AT LEAST 48 HOURS PRIOR TO CONSTRUCTION, CALL "ONE CALL" AT 1.800.425.5555.
- DO NOT BACKFILL WITH NATIVE MATERIAL ON PUBLIC RIGHT-OF-WAY. ALL MATERIAL MUST BE IMPORTED.
- EROSION CONTROL: ALL "LAND DISTURBING ACTIVITY" IS SUBJECT TO PROVISIONS OF MERCER ISLAND ORDINANCE 95C-118 "STORM WATER MANAGEMENT." SPECIFIC ITEMS TO BE FOLLOWED AT YOUR SITE.
- PROTECT ADJACENT PROPERTIES FROM ANY INCREASED RUNOFF OR SEDIMENTATION DUE TO THE CONSTRUCTION PROJECT THROUGH THE USE OF APPROPRIATE "BEST MANAGEMENT PRACTICES" (BMP) EXAMPLES INCLUDE, BUT ARE NOT LIMITED TO, SEDIMENT TRAPS, SEDIMENT PONDS, FILTER FABRIC FENCES, VEGETATIVE BUFFER STRIPS OR BIOENGINEERED SWALES.
- CONSTRUCTION ACCESS TO SITE SHOULD BE LIMITED TO ONE ROUTE. STABILIZE ENTRANCE WITH QUARRY SPALLS TO PREVENT SEDIMENT FROM LEAVING THE SITE OR ENTERING THE STORM DRAINS.
- PREVENT SEDIMENT, CONSTRUCTION DEBRIS, PAINTS, SOLVENTS, ETC., OR OTHER TYPES OF POLLUTION FROM ENTERING PUBLIC STORM DRAINS. KEEP ALL POLLUTION ON YOUR SITE.
- ALL EXPOSED SOILS SHALL REMAIN DENUDED FOR NO LONGER THAN SEVEN (7) DAYS AND SHALL BE STABILIZED WITH MULCH, HAY, OR THE APPROPRIATE GROUND COVER. ALL EXPOSED SOILS SHALL BE COVERED IMMEDIATELY DURING ANY RAIN EVENT.
- INSTALLATION OF CONCRETE DRIVEWAYS, TREES, SHRUBS, IRRIGATION, BOULDERS, BERMS, WALLS, GATES, AND OTHER IMPROVEMENTS ARE NOT ALLOWED IN THE PUBLIC RIGHT-OF-WAY WITHOUT PRIOR APPROVAL, AND AN ENCROACHMENT AGREEMENT AND RIGHT OF WAY PERMIT FROM THE SENIOR DEVELOPMENT ENGINEER.
- OWNER SHALL CONTROL DISCHARGE OF SURFACE DRAINAGE RUNOFF FROM EXISTING AND NEW IMPERVIOUS AREAS IN A RESPONSIBLE MANNER. CONSTRUCTION OF NEW GUTTERS AND DOWNSPOUTS, DRY WELLS, LEVEL SPREADERS OR DOWNSTREAM CONVEYANCE PIPE MAY BE NECESSARY TO MINIMIZE DRAINAGE IMPACT TO YOUR NEIGHBORS. CONSTRUCTION OF MINIMUM DRAINAGE IMPROVEMENTS SHOWN OR CALLED OUT ON THIS PLAN DOES NOT IMPLY RELIEF FROM CIVIL LIABILITY FOR YOUR DOWNSTREAM DRAINAGE.
- POT HOLING THE PUBLIC UTILITIES IS REQUIRED PRIOR TO ANY GRADING ACTIVITIES LESS THAN 6" OVER THE PUBLIC MAINS (WATER, SEWER AND STORM SYSTEMS). IF THERE IS A CONFLICT, THE APPLICANT IS REQUIRED TO SUBMIT A REVISION FOR APPROVAL PRIOR TO ANY GRADING ACTIVITIES OVER THE PUBLIC MAINS.
- REMEMBER: EROSION CONTROL IS YOUR FIRST INSPECTION.
- ROOF DRAINS MUST BE CONNECTED TO THE STORM DRAIN SYSTEM AND INSPECTED BY THE PUBLIC WORKS DEPARTMENT PRIOR TO ANY BACKFILLING OF PIPE.
- SILT FENCE: CLEAN AND PROVIDE REGULAR MAINTENANCE OF THE SILT FENCE. THE FENCE IS TO REMAIN VERTICAL AND IS TO FUNCTION PROPERLY THROUGHOUT THE TERM OF THE PROJECT.
- WORK IN PUBLIC RIGHT OF WAY REQUIRES A RIGHT-OF-WAY USE PERMIT.
- REFER TO WATER SERVICE PERMIT FOR ACTUAL LOCATION OF NEW WATER METER AND SERVICE LINE DETERMINED BY MERCER ISLAND WATER DEPARTMENT.
- THE TV INSPECTION OF THE EXISTING SIDE SEWER TO THE CITY SEWER MAIN IS REQUIRED. IF THE RESULT OF THE TV INSPECTION IS NOT IN SATISFACTORY CONDITION, AS DETERMINED BY THE CITY OF MERCER ISLAND INSPECTOR, THE REPLACEMENT OF THE EXISTING SIDE SEWER IS REQUIRED. ALTERNATELY, A PRESSURE TEST OF THE SIDE SEWER, FROM SEWER MAIN TO POINT OF CONNECTION, MAY BE SUBSTITUTED FOR THE VIDEO INSPECTION.
- NEWLY INSTALLED SIDE SEWER REQUIRES A 4 P.S.I. AIR TEST OR PROVIDE 10' OF HYDROSTATIC HEAD TEST.
- THE LIMITS AND EXTENTS OF THE PAVEMENT IN THE PUBLIC RIGHT OF WAY SHALL BE DETERMINED BY THE CITY ENGINEER PRIOR TO FINALIZING THE PROJECT.
- TREE PROTECTION INSPECTION REQUIRED BEFORE ANY WORK BEGINS, CALL 206-275-7713.

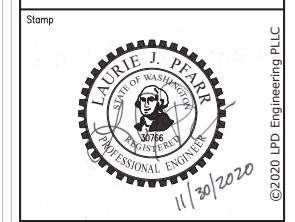
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 CITY OF MERCER ISLAND NOTES 10



NTS
 SILT FENCE 7

NTS
 NOT USED 11

NTS
 NOT USED 8



No.	Revisions	Date

Project Name

KAHAN RESIDENCE
8163 W MERCER WAY
 City of Mercer Island, Washington

Project No.	272-20-01
Issue Date	11/30/2020
Scale	As Noted
Designed	ACW
Checked	LJP
Drawn	KES
Approved	LJP

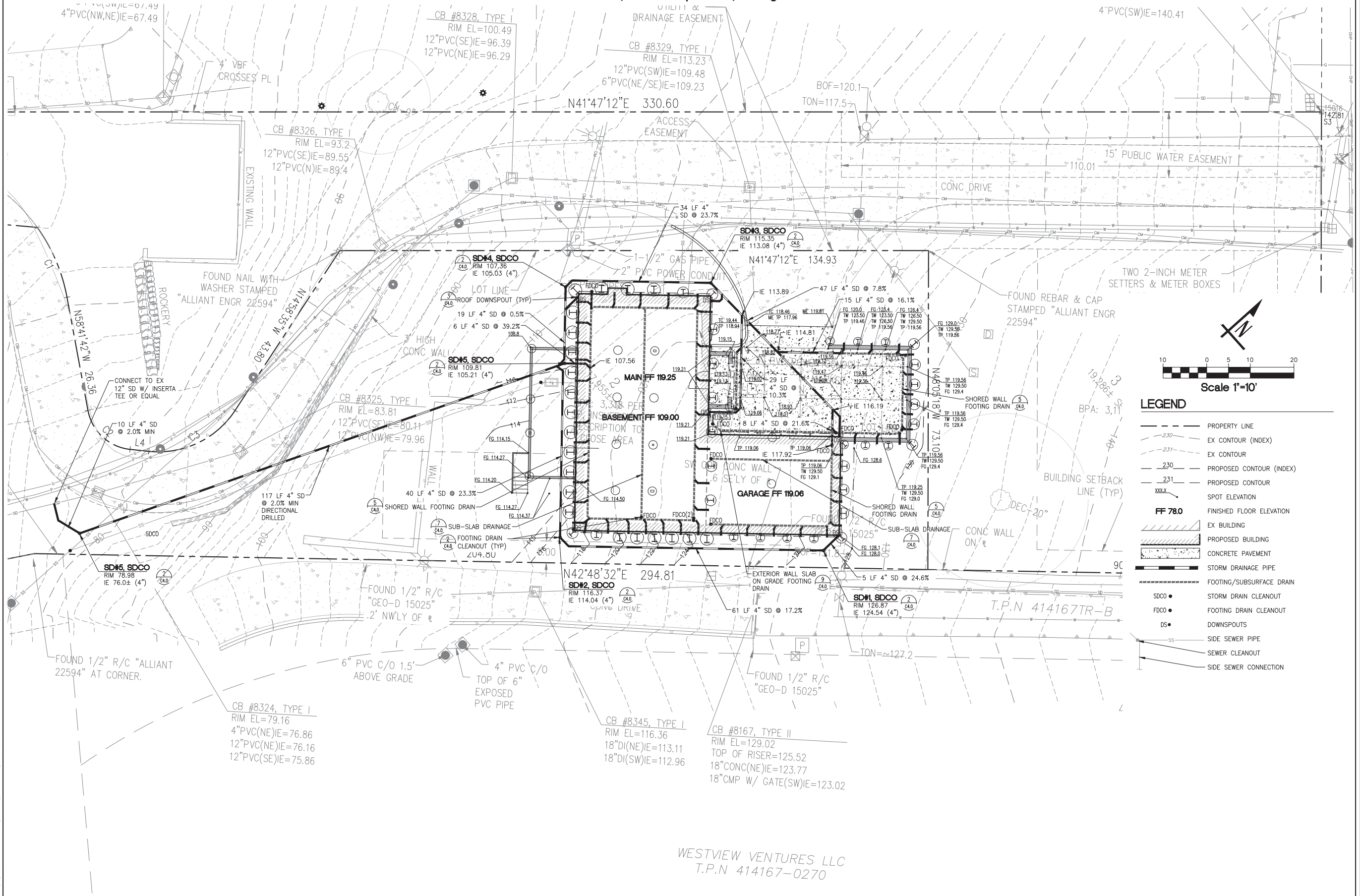
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Sheet
C1.1

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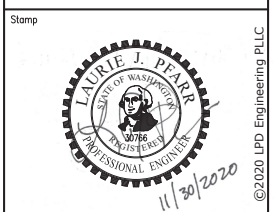
Permit Documents

Section 36, Township 24N, Range 4E W.M.



LEGEND

- PROPERTY LINE
- - - - EX CONTOUR (INDEX)
- - - - EX CONTOUR
- - - - PROPOSED CONTOUR (INDEX)
- - - - PROPOSED CONTOUR
- SPOT ELEVATION
- FF 78.0 FINISHED FLOOR ELEVATION
- ▨ EX BUILDING
- ▨ PROPOSED BUILDING
- ▨ CONCRETE PAVEMENT
- STORM DRAINAGE PIPE
- FOOTING/SUBSURFACE DRAIN
- SDCO • STORM DRAIN CLEANOUT
- FDCO • FOOTING DRAIN CLEANOUT
- DS • DOWNSPOUTS
- SS --- SIDE SEWER PIPE
- SEWER CLEANOUT
- SIDE SEWER CONNECTION



No.	Revisions	Date



Project Name
 KAHAN RESIDENCE
 8163 W MERCER WAY
 City of Mercer Island, Washington

Project No.	272-20-01
Issue Date	11/30/2020
Scale	1"=10'
Designed	ACW
Checked	LJP
Drawn	KES
Approved	LJP

Description
GRADING & DRAINAGE

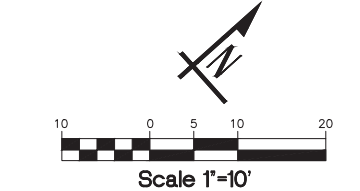
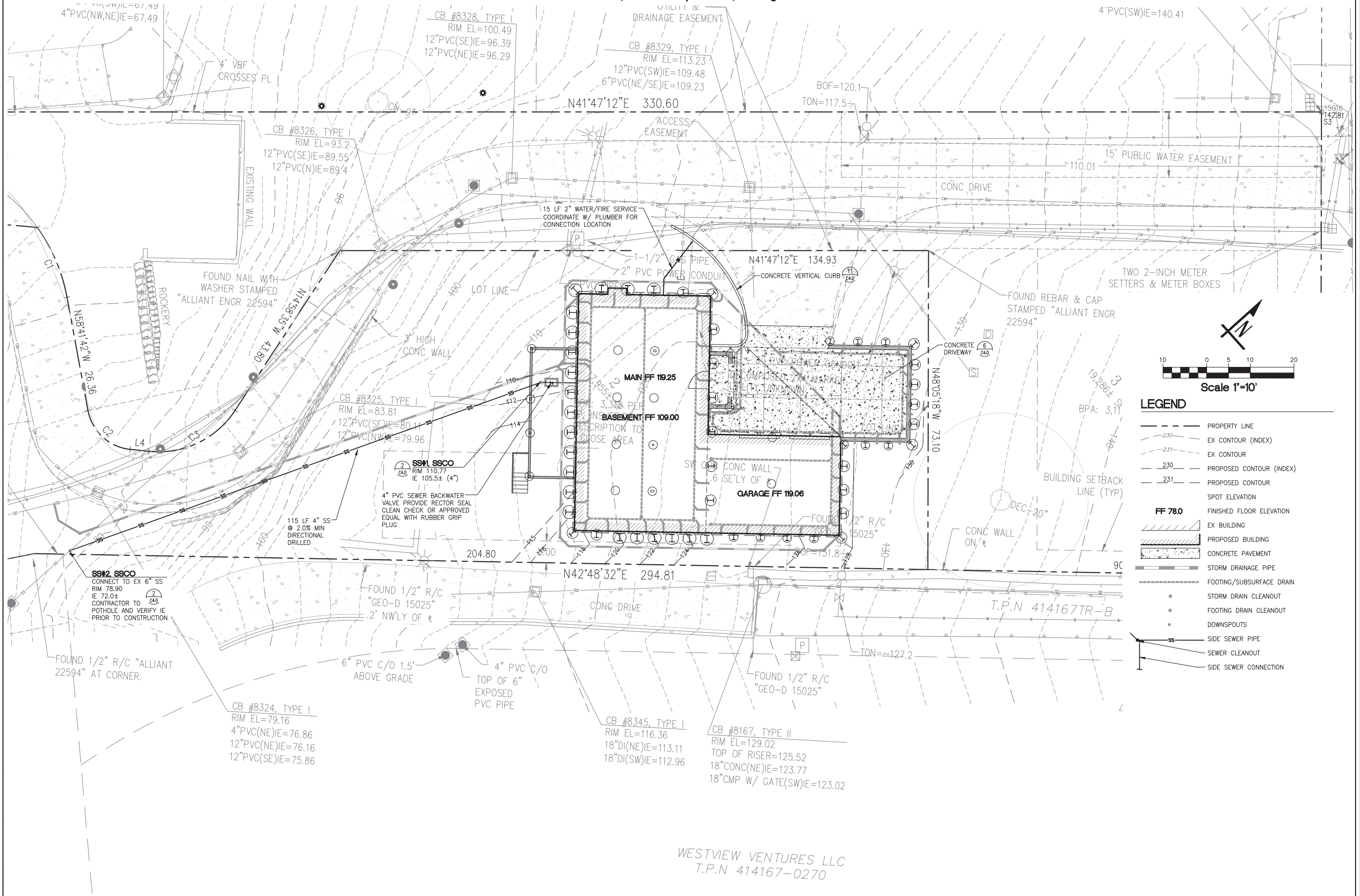
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WESTVIEW VENTURES LLC
 T.P.N 414167-0270



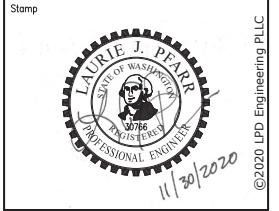
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Section 36, Township 24N, Range 4E W.M.



LEGEND

- PROPERTY LINE
- - - - EX CONTOUR (INDEX)
- - - - EX CONTOUR
- - - - PROPOSED CONTOUR (INDEX)
- - - - PROPOSED CONTOUR
- SPOT ELEVATION
- FF 78.0 FINISHED FLOOR ELEVATION
- ▨ EX BUILDING
- ▨ PROPOSED BUILDING
- ▨ CONCRETE PAVEMENT
- ▨ STORM DRAINAGE PIPE
- ▨ FOOTING/SUBSURFACE DRAIN
- STORM DRAIN CLEANOUT
- FOOTING DRAIN CLEANOUT
- DOWNSPOUTS
- SS SIDE SEWER PIPE
- SEWER CLEANOUT
- SIDE SEWER CONNECTION



No.	Revisions	Date

Project Name

KAHAN RESIDENCE
8163 W MERCER WAY
 City of Mercer Island, Washington

Project No.	272-20-01
Issue Date	11/30/2020
Scale	1"=10'
Designed	ACW Checked LJP
Drawn	KES Approved LJP

Description

UTILITIES & PAVING

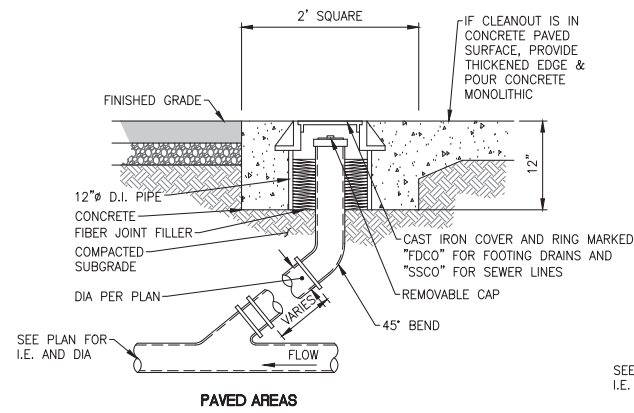
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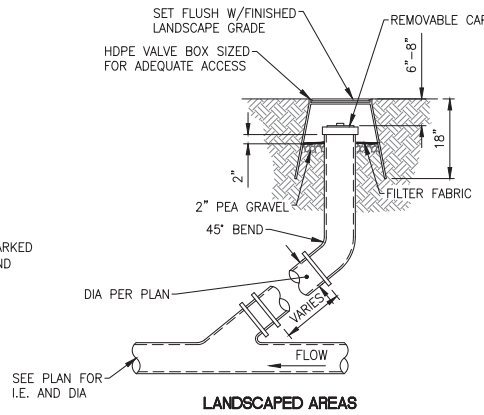
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 T.P.N 414167-0270



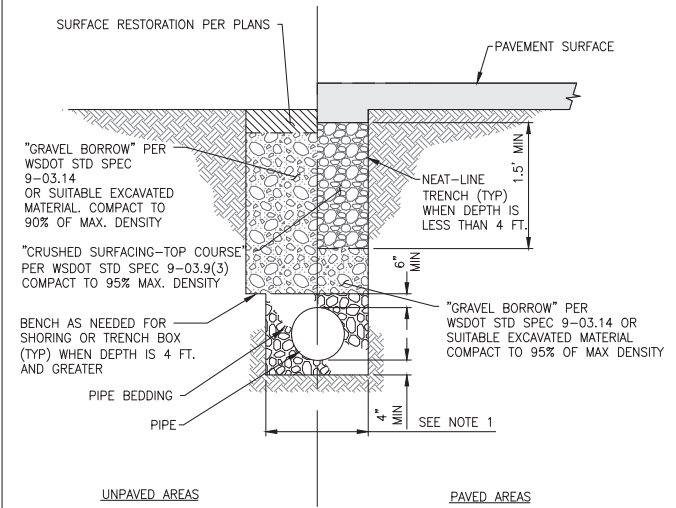
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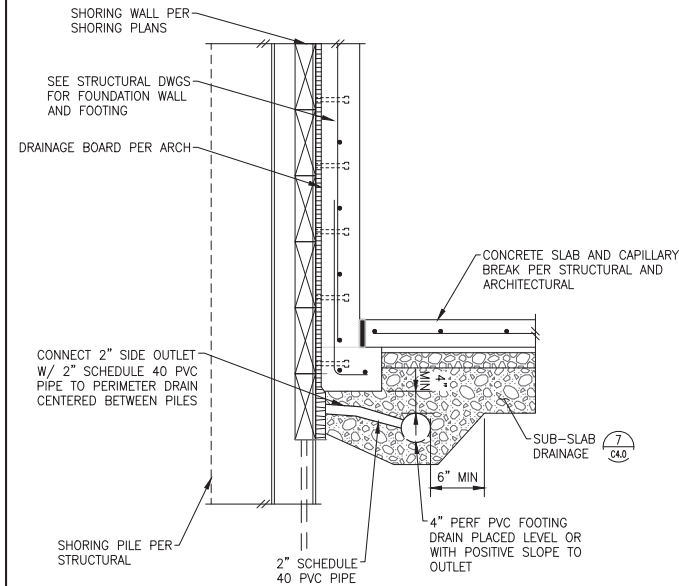
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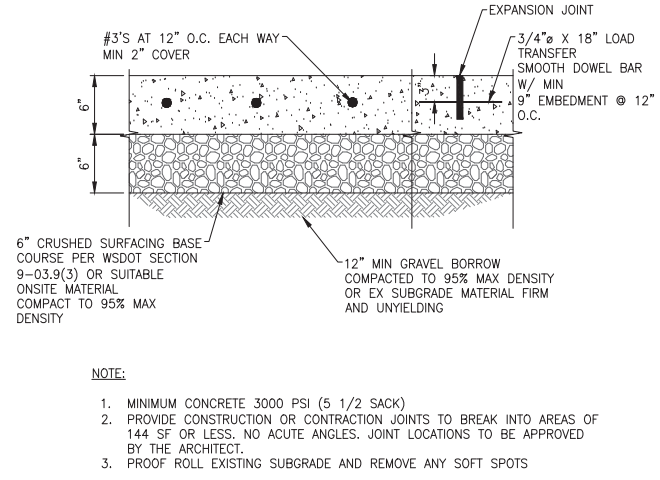
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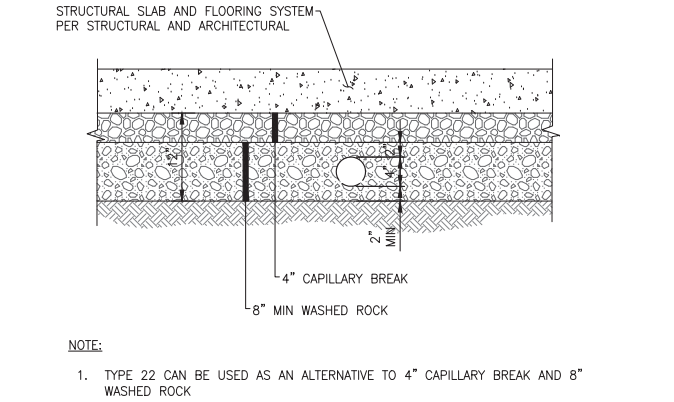
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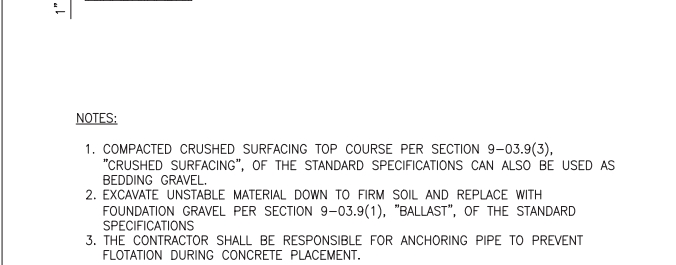
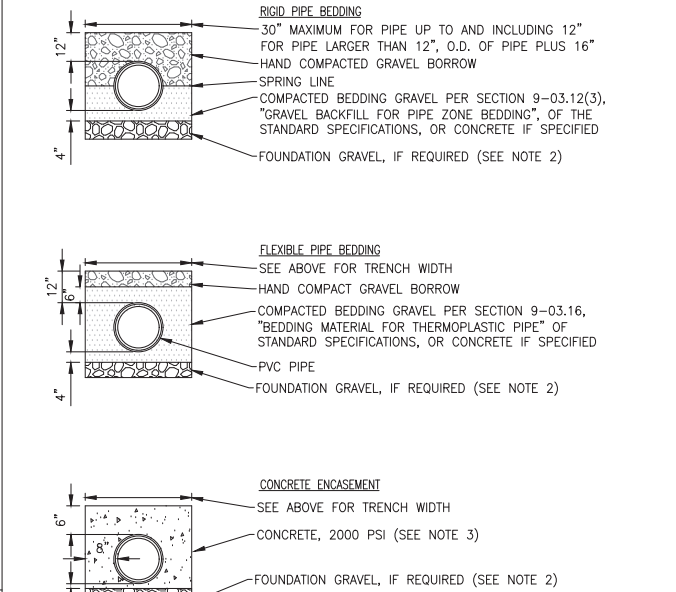
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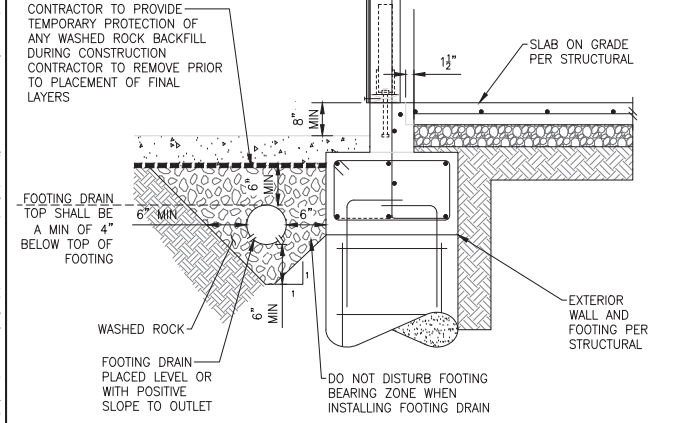
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CONCRETE DRIVEWAY 6



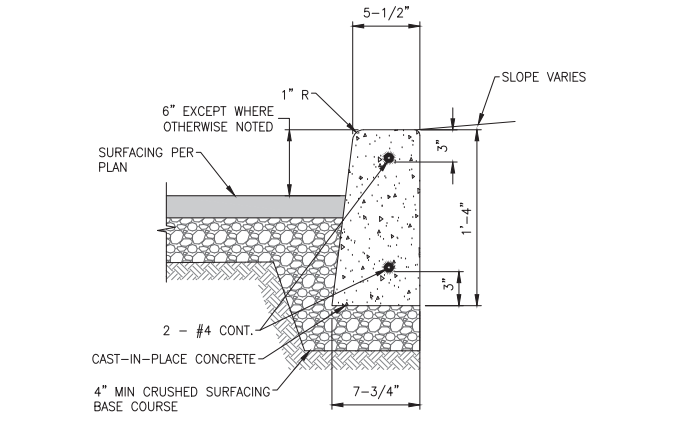
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SUB-SLAB DRAINAGE 7



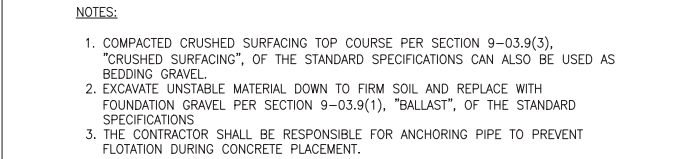
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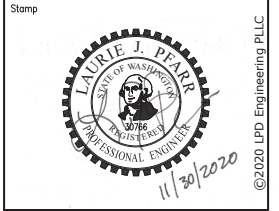
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NOT USED 10



NTS
CONCRETE VERTICAL CURB 11



NTS
PIPE TRENCH 12



No.	Revisions	Date

Project Name

KAHAN RESIDENCE
8163 W MERCER WAY
City of Mercer Island, Washington

Project No.	272-20-01
Issue Date	11/30/2020
Scale	As Noted
Designed	ACW
Checked	LJP
Drawn	KES
Approved	LJP

Description
DRAINAGE, UTILITIES & PAVING DETAILS

Sheet
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Permit Documents



APPENDIX B

Design Calculations and Supporting Information

Kahan Residence
Conveyance Analysis Spreadsheet

11/30/2020

Pipe Run	Size <i>(inches)</i>	Mannings N	Plan Slope <i>(ft/ft)</i>	Qfull <i>(cfs)</i>	Tributary Basins	Total Tributary Area <i>(acres)</i>	Tributary Impervious Area <i>(acres)</i>	Tributary Pervious Area <i>(acres)</i>	Qtrib, 25-year (MGSFlood, 15 min) <i>(cfs)</i>	% Full	Qtrib, 100-year (MGSFlood, 15 min) <i>(cfs)</i>	% Full
Southwest Outlet	4	0.011	0.02	0.32	Building Roof	0.057	0.057	0.000	0.039	12%	0.058	18%

MGS FLOOD
PROJECT REPORT – CONVEYANCE (SW 4” SD OUTLET)

Program Version: MGSFlood 4.50
Program License Number: 201410003
Project Simulation Performed on: 11/25/2020 4:00 PM
Report Generation Date: 11/25/2020 4:01 PM

Input File Name: Conveyance.fld
Project Name: Kahan Residence
Analysis Title: Conveyance
Comments: Tributary area includes building roof

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

***** Default HSPF Parameters Used (Not Modified by User) *****

***** **WATERSHED DEFINITION** *****

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	0.057	0.057
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	0.057	0.057

-----**SCENARIO: PREDEVELOPED**

Number of Subbasins: 1

----- Subbasin : Subbasin 1 -----
-----Area (Acres) -----
Impervious 0.057

Subbasin Total 0.057

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

----- Subbasin : Subbasin 1 -----
-----Area (Acres) -----
Impervious 0.057

Subbasin Total 0.057

*****FLOOD FREQUENCY AND DURATION STATISTICS*****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

Number of Links: 0

*****Compliance Point Results*****

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

*** Point of Compliance Flow Frequency Data ***

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	2.124E-02	2-Year	2.124E-02
5-Year	2.759E-02	5-Year	2.759E-02
10-Year	3.104E-02	10-Year	3.104E-02
25-Year	3.907E-02	25-Year	3.907E-02
50-Year	4.973E-02	50-Year	4.973E-02
100-Year	5.750E-02	100-Year	5.750E-02
200-Year	5.960E-02	200-Year	5.960E-02
500-Year	6.238E-02	500-Year	6.238E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

Sediment Facility Sizing Calculations

Per the 2014 DOE Manual

Project Name: Kahan Residence

Required Sediment Facility Surface Area (SA):

$$SA = 2 \cdot Q / V_{sed}$$

Where: Q = 2-year developed flow rate from MGS Flood
V_{sed} = Settling Velocity (0.00096 ft/sec)

Calculation:	multiplier =	2	
	Q =	0.0321	cfs
	V _{sed} =	0.00096	fps
	Required SA =	66.8	square feet

Equivalent Sediment Trap Volume:

To determine the minimum sediment trap volume, an equivalent sediment trap was sized based upon the required surface area.

Length of Top Surface Area =	9	feet
Width of Top Surface Area =	8	feet
Surface Area Provided =	72	square feet
Side Slope =	0	(H:1V)
Total Depth of Sediment Trap =	3.5	feet
Bottom Length of Sediment Trap =	9	feet
Bottom Width of Sediment Trap =	8	feet
Total pond Volume =	252	cubic feet
	1884.96	gallons

MGS FLOOD
PROJECT REPORT – TESC SEDIMENT SIZING

Program Version: MGSFlood 4.50
Program License Number: 201410003
Project Simulation Performed on: 11/25/2020 3:56 PM
Report Generation Date: 11/25/2020 3:56 PM

Input File Name: TESC Sizing.fld
Project Name: Kahan Residence
Analysis Title: TESC Sizing
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

***** Default HSPF Parameters Used (Not Modified by User) *****

***** **WATERSHED DEFINITION** *****

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	0.086	0.086
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	0.086	0.086

-----**SCENARIO: PREDEVELOPED**

Number of Subbasins: 1

----- Subbasin : Subbasin 1 -----
-----Area (Acres) -----
Impervious 0.086

Subbasin Total 0.086

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

----- Subbasin : Subbasin 1 -----
 -----Area (Acres) -----
 Impervious 0.086

 Subbasin Total 0.086

*****FLOOD FREQUENCY AND DURATION STATISTICS*****

-----SCENARIO: PREDEVELOPED

Number of Subbasins: 1

Number of Links: 0

-----SCENARIO: POSTDEVELOPED

Number of Subbasins: 1

Number of Links: 0

*****Compliance Point Results *****

Scenario Predeveloped Compliance Subbasin: Subbasin 1

Scenario Postdeveloped Compliance Subbasin: Subbasin 1

*** Point of Compliance Flow Frequency Data ***

Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	3.205E-02	2-Year	3.205E-02
5-Year	4.163E-02	5-Year	4.163E-02
10-Year	4.683E-02	10-Year	4.683E-02
25-Year	5.895E-02	25-Year	5.895E-02
50-Year	7.504E-02	50-Year	7.504E-02
100-Year	8.676E-02	100-Year	8.676E-02
200-Year	8.993E-02	200-Year	8.993E-02
500-Year	9.411E-02	500-Year	9.411E-02

** Record too Short to Compute Peak Discharge for These Recurrence Intervals



APPENDIX C

Construction Stormwater Pollution Prevention Plan (SWPPP)

KAHAN RESIDENCE

CONSTRUCTION SWPPP NARRATIVE

NOVEMBER 30, 2020

The following Construction Storm Water Pollution Prevention Plan (SWPPP) narrative is for the Kahan Residence project at 8163 West Mercer Way in Mercer Island, Washington. The narrative supplements the Temporary Erosion and Sediment Control (TESC) plan. This narrative and the drawings address the requirements of Volume II of the 2014 Department of Ecology (DOE) Stormwater Management Manual for Western Washington. Refer to the TESC plan (Sheet C1.0) and TESC details (Sheet C1.1) for more information regarding any erosion or sedimentation control measures involved in this project.

I. CONSTRUCTION STORMWATER POLLUTION PREVENTION ELEMENTS

- 1) **Mark Clearing Limits:** Clearing limits will be delineated on the TESC and Site Demolition plan. The actual limits of clearing will likely be smaller than the limit of work, but this identifies the maximum extent of the clearing limits. Areas impacted and not anticipated to be covered with final measures shall be stabilized using approved permanent TESC methods.
- 2) **Establish Construction Access:** Construction access will be provided via the existing concrete driveway from W Mercer Way. The Contractor shall provide wheel wash if necessary.
- 3) **Control Flow Rates:** Stormwater flow control during construction is anticipated to be mitigated by routing runoff to a temporary sediment settling tank. Refer to the Sediment Facility Sizing calculations and the MGS Flood output included within Appendix B of the project's stormwater site plan.
- 4) **Install Sediment Controls:** DOE approved BMPs for sediment controls are shown on the TESC plan. Sediment will be controlled using silt fence (BMP C233).
- 5) **Stabilize Soils:** It is possible that some of the earthwork and grading may occur in wet weather conditions. The site must be stabilized and no soils will be allowed to remain unstabilized for more than two days between October 1st and April 30th. From May 1 through September 30, install cover measures to protect disturbed areas that will remain unworked for seven days or more. By October 8, seed all areas that will remain unworked from October 1 through April 30. Mulch all seeded areas.

Exposed slopes will be protected by DOE-approved coverage methods. BMPs including, but not limited to: C101, Preserving Natural Vegetation; C121, Mulching; C123, Plastic Covering; C130, Surface Roughening; C140, Dust Control; and T5.13 Post Construction Soil Amendment will be used to stabilize on-site soils during construction.

- 6) **Protect Slopes:** The DOE-approved BMPs for slope protection will be utilized during construction. Concentrated discharges shall not be allowed to flow over the top of steep slopes. BMPs including, but not limited to C101, Preserving Natural Vegetation; C208, Triangular Silt Dike; and C233, Silt Fence are to be utilized to protect slopes during construction.

- 7) **Protect Drain Inlets:** Drainage structures in areas where no work occurs will remain and will be protected; discharge points to the public storm drain main line will also be protected. To prevent discharge of turbid water downstream, all existing catch basins located within the disturbance area and outside of the disturbance area within approximately 300 feet downstream of the site will be protected with storm drain inlet protection (BMP C220). The Contractor shall remove inlet protection at the end of the project without releasing captured sediment into the storm system.
- 8) **Stabilize Channels and Outlets:** Channels are not proposed as part of this project and BMPs for channel stabilization are not expected. DOE-approved BMPs for channel stabilization include, but are not limited to: C200, Interceptor Dike and Swale; and C207, Check Dams.
- 9) **Control Pollutants:** Temporary protection of the disturbed soils provides the first level of protection for pollution control, and perimeter measures downstream will mitigate the remaining pollutants. The temporary protection of disturbed soils may be mitigated with a temporary sump and pump facility to provide the second level of interception of pollutants. This collection system filters sediments prior to the pump system. The pump system will then route stormwater via force mains into the temporary sediment settling tank. Construction debris will be removed from the site. The Contractor will be responsible for managing their construction equipment per DOE-approved BMPs. If a truck wheel wash is required, truck wheel wash water and concrete truck washout water shall be collected and discharged to the public sanitary sewer (SS) system. To apply for and obtain a SS release, contact the local sewer purveyors (City of Mercer Island and King County Metro) for authorization.
- 10) **Control De-Watering:** The majority of the earthwork on the project will be constructed during the dry season, therefore it is not anticipated that groundwater will be encountered in the excavations for this project. In the event that perched groundwater is encountered during any wet season construction, the Contractor shall route it to the sediment settling facility by pumping it out of the excavation.
- 11) **Maintain BMPs:** DOE-approved standard BMP maintenance will be required in accordance with the DOE standard TESC plan notes and the City of Mercer Island Notes (Sheet C1.1)
- 12) **Manage the Project:** All phases of construction will be managed by the Contractor. The site must be stabilized and no soils will be allowed to remain exposed and unworked for more than two days between October 1st and April 30th and for more than seven days between May 1st and September 30th. The Contractor will provide maintenance and monitoring of TESC BMPs. Work of all contractors will be coordinated to minimize the duration of disturbance on the site. The best management practices shown on the TESC plan are minimum requirements. Failure to maintain SWPPP measures in accordance with adopted standards may result in the work being performed at the City's direction and the costs assessed as a lien against the property where such facilities are located.
- 13) **Protect LID BMPs:** There are no proposed LID facilities associated with this project, and therefore protection for element 13 is not required.

2. PROJECT DESCRIPTION

The proposed project will include the construction of a new single-family residence on the undeveloped parcel included in the property, as well as an attached garage building and extension to the existing driveway.

The project proposes 3,837 square feet (0.088 acres) of new plus replaced hard surface. Flow control is not required, as the site directly discharges to a flow control-exempt surface water (Lake Washington). Water quality treatment is not required because the project proposes less than 5,000 square feet of pollution-generating hard surface (PGHS) and less than $\frac{3}{4}$ acre of pollution-generating pervious surface (PGPS). Refer to the project's stormwater site plan for more information.

3. EXISTING SITE CONDITIONS

The property (Parcel #3358500387) is undeveloped and has a total area of approximately 17,955 square feet (0.412 acres). Topography for the site is fairly steep, falling from approximately 130 feet in the northeast corner to 10 feet at the southwest corner. The steepest slopes on the site are approximately 67%.

Per the King County iMap, the project is within the Lake Washington drainage Basin. Runoff from the site is generally collected in catch basins and conveyed southwest to the discharge point of Lake Washington.

4. ADJACENT AREAS

The site is bounded by single-family residences on all sides with an access easement to W Mercer Way to the northeast. Vehicular access to the site is from W Mercer Way.

5. CRITICAL AREAS

King County critical areas mapping indicates that the entire site is located in a designated Erosion Hazard area. Other environmental maps available from the City of Mercer Island indicate that the majority of the site is a protected slope area with Steep Slope Hazards. Other ECAs include both Potential Slide and Seismic Hazards.

6. SOILS

Per the Natural Resources Conservation Service Web Soil Survey, the entire site is underlain with Kitsap silt loam, 2 to 8 percent slopes (KpD). A geotechnical report has been prepared by Geotech Consultants Inc., dated October 6, 2020. The subsurface explorations on the site revealed soil conditions characterized by low permeability. In some areas, conducting test borings was a challenge due to the presence of dense or cobbly subsurface soil conditions.

7. POTENTIAL EROSION PROBLEM AREAS

The site is within an erosion hazard area. Therefore, per the proposed contract documents, the contractor is to provide protection for soils to limit the exposure to erosion. The limitation of disturbance, adequate cover practices, seasonal work limitation, and runoff control are the most effective methods for reduction of turbidity in stormwater runoff. Any runoff that occurs will be directed to the temporary sump and then pumped to the sediment settling tank. Areas that have

not been permanently stabilized must be addressed using DOE-approved BMPs, per the construction documents.

8. CONSTRUCTION PHASING

At this time, it is not expected that the project will be formally phased. The contractor is responsible for coordinating work of all subcontractors to keep the duration of site disturbance limited to the maximum extent possible.

9. CONSTRUCTION SCHEDULE

Construction is expected to begin in Spring 2021 and be completed by Winter 2021.

Earthwork activities are not expected to take place in the wet season, October 1st to April 30th. Should any wet weather conditions occur during construction, the contractor shall implement the de-watering procedures outlined in this SWPPP and applicable BMPs including, but not limited to C123, Plastic Covering; C121, Mulching; C122, Nets and Blankets; C126, Polyacrylamide for Soil Erosion Protection; C130, Surface Roughening.

10. FINANCIAL/OWNERSHIP RESPONSIBILITIES

This property is owned and operated by the John and Heather Kahan. The accepted low bidder on the project will be responsible for posting a performance and payment bond with the Kahans, and thus will be the responsible party for any liability associated with erosion and sedimentation impact.

11. ENGINEERING CALCULATIONS

A copy of any calculations performed during design of the project and relevant storm drainage modeling discussions is included in the project's Stormwater Site Plan.



APPENDIX D

Geotechnical Report

October 6, 2020

JN 20279

John Kahan
8167 West Mercer Way
Mercer Island, Washington

via email: jbkahan@msn.com

Subject: **Transmittal Letter – Geotechnical Engineering Study and Critical Area Study**
Proposed New Residence
8163 West Mercer Way
Mercer Island, Washington

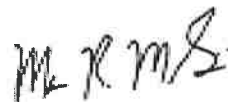
Dear Mr. Kahan,

Attached to this transmittal letter is our geotechnical engineering report for the proposed new residence to be constructed in Mercer Island. The scope of our services consisted of exploring site surface and subsurface conditions, and then developing this report to provide recommendations for general earthwork and design considerations for foundations, retaining walls, subsurface drainage, slope stability, and temporary excavations and shoring. This work was authorized by your acceptance of our proposal, P-10654, dated July 30, 2020.

The attached report contains a discussion of the study and our recommendations. Please contact us if there are any questions regarding this report, or for further assistance during the design and construction phases of this project.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.



Marc R. McGinnis, P.E.
Principal

cc: **Brandt Design Group** – Bree Medley
via email: bree@brandtdesigngroup.com

MKM/MRM:kg

GEOTECHNICAL ENGINEERING STUDY
Proposed New Residence
8163 West Mercer Way
Mercer Island, Washington

This report presents the findings and recommendations of our geotechnical engineering study for the site of the proposed new residence to be constructed in Mercer Island.

Development of the property is in the planning stage, and detailed plans were not available at the time of this study. Preliminary plans were provided to us, prepared by Brandt Design Group, dated May 20, 2020. A topographic survey had also been prepared by CORE Design, dated April 20, 2015. For the purposes of this report, Project North is parallel to West Mercer Way, which is the same orientation used on Brandt Design's plans. Based on the plans, the property will be developed with a new residence located on the eastern extent of the irregular shaped lot. The new house will be two stories in height and will contain a western facing daylight basement. A two-story deck is shown extending off the western side of the main and upper levels, and a patio will likely be constructed off the west side of the house at the basement level. Currently, the existing driveway apron is proposed for use in the new construction, and will provide access to an attached, two-car garage. An accessory parking spot is shown east of the driveway. Preliminary property line setbacks of 10 feet from the north, 20 feet from the east, and 7.5 feet from the south are shown. Based on the preliminary cross sections, finish floor elevations of 119.25 feet and 109 feet are proposed for the main floor and basement. Based on these elevations, we can anticipate that excavations for the garage are planned to be relatively minimal, and excavations for the daylight basement and accessory parking area will be on the order of 10 feet.

If the scope of the project changes from what we have described above, we should be provided with revised plans in order to determine if modifications to the recommendations and conclusions of this report are warranted.

SITE CONDITIONS

SURFACE

The Vicinity Map, Plate 1, illustrates the general location of the site near the southern tip of Mercer Island. The irregularly-shaped site encompasses approximately 0.4 acres between two other single-family properties connected by a winding, private driveway. The site is bordered to the north and south by driveways, and to the east and west by single family properties containing large single-family residences. The western adjacent property is owned by the client and is located well away from the subject site. The upslope, eastern property contains a newer two-story residence with a daylight basement situated greater than 10 feet from the property line. The neighbor's yard appears to extend past the surveyed property lines based on observations made in the field.

The site is currently undeveloped and is covered with blackberry bushes and tall grass. As mentioned previously, a hammerhead apron was installed into the expected building area when the driveway was originally constructed. What appears to be an old house foundation is located west of the development area, near where the lot necks down as the driveway meanders to the south to the adjacent western house. Previous documentation would indicate that this structure functioned as a barn prior to the property being subdivided in the late 1990's. An old, 6 to 12-foot tall concrete retaining wall lines the eastern side of the driveway downslope of the planned development area

and the old foundation. This wall was observed to lean downslope slightly and had several visible cracks in its face. The grade across the lot and the surrounding properties generally slopes downward from east to west, with a total elevation change of 92 feet across the total property bounds. A relatively flat plateau has been created just south of the driveway and is likely composed of fill that was stockpiled on this lot during previous construction activity. This plateau is located approximately 6 to 8 feet higher than the driveway apron grade. Atop this plateau, and from the eastern property line, the grade carries out gently to moderately across the proposed development area, before dropping steeply downward to the west at an inclination of approximately 50 percent, with shorter portions of the steep slope inclined from 50 to 70 percent. Parts of this steep slope terminate along the irregular driveway alignment and may have been oversteepened when the driveway was built. This moderate to steep slope continues westward across the remainder of the property, and continues into the neighboring downslope, western property.

Research conducted on the City of Mercer Island GIS indicates that the subject site is mapped within a Potential Landslide Hazard Area. The site is also mapped within an Erosion Hazard Area and Seismic Hazard Area. The slope to the west of the planned development area meets the criteria for a Steep Slope and most of the site would meet the criteria for an Erosion Hazard. The *Mercer Island Landslide Hazard Assessment Map* (Troost and Wisher, 2009) indicates that several documented landslides have occurred in the general vicinity of the site. As a whole, the southern point of Mercer Island is well known for its landslide history, and the area is known to be underlain by slide debris and mass wasting deposits. We did not observe any indications of recent instability on the site during our field work. Past slides have occurred as shallow movement (less than 5 feet in depth) and larger movements up to 20 feet in depth. These slides affect the loose soils overlying the glacially-compressed silt, and are typically triggered following extended periods of rainfall.

While historic landslide records are difficult to obtain in this area of King County, we are aware that a large landslide affected the property two lots south of the subject site (#8235) in 1996. Our firm provided geotechnical services related to the investigation and stabilization of this landslide. The slope failure occurred on the downslope side of the existing residence and extended to a depth of approximately 20 feet. The slide mass extended through loose fill and colluvium, failing along the underlying dense silt, subsequently, soldier pile walls were constructed along the western side of the house and extending west along the northern side of the site to prevent another deep failure. These soldier pile walls are embedded into the dense silt.

We have not been able to find structural documents associated with the recently-constructed house upslope of the site. Considering the relatively poor surface soils known to underlie this area, it should have been supported on piles embedded into the underlying dense soils.

SUBSURFACE

The subsurface conditions on the subject lot were explored by drilling three test borings at the approximate locations shown on the Site Exploration Plan, Plate 2. Our exploration program was based on the proposed construction, anticipated subsurface conditions and those encountered during exploration, and the scope of work outlined in our proposal.

The borings were drilled on September 14, 2020 using a track-mounted, hollow-stem auger drill. Samples were taken at approximate 2.5 and 5-foot intervals with a standard penetration sampler. This split-spoon sampler, which has a 2-inch outside diameter, is driven into the soil with a 140-pound hammer falling 30 inches. The number of blows required to advance the sampler a given distance is an indication of the soil density or consistency. A geotechnical engineer from our staff

observed the drilling process, logged the test borings, and obtained representative samples of the soil encountered. The Test Boring Logs are attached as Plates 3 through 5.

Soil Conditions

Test Boring 1 was drilled off the edge of the hammerhead in the concrete driveway, and Test Boring 2 was drilled near the western edge of the proposed residence. Beneath the ground surface, approximately 7 feet of fill was encountered in Test Boring 2, which was drilled near the top of the steep slope. A thick layer of asphalt was encountered at 5 feet in Test Boring 2 and may have been a part of an old driveway associated with the foundation remains found to the west of this location. Beneath the fill in Test Boring 2, and beneath the ground surface in Test Boring 1, medium-stiff, and stiff silt was encountered. This silt was observed to contain organics, and was jumbled, fractured and blocky. This upper, looser silt deposit appears to be colluvium which would have been deposited during an older landslide event. This loose, fractured silt extended to a depth of approximately 22 feet in Test Boring 1, and 25 feet in Test Boring 2, where the silt became massive and hard. This hard silt extended to the base of the two test borings at a depth of 36.5 feet.

Test Boring 3 was attempted several times close to the approximate mapped location. This exploration met auger refusal at depths of 2 to 4 feet in this general area on what felt like large cobbles or quarry spalls. We were not able to hand clear the holes past this depth to try to advance the auger deeper. The presence of asphalt in Test Boring 2, as well as the rocks found at a shallow depth in Test Boring 3 could be an indicator that this site was used as a construction laydown area during the construction of either upslope or downslope residences. Regardless, we were not able to advance this boring to a useful depth in this location, no matter how much effort the driller made. We anticipate that an approximate 8-foot thick layer of fill would be encountered in this location beneath the existing ground surface, before aligning with the subsurface soil profile found in the location of Test Boring 1.

As stated above, obstructions in the form of what appeared to be quarry spalls or heavy cobbles were encountered in the vicinity of Test Boring 3, making it impossible to drill a boring. Debris, buried utilities, and old foundation and slab elements are commonly encountered on sites that have had previous development.

We conducted several borings for the development of the property to the south in the Fall of 1999 (currently addressed 8177 West Mercer Way, but the street address was 8229 West Mercer Way at the time of that report). Three borings were drilled across the upper lot, near the level of the subject site. These borings encountered approximately 20 to 25 feet of colluvium that was underlain by very dense silt. Even within the very dense silt, some moderate fracturing was observed. The results of these test borings are in general conformance with the subsurface conditions encountered in the test borings conducted for the proposed new residence.

We understand that the upslope (#8159) and downslope residences (#8167) were constructed less than 5 years ago. No recent public geotechnical information was attainable for the upslope property outside of the original short-plat report for the property conducted in 1996. However, PanGEO, Incorporated conducted the study for the downslope property in 2016. We were able to find the logs of their test borings on Mercer Island's GIS website. As part of their study, three borings were drilled within the residence footprint, as well as near the alignments of proposed permanent shoring walls near the eastern extent of the planned

development area. These borings were located within a more moderately sloped area and encountered mass wasting (aka colluvium) and beach deposits to depths of approximately 10 to 15 feet beneath the ground surface. Medium-dense and denser sand, silty sand and silt were encountered beneath the mass wasting deposits, extending to the maximum drill depths attainable by the small, hand-carried Acker drill used. It is our understanding that the downslope residence is supported by small diameter pipe piles. No construction information was available for the upslope house, but we anticipate that the upslope residence is also supported on deep foundations.

Logs of the adjacent borings discussed above can be found in Appendix A. These borings are also publicly available on the City of Mercer Island GIS Tool.

Groundwater Conditions

No groundwater seepage was observed at a depth during drilling. It should be noted that groundwater levels vary seasonally with rainfall and other factors. We anticipate that groundwater could be found in more permeable soil layers, fracture zones in the silt, and between the looser near-surface soil and the underlying hard silt.

The stratification lines on the logs represent the approximate boundaries between soil types at the exploration locations. The actual transition between soil types may be gradual, and subsurface conditions can vary between exploration locations. The logs provide specific subsurface information only at the locations tested. If a transition in soil type occurred between samples in the borings, the depth of the transition was interpreted. The relative densities and moisture descriptions indicated on the test boring logs are interpretive descriptions based on the conditions observed during drilling.

CRITICAL AREA STUDY (MICC 19.07)

Seismic Hazard and Potential Landslide Hazard Areas: The entire subject site is located within a mapped Seismic Hazard Area and a Potential Landslide Hazard area. This is noted on the attached Site Exploration Plan.

Both geologic hazard areas cover much of the general vicinity to the north and south as well. The core of the subject site consists of hard, glacially compressed, native soil that has a low potential for deep-seated landslides. However, this competent soil is overlain by looser fill and colluvial soils that could experience slope movement, particularly during a large earthquake. The recommendations presented in our report are intended to stabilize the development area in the event of foreseeable slope movement, thereby mitigating the Potential Landslide Hazard risk.

The foundations for the new construction will be supported on hard, non-liquefiable soils, which will mitigate the Seismic Hazard.

Steep Slope Hazard Areas: Based on the provided topographic map of the subject site, and our site observations, the slope immediately west of the proposed house is over 10 feet in height and exceeds an inclination of 40 percent. This slope would meet the definition of a steep slope under the MICC. From our observations, and the findings of our explorations, this slope has been created by placement of fill on the lot, and previous excavation for the driveway extending to the adjacent western lot. The approximate top and toe of the steep slope is indicated on the attached Site Exploration Plan.

It is our opinion that no buffers or setbacks are needed from this Steep Slope, provided the recommendations presented in this report are followed. The recommendations presented in the report are intended to prevent adverse impacts to the stability of the steep slope, and to protect the planned development from foreseeable future soil movement on the steep slope.

Erosion Hazard Area: The site also meets the City of Mercer Island's criteria for an Erosion Hazard Area. This has also been indicated on the attached Site Exploration Plan.

Excavation and construction of the planned residence can be accomplished without adverse erosion impacts to the site and surrounding properties by exercising care, and being proactive with the maintenance and potential upgrading of the erosion control system through the entire construction process. Proper erosion control implementation will be important to prevent adverse impacts to the site and neighboring properties, particularly if grading and construction occurs during the wet season. The temporary erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered during the site work. One of the most important considerations, particularly during wet weather, is to immediately cover any bare soil areas to prevent accumulated water or runoff from the work area from becoming silty in the first place. Silty water cannot be discharged off the site, so a temporary holding tank should be planned for wet weather earthwork. A wire-backed silt fence bedded in compost, not native soil, or sand, should be erected as close as possible to the planned work area, and the existing vegetation west of the silt fence be in place. Rocked construction access and staging areas should be established wherever trucks will have to drive off of pavement, in order reduce the amount of soil or mud carried off the property by trucks and equipment. Covering the base of the excavation with a layer of clean gravel or rock is also prudent to reduce the amount of mud and silty water generated. Cut slopes and soil stockpiles should be covered with plastic during wet weather. Soil stockpiles should be minimized. Silty water accumulating in the excavation must not be allowed to flow off the site. In wet conditions, this can require the use of temporary holding tanks (aka Baker tanks). Following rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface.

Buffers and Mitigation: The attached Site Exploration Plan (Plate 2) denotes the extents of the critical areas that cover the site. Under MICC 19.07.160(C), the code-prescriptive buffer of 25 feet is indicated from all sides of a shallow landslide-hazard area. As noted above, the entire site lies within a mapped Potential Landslide Hazard Area, and the prescriptive buffer would extend far beyond the boundaries of the property and the planned development area. The prescriptive Steep Slope buffers from the top and toe of the western steep slope are indicated on the Plan. No buffer is required by the MICC for an Erosion Hazard Area.

We recognize that the planned development will occur within the designated critical areas and their applicable prescriptive buffers. The recommendations presented in this geotechnical report are intended to allow the project to be constructed in the proposed configuration without adverse impacts to critical areas on the site or the neighboring properties. The geotechnical recommendations associated with foundations, shoring, and erosion control will mitigate any potential hazards to geologic critical areas on the site.

Statement of Risk: In order to satisfy the City of Mercer Island's requirements, a statement of risk is needed. As such, we make the following statement:

Provided the recommendations in this report are followed, it is our professional opinion that the recommendations presented in this report for the planned alteration will render the development as safe as if it were not located in a geologically hazardous area, and will not

adversely impact critical areas on adjacent properties.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.

The test borings conducted for this study encountered loose fill and colluvium beneath the ground surface. Hard silt was not encountered until a depth of 22 feet on the eastern, upslope side of the site, and until 25 feet on the western, downslope side of the site. Any new foundations constructed atop the loose, unconsolidated fill soil and colluvium would result in excessive post-construction settlement. All new foundation loads need to bear on, or into the suitable bearing soils. Due to the depth of the loose and medium-dense soils (22 to 25 feet), the excavations needed to reach competent soils would be near impossible to achieve without extensive excavation shoring. Therefore, we recommend that the new residence be supported on deep foundations that are embedded into the dense soil. This includes any building floors, or settlement sensitive elements, such as entryways or stairways. For most of the residence, the deep foundations system could consist of small diameter pipe piles that are driven to refusal in the underlying dense soil. An expanded discussion can be found in the **Pipe Piles** section of this report.

It is likely that some settlement of the ground surrounding pile-supported buildings will occur over time. In order to reduce the potential problems associated with this, we recommend the following:

- Fill to the desired site grades several months prior to constructing on-grade slabs, walkways, and pavements around the buildings. This allows the underlying soils to undergo some consolidation under the new soil loads before final grading is accomplished.
- Construct all entrance walkways as reinforced slabs that are doweled into the grade beam at the door thresholds. This will allow the walkways to ramp down and away from the building as they settle, without causing a downset at the threshold.
- Isolate on-grade elements, such as walkways or pavements, from pile-supported foundations and columns to allow differential movement.

As previously discussed, the subject site is located within a Potential Landslide Hazard area that encompasses much of the general vicinity. The core of the subject site consists of hard native silt that has a low potential for deep-seated landslides. However, slides within the near-surface fill and colluvial soil can, and have, occurred in this area. The hazard to the residence associated with a potential failure of the onsite steep slope, or even of the leaning concrete retaining wall on the adjacent western property, will be mitigated by proper retention of the loose soils within the development area. Removal of any of the existing fill located in the western portion of the site on the steep slope will reduce the potential for future instability. Even so, due to the loose conditions of the surficial soils, and the steep slope west and northwest of the residence location, a stabilization wall will be needed along the downslope side of the residence to retain the upper, loose fill and colluvium and stabilize the development area. The stabilization wall should consist of

closely-spaced, heavily-reinforced drilled concrete piles that will embed significantly into the underlying, hard silt. The wall will need to run along the entire western perimeter of the house, and will need to return along the north side of the living space that will occupy the western half of the house. As discussed below, removal of at least some of the fill located on the western side of the site will reduce the depth and structural reinforcing necessary for the stabilization wall. Further discussion regarding the stabilization wall can be found in the **Stabilization Wall** section of this report. The western and northern foundation wall of the house could be supported on the drilled piles, but it is typically better to locate these piles outside the footprint of the structure, in order to provide stabilization for at least a narrow strip of ground alongside the house.

As discussed above in the **Critical Area Study** section, the recommendations presented in this report are intended to prevent adverse impacts to the stability of the slope onsite, protect the planned development from damage in the event of future instability, and prevent the development from adversely affecting the stability of surrounding properties. It should be noted that the proposed stabilization wall will not increase the stability of the slope west of the development area outside of transferring the weight of the new residence through the potentially unstable soils down to a competent soil strata. The future property owners should be made well aware that there always exists at least some risk with owning property on, or near steep slopes.

As previously discussed, the new residence will contain a basement constructed into the slope located west of the garage footprint. We anticipate that excavations of approximately 10 feet will be needed to reach the basement level in areas. It is not known if the adjacent western house incorporated a substantial pile foundation or a stabilization wall in its design. Considering this, and the low strength of the near-surface soils, we recommend that any temporary cuts along the east and south sides of the basement be shored using soldier piles. Based on the preliminary plan, we anticipate that shoring will be needed along the south and eastern sides of the basement excavation as well as along the perimeter of the driveway parking area along the eastern extent of the site. These soldier piles must consider the loose conditions of the near-surface soils. Driven soldier piles can cause excessive ground vibrations in the loose upper soils and should not be utilized for this project.

The proposed parking area on the eastern side of the driveway shows a retaining wall lining its perimeter. As discussed above, excavation shoring will be needed in this area as well due to the location of this wall to the property line, and the depth of the excavation that will be needed to create a flat area at the same elevation as the driveway. The shoring system in this area could consist of permanent soldier piles that remain exposed following construction, or a concrete retaining wall could be cast in front of the wall. Both temporary and permanent shoring design recommendations can be found in the **Shoring** section of this report. We recommend that the driveway slab be poured up to the face of this wall for additional lateral support.

The basement for the new residence will be excavated into soil with a low permeability. We recommend installing an underslab drainage system beneath the basement slab of the new residence. This system would consist of a layer of clean crushed rock beneath the interior slab or crawlspace. The rock layer should be at least 12 inches thick and contain 4-inch diameter, perforated PVC pipes at no more than 15-foot center-to-center spacings. The entire rock layer and pipe system should be covered with a thick vapor retarder/barrier. The perforated pipes should tie into the exterior footing drains. The **Drainage Considerations** section of this report contains an expanded discussion of our subsurface drainage recommendations.

The adjacent older houses are likely supported on conventional foundations that bear on compressible soils. As a result, it is likely that they have undergone excessive settlement already.

There is always some risk associated with demolition and foundation construction near structures such as this. It is imperative that unshored excavations do not extend below a 2:1 (Horizontal:Vertical) imaginary bearing zone sloping downward from existing footings. Contractors working on the demolition and construction of your home must be cautioned to avoid strong ground vibrations, which could cause additional settlement in the neighboring foundations. Installation of driven pipe piles is a loud process, but does not result in strong ground vibrations. During demolition, strong pounding on the ground with the excavator, which is often used to break up debris and concrete, should not occur. Large equipment and vibratory compactors, such as hoepacks, should not be used close to the property lines. Additionally, in order to protect yourselves from unsubstantiated damage claims from the adjacent owners, 1) the existing condition of the foundation should be documented before starting demolition, and 2) the footings should be monitored for vertical movement during the demolition, excavation, and construction process. These are common recommendations for projects located close to existing structures that may bear on loose soil and have already experienced excessive settlement. We can provide additional recommendations for documentation and monitoring of the adjacent structures, if desired.

The excavated soil will be unusable as fill for the project and should be hauled off the site. No soil generated from the project excavation or new structural fill should be placed on, or near the steep slope, as the surcharge from the additional soils could reduce the stability of the slope. No water should be directed towards the steep slope along the western side of the development. Poorly managed stormwater runoff is a common cause of slope instability that is well documented in the Puget Sound area.

Due to the silty, fine-grained nature of the upper fill and native soils onsite, the steep inclination of the slope to the west of the proposed residence, and the Potential Landslide Hazard, it is our professional opinion that onsite infiltration or dispersion of stormwater is not feasible for this project. All collected stormwater, even from paved surfaces, should be discharged to an approved stormwater system. Pervious pavements should not be used for this project.

While the site is mapped as an Erosion Hazard Area, the potential for adverse erosion problems can be mitigated by properly implemented erosion control measures. The erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered. We anticipate that a silt fence will be needed around the downslope sides of any cleared areas. Existing pavements, ground cover, and landscaping should be left in place wherever possible to minimize the amount of exposed soil. Rocked staging areas and construction access roads should be provided to reduce the amount of soil or mud carried off the property by trucks and equipment. Trucks should not be allowed to drive off of the rock-covered areas. Cut slopes and soil stockpiles should be covered with plastic during wet weather. Following clearing or rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface. On most construction projects, it is necessary to periodically maintain or modify temporary erosion control measures to address specific site and weather conditions.

The drainage and waterproofing recommendations presented in this report are intended only to prevent active seepage from flowing through concrete walls or slabs. Even in the absence of active seepage into and beneath structures, water vapor can migrate through walls, slabs, and floors from the surrounding soil, and can even be transmitted from slabs and foundation walls due to the concrete curing process. Water vapor also results from occupant uses, such as cooking, cleaning, and bathing. Excessive water vapor trapped within structures can result in a variety of undesirable conditions, including, but not limited to, moisture problems with flooring systems, excessively moist air within occupied areas, and the growth of molds, fungi, and other biological organisms that may

be harmful to the health of the occupants. The designer or architect must consider the potential vapor sources and likely occupant uses, and provide sufficient ventilation, either passive or mechanical, to prevent a buildup of excessive water vapor within the planned structure.

Geotech Consultants, Inc. should be allowed to review the final development plans to verify that the recommendations presented in this report are adequately addressed in the design. Such a plan review would be additional work beyond the current scope of work for this study, and it may include revisions to our recommendations to accommodate site, development, and geotechnical constraints that become more evident during the review process.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

SEISMIC CONSIDERATIONS

In accordance with the International Building Code (IBC), the site class within 100 feet of the ground surface is best represented by Site Class Type D (Stiff Soil). As noted in the USGS website, the mapped spectral acceleration value for a 0.2 second (S_s) and 1.0 second period (S_1) equals 1.46g and 0.55g, respectively.

The IBC and ASCE 7 require that the potential for liquefaction (soil strength loss) during an earthquake be evaluated for the peak ground acceleration of the Maximum Considered Earthquake (MCE), which has a probability of occurring once in 2,475 years (2 percent probability of occurring in a 50-year period). The MCE peak ground acceleration adjusted for site class effects (F_{PGA}) equals 0.61g. The soils beneath the site are not susceptible to seismic liquefaction under the ground motions of the MCE (because of their dense nature and the absence of near-surface groundwater).

Sections 1803.5 of the IBC and 11.8 of ASCE 7 require that other seismic-related geotechnical design parameters (seismic surcharge for retaining wall design and slope stability) include the potential effects of the Design Earthquake. The peak ground acceleration for the Design Earthquake is defined in Section 11.2 of ASCE 7 as two-thirds (2/3) of the MCE peak ground acceleration, or 0.41g.

PIPE PILES

Three- or 4-inch-diameter pipe piles driven with an 850- or 1,100- or 2,000-pound hydraulic jackhammer to the following final penetration rates may be assigned the following compressive capacities.

INSIDE PILE DIAMETER	FINAL DRIVING RATE (850-pound hammer)	FINAL DRIVING RATE (1,100-pound hammer)	FINAL DRIVING RATE (2,000-pound hammer)	ALLOWABLE COMPRESSIVE CAPACITY
3 inches	10 sec/inch	6 sec/inch	2 sec/inch	6 tons
4 inches	16 sec/inch	10 sec/inch	4 sec/inch	10 tons

Note: The refusal criteria indicated in the above table are valid only for pipe piles that are installed using a hydraulic impact hammer carried on leads that allow the hammer to sit on

the top of the pile during driving. If the piles are installed by alternative methods, such as a vibratory hammer or a hammer that is hard mounted to the installation machine, numerous load tests to 200 percent of the design capacity would be necessary to substantiate the allowable pile load. The appropriate number of load tests would need to be determined at the time the contractor and installation method are chosen.

As a minimum, Schedule 40 pipe should be used. The site soils are not highly organic and are not located near salt water. As a result, they do not have an elevated corrosion potential. Considering this, it is our opinion that standard "black" pipe can be used, and corrosion protection, such as galvanizing, is not necessary for the pipe piles.

We expect that the City of Mercer Island will require geotechnical observation of the pile installation. Considering this, the recommendations we have made above for minimum refusal criteria, and our previous experience with pile projects in close proximity to the site, it is our professional opinion that the recommended capacities do not need to be verified by load testing.

Pile caps and grade beams should be used to transmit loads to the piles. Isolated pile caps should include a minimum of two piles to reduce the potential for eccentric loads being applied to the piles. Subsequent sections of pipe can be connected with slip or threaded couplers, or they can be welded together. If slip couplers are used, they should fit snugly into the pipe sections. This may require that shims be used or that beads of welding flux be applied to the outside of the coupler.

Lateral loads due to wind or seismic forces may be resisted by passive earth pressure acting on the vertical, embedded portions of the foundation. For this condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level compacted fill. We recommend using a passive earth pressure of 250 pounds per cubic foot (pcf) for this resistance. If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. We recommend a safety factor of at least 1.5 for the foundation's resistance to lateral loading, when using the above ultimate passive value.

STABILIZATION WALL

As discussed in the **General** section, a retaining structure consisting of closely spaced, reinforced concrete piles is needed along the downslope, western edge of the residence to provide complete stabilization. The piles should be spaced no further apart than 3 feet edge-to-edge so that the soil will arch between them, in the event that the ground downslope of the piles moves away.

The piles would be constructed by setting steel H-beams or rebar cages in drilled holes and grouting the spaces between the steel reinforcements and the soil with concrete for the entire height of the hole. We anticipate that at least the upper portions of the pile shafts will require casing due to the presence of loose, wet soil. Excessive ground loss in the drilled holes must be avoided to reduce the potential for settlement of adjacent structures. If water is present in a hole at the time of construction, concrete must be tremied to the bottom of the hole. The contractor should be well prepared for this and have at least one casing and a tremie pipe of sufficient length prior to starting drilling.

The stabilization wall should be designed for an active soil pressure equal to that pressure exerted by an equivalent fluid with a unit weight of 45 pcf extending to the very stiff to hard silt encountered below the fill and colluvium in our test borings. This correlates to an approximate elevation of 89 feet along the western wall of the proposed development area. Along the northern side of the

planned house, the elevation of the very stiff to hard silt can be assumed to step up from elevation 89 feet to 94 feet along the north wall of the living area, west of the garage. The total stabilization depth will be influenced by the final elevation of the basement slab and foundations. The depth of the lateral active soil load acting on the piles could be reduced by removing some of the fill and colluvium underneath the western portion of the house, and using either a deepened crawl space, or a structural slab constructed over geofoam. An ultimate passive soil pressure equal to that pressure exerted by a fluid with a density of 375 pcf will resist the lateral movement of the piles below the recommended the stabilization elevation.

If the stabilization piles will be used to support the foundation of the structure, a seismic surcharge pressure of 10H pounds per square foot should be added to the active design earth pressure. H is the design retention depth of the stabilization piles.

If the drilled piles for the stabilization wall are used to support the downslope side of the structure or deck, the vertical capacity of the piles will be developed by skin friction between the concrete and the hard silt soils found in Borings 1 and 2. An allowable skin friction of 900 pounds per square foot can be assumed for this embedded portion of the piles.

FOUNDATION AND RETAINING WALLS

Retaining walls backfilled on only one side should be designed to resist the lateral earth pressures imposed by the soil they retain. The following recommended parameters are for walls that restrain level backfill:

PARAMETER	VALUE
Active Earth Pressure *	45 pcf
Passive Earth Pressure	250 pcf
Soil Unit Weight	130 pcf

Where: pcf is Pounds per Cubic Foot, and Active and Passive Earth Pressures are computed using the Equivalent Fluid Pressures.

* For a restrained wall that cannot deflect at least 0.002 times its height, a uniform lateral pressure equal to 10 psf times the height of the wall should be added to the above active equivalent fluid pressure. This applies only to walls with level backfill.

The design values given above do not include the effects of any hydrostatic pressures behind the walls and assume that no surcharges, such as those caused by slopes, vehicles, or adjacent foundations will be exerted on the walls. If these conditions exist, those pressures should be added to the above lateral soil pressures. Where sloping backfill is desired behind the walls, we will need to be given the wall dimensions and the slope of the backfill in order to provide the appropriate design earth pressures. The surcharge due to traffic loads behind a wall can typically be accounted for by adding a uniform pressure equal to 2 feet multiplied by the above active fluid density. Heavy construction equipment should not be operated behind retaining and foundation walls within a distance equal to the height of a wall, unless the walls are designed for the additional lateral pressures resulting from the equipment.

The values given above are to be used to design only permanent foundation and retaining walls that are to be backfilled, such as conventional walls constructed of reinforced concrete or masonry.

It is not appropriate to use the above earth pressures and soil unit weight to back-calculate soil strength parameters for design of other types of retaining walls, such as soldier pile, reinforced earth, modular or soil nail walls. We can assist with design of these types of walls, if desired.

The values for friction and passive resistance are ultimate values and do not include a safety factor. Restrained wall soil parameters should be utilized the wall and reinforcing design for a distance of 1.5 times the wall height from corners or bends in the walls, or from other points of restraint. This is intended to reduce the amount of cracking that can occur where a wall is restrained by a corner.

Wall Pressures Due to Seismic Forces

Per IBC Section 1803.5.12, a seismic surcharge load need only be considered in the design of walls over 6 feet in height. A seismic surcharge load would be imposed by adding a uniform lateral pressure to the above-recommended active pressure. The recommended seismic surcharge pressure for this project is $10H$ pounds per square foot (psf), where H is the design retention height of the wall. Using this increased pressure, the safety factor against sliding and overturning can be reduced to 1.2 for the seismic analysis.

Retaining Wall Backfill and Waterproofing

Backfill placed behind retaining or foundation walls should be coarse, free-draining structural fill containing no organics. This backfill should contain no more than 5 percent silt or clay particles and have no gravel greater than 4 inches in diameter. The percentage of particles passing the No. 4 sieve should be between 25 and 70 percent. The site soils are fine-grained and have a high silt content. As a result, they are not free draining, and cannot be adequately compacted to avoid excessive post-construction settlement. We recommend that the native soils not be reused as retaining wall backfill.

The purpose of these backfill requirements is to ensure that the design criteria for a retaining wall are not exceeded because of a build-up of hydrostatic pressure behind the wall. Also, subsurface drainage systems are not intended to handle large volumes of water from surface runoff. The top 12 to 18 inches of the backfill should consist of a compacted, relatively impermeable soil or topsoil, or the surface should be paved. The ground surface must also slope away from backfilled walls at one to 2 percent to reduce the potential for surface water to percolate into the backfill.

Water percolating through pervious surfaces (pavers, gravel, permeable pavement, etc.) must also be prevented from flowing toward walls or into the backfill zone. Foundation drainage and waterproofing systems are not intended to handle large volumes of infiltrated water. The compacted subgrade below pervious surfaces and any associated drainage layer should therefore be sloped away. Alternatively, a membrane and subsurface collection system could be provided below a pervious surface.

It is critical that the wall backfill be placed in lifts and be properly compacted, in order for the above-recommended design earth pressures to be appropriate. The recommended wall design criteria assume that the backfill will be well-compacted in lifts no thicker than 12 inches. The compaction of backfill near the walls should be accomplished with hand-operated equipment to prevent the walls from being overloaded by the higher soil forces that occur during compaction. The section entitled ***General Earthwork and Structural Fill*** contains additional recommendations regarding the placement and compaction of structural fill behind retaining and foundation walls.

The above recommendations are not intended to waterproof below-grade walls, or to prevent the formation of mold, mildew, or fungi in interior spaces. Over time, the performance of subsurface drainage systems can degrade, subsurface groundwater flow patterns can change, and utilities can break or develop leaks. Therefore, waterproofing should be provided where future seepage through the walls is not acceptable. This typically includes limiting cold-joints and wall penetrations and using bentonite panels or membranes on the outside of the walls. There are a variety of different waterproofing materials and systems, which should be installed by an experienced contractor familiar with the anticipated construction and subsurface conditions. Applying a thin coat of asphalt emulsion to the outside face of a wall is not considered waterproofing and will only help to reduce moisture generated from water vapor or capillary action from seeping through the concrete. As with any project, adequate ventilation of basement and crawl space areas is important to prevent a buildup of water vapor that is commonly transmitted through concrete walls from the surrounding soil, even when seepage is not present. This is appropriate even when waterproofing is applied to the outside of foundation and retaining walls. We recommend that you contact an experienced envelope consultant if detailed recommendations or specifications related to waterproofing design or minimizing the potential for infestations of mold and mildew are desired.

BUILDING FLOORS

The building floors can be constructed as either structural slabs that are designed to span between the pile supported foundations, or as a framed floor above a crawlspace. Even where the exposed soils appear dry, water vapor will tend to naturally migrate upward through the soil to the new constructed space above it. This can affect moisture-sensitive flooring, cause imperfections or damage to the slab, or simply allow excessive water vapor into the space above the slab. All interior slabs-on-grade should be underlain by a capillary break drainage layer consisting of a minimum 4-inch thickness of clean gravel or crushed rock that has a fines content (percent passing the No. 200 sieve) of less than 3 percent and a sand content (percent passing the No. 4 sieve) of no more than 10 percent. Pea gravel or crushed rock are typically used for this layer.

As noted by the American Concrete Institute (ACI) in the *Guides for Concrete Floor and Slab Structures*, proper moisture protection is desirable immediately below any on-grade slab that will be covered by tile, wood, carpet, impermeable floor coverings, or any moisture-sensitive equipment or products. ACI recommends a minimum 10-mil thickness vapor retarder for better durability and long-term performance than is provided by 6-mil plastic sheeting that has historically been used. A vapor retarder is defined as a material with a permeance of less than 0.3 perms, as determined by ASTM E 96. It is possible that concrete admixtures may meet this specification, although the manufacturers of the admixtures should be consulted. Where vapor retarders are used under slabs, their edges should overlap by at least 6 inches and be sealed with adhesive tape. The sheeting should extend to the foundation walls for maximum vapor protection.

If no potential for vapor passage through the slab is desired, a vapor *barrier* should be used. A vapor barrier, as defined by ACI, is a product with a water transmission rate of 0.01 perms when tested in accordance with ASTM E 96. Reinforced membranes having sealed overlaps can meet this requirement.

We recommend that the contractor, the project materials engineer, and the owner discuss these issues and review recent ACI literature and ASTM E-1643 for installation guidelines and guidance on the use of the protection/blotter material.

EXCAVATIONS AND SLOPES

Temporary excavation slopes should not exceed the limits specified in local, state, and national government safety regulations. Also, temporary cuts should be planned to provide a minimum 2 to 3 feet of space for construction of foundations, walls, and drainage. Based upon Washington Administrative Code (WAC) 296, Part N, the soil at the subject site would generally be classified as Type C. Temporary cut slopes up to approximately 4 feet in height could be excavated at an inclination no steeper than 1.5:1 (Horizontal:Vertical), extending continuously between the top and the bottom of a cut. Taller cuts, especially along the east and south sides, should be shored with soldier piles.

The above-recommended temporary slope inclination is based on the conditions exposed in our explorations, and on what has been successful at other sites with similar soil conditions. It is possible that variations in soil and groundwater conditions will require modifications to the inclination at which temporary slopes can stand. Temporary cuts are those that will remain unsupported for a relatively short duration to allow for the construction of foundations, retaining walls, or utilities. Temporary cut slopes should be protected with plastic sheeting during wet weather. It is also important that surface runoff be directed away from the top of temporary slope cuts. Cut slopes should also be backfilled or retained as soon as possible to reduce the potential for instability. Please note that loose soil can cave suddenly and without warning. Excavation, foundation, and utility contractors should be made especially aware of this potential danger. These recommendations may need to be modified if the area near the potential cuts has been disturbed in the past by utility installation, or if settlement-sensitive utilities are located nearby.

All permanent cuts into onsite soil should be inclined no steeper than 3:1 (H:V). Water should not be allowed to flow uncontrolled over the top of any temporary or permanent slope. All permanently exposed slopes should be seeded with an appropriate species of vegetation to reduce erosion and improve the stability of the surficial layer of soil.

Any disturbance to the existing slope outside of the building limits may reduce the stability of the slope. Damage to the existing vegetation and ground should be minimized, and any disturbed areas should be revegetated as soon as possible. Soil from the excavation should not be placed on the slope, and this may require the off-site disposal of any surplus soil.

SOLDIER PILE SHORING

As discussed in the **General** section, the excavation for the proposed basement and eastern parking area will require temporary shoring. Cantilevered soldier pile systems have proven to be an efficient method for providing excavation shoring. The shoring design should be submitted to Geotech Consultants, Inc. for review prior to beginning site excavation. We are available and would be pleased to assist in this design effort. A safety factor of either 1.2 or 1.5 should be included in the design of the shoring depending on whether the shoring is temporary or permanent.

Soldier Pile Installation

Soldier pile walls would be constructed after making planned cut slopes, and prior to commencing the mass excavation, by setting steel H-beams in a drilled hole and grouting the space between the beam and the soil with concrete for the entire height of the drilled hole. We anticipate that at least a top casing extending to the underlying competent silt will be needed to prevent caving in the upper, loose soils. The contractor should be prepared to

case the holes or use the slurry method if caving soil is encountered. Excessive ground loss in the drilled holes must be avoided to reduce the potential for settlement on adjacent properties. If water is present in a hole at the time the soldier pile is poured, concrete must be tremied to the bottom of the hole.

As excavation proceeds downward, the space between the piles should be lagged with timber, and any voids behind the timbers should be filled with pea gravel, or a slurry comprised of sand and fly ash. Treated lagging is usually required for permanent walls, while untreated lagging can often be utilized for temporary shoring walls. Temporary vertical cuts will be necessary between the soldier piles for the lagging placement. The prompt and careful installation of lagging is important, particularly in loose or caving soil, to maintain the integrity of the excavation and provide safer working conditions. Additionally, care must be taken by the excavator to remove no more soil between the soldier piles than is necessary to install the lagging. Caving or overexcavation during lagging placement could result in loss of ground on neighboring properties. Timber lagging should be designed for an applied lateral pressure of 30 percent of the design wall pressure if the pile spacing is less than three pile diameters. For larger pile spacings, the lagging should be designed for 50 percent of the design load.

Soldier Pile Wall Design

Temporary soldier pile shoring that is cantilevered, and that has a level backslope, should be designed for an active soil pressure equal to that pressure exerted by an equivalent fluid with a unit weight of 45 pounds per cubic foot (pcf). For a permanent wall east of the driveway and parking space, an active soil pressure equal to that pressure exerted by an equivalent fluid with a unit weight of 60 pounds per cubic foot (pcf) should be used to account for the sloped condition. Traffic surcharges, such as from the adjacent southern driveway, can typically be accounted for by increasing the effective height of the shoring wall by 2 feet. Existing adjacent structures such as the neighboring southern driveway will exert surcharges on the proposed shoring wall. Slopes above the shoring walls will exert additional surcharge pressures. These surcharge pressures will vary, depending on the configuration of the cut slope and shoring wall. We can provide recommendations regarding slope and building surcharge pressures when the preliminary shoring design is completed.

It is important that the shoring design provides sufficient working room to drill and install the soldier piles, without needing to make unsafe, excessively steep temporary cuts. Cut slopes should be planned to intersect the backside of the drilled holes, not the back of the lagging.

The soils below the excavation level for the shoring will be loose, and have a low strength. Lateral movement of the soldier piles below the excavation level will be resisted by an ultimate passive soil pressure equal to that pressure exerted by a fluid with a density of 250 pcf. This value is low due to the very low internal strength of the fill and colluvial soils that the soldier piles will be embedded into. No safety factor is included in the given value. This soil pressure is valid only for a level excavation in front of the soldier pile; it acts on two times the grouted pile diameter. Cut slopes made in front of shoring walls significantly decrease the passive resistance. The minimum embedment below the floor of the excavation for cantilever soldier piles should be equal to the height of the "stick-up."

EXCAVATION AND SHORING MONITORING

As with any shoring system, there is a potential risk of greater-than-anticipated movement of the shoring and the ground outside of the excavation. This can translate into noticeable damage of surrounding on-grade elements, such as foundations and slabs. Therefore, we recommend making an extensive photographic and visual survey of the project vicinity, prior to demolition activities, installing shoring or commencing excavation. This documents the condition of buildings, pavements, and utilities in the immediate vicinity of the site in order to avoid, and protect the owner from, unsubstantiated damage claims by surrounding property owners.

Additionally, the shoring walls and any adjacent foundations should be monitored during construction to detect soil movements. To monitor their performance, we recommend establishing a series of survey reference points to measure any horizontal deflections of the shoring system. Control points should be established at a distance well away from the walls and slopes, and deflections from the reference points should be measured throughout construction by survey methods. At least one third of the installed soldier piles should be monitored by taking readings at the top of the pile. Additionally, benchmarks installed on the surrounding buildings should be monitored for at least vertical movement. We suggest taking the readings at least once a week, until it is established that no deflections are occurring. The initial readings for this monitoring should be taken before starting any demolition or excavation on the site.

DRAINAGE CONSIDERATIONS

We anticipate that permanent foundation walls may be constructed against the shoring walls. Where this occurs, a plastic-backed drainage composite, such as Miradrain, Battledrain, or similar, should be placed against the entire surface of the shoring prior to pouring the foundation wall. Weep pipes located no more than 6 feet on-center should be connected to the drainage composite and poured into the foundation walls or the perimeter footing. A footing drain installed along the inside of the perimeter footing will be used to collect and carry the water discharged by the weep pipes to the storm system. Isolated zones of moisture or seepage can still reach the permanent wall where groundwater finds leaks or joints in the drainage composite. This is often an acceptable risk in unoccupied below-grade spaces, such as parking garages. However, formal waterproofing is typically necessary in areas where wet conditions at the face of the permanent wall will not be tolerable. If this is a concern, the permanent drainage and waterproofing system should be designed by a specialty consultant familiar with the expected subsurface conditions and proposed construction. A typical shoring drainage detail is attached to this report as Plate 6.

Footing drains should be used where: (1) crawl spaces or basements will be below a structure; (2) a slab is below the outside grade; or (3) the outside grade does not slope downward from a building. Drains should also be placed at the base of all earth-retaining walls. These drains should be surrounded by at least 6 inches of 1-inch-minus, washed rock that is encircled with non-woven, geotextile filter fabric (Mirafi 140N, Supac 4NP, or similar material). At its highest point, a perforated pipe invert should be at least 6 inches below the bottom of a slab floor or the level of a crawl space. The discharge pipe for subsurface drains should be sloped for flow to the outlet point. Roof and surface water drains must not discharge into the foundation drain system. A typical footing drain detail is attached to this report as Plate 7. For the best long-term performance, perforated PVC pipe is recommended for all subsurface drains. Clean-outs should be provided for potential future flushing or cleaning of footing drains.

Drainage inside the building's footprint should also be provided where (1) a crawl space or slab will slope or be lower than the surrounding ground surface, (2) an excavation encounters significant seepage, or (3) an excavation for a building will be close to the expected high groundwater elevations. We can provide recommendations for interior drains, should they become necessary, during excavation and foundation construction. A typical underslab drainage detail is attached to this report as Plate 8.

As a minimum, a vapor retarder, as defined in the **Building Floors** section, should be provided in any crawl space area to limit the transmission of water vapor from the underlying soils. Crawl space grades are sometimes left near the elevation of the bottom of the footings. As a result, an outlet drain is recommended for all crawl spaces to prevent an accumulation of any water that may bypass the footing drains. Providing a few inches of free draining gravel underneath the vapor retarder is also prudent to limit the potential for seepage to build up on top of the vapor retarder.

Groundwater was observed during our field work. If seepage is encountered in an excavation, it should be drained from the site by directing it through drainage ditches, perforated pipe, or French drains, or by pumping it from sumps interconnected by shallow connector trenches at the bottom of the excavation.

The excavation and site should be graded so that surface water is directed off the site and away from the tops of slopes. Water should not be allowed to stand in any area where foundations, slabs, or pavements are to be constructed. Final site grading in areas adjacent to the residence should slope away at least one to 2 percent, except where the area is paved. Surface drains should be provided where necessary to prevent ponding of water behind foundation or retaining walls. A discussion of grading and drainage related to pervious surfaces near walls and structures is contained in the **Foundation and Retaining Walls** section.

GENERAL EARTHWORK AND STRUCTURAL FILL

All building and pavement areas should be stripped of surface vegetation, topsoil, organic soil, and other deleterious material. It is important that existing foundations be removed before site development. The stripped or removed materials should not be mixed with any materials to be used as structural fill, but they could be used in non-structural areas, such as landscape beds.

Structural fill is defined as any fill, including utility backfill, placed under, or close to, a building, or in other areas where the underlying soil needs to support loads. All structural fill should be placed in horizontal lifts with a moisture content at, or near, the optimum moisture content. The optimum moisture content is that moisture content that results in the greatest compacted dry density. The moisture content of fill is very important and must be closely controlled during the filling and compaction process.

The allowable thickness of the fill lift will depend on the material type selected, the compaction equipment used, and the number of passes made to compact the lift. The loose lift thickness should not exceed 12 inches, but should be thinner if small, hand-operated compactors are used. We recommend testing structural fill as it is placed. If the fill is not sufficiently compacted, it should be recompacted before another lift is placed. This eliminates the need to remove the fill to achieve the required compaction.

The following table presents recommended levels of relative compaction for compacted fill:

LOCATION OF FILL PLACEMENT	MINIMUM RELATIVE COMPACTION
Beneath walkways	95%
Filled slopes and behind retaining walls	90%
Beneath pavements	95% for upper 12 inches of subgrade; 90% below that level

Where: Minimum Relative Compaction is the ratio, expressed in percentages, of the compacted dry density to the maximum dry density, as determined in accordance with ASTM Test Designation D 1557-91 (Modified Proctor).

LIMITATIONS

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the test borings are representative of subsurface conditions on the site. If the subsurface conditions encountered during construction are significantly different from those observed in our explorations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unanticipated conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking samples in test borings. Subsurface conditions can also vary between exploration locations. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

The recommendations presented in this report are directed toward the protection of only the proposed residence from damage due to slope movement. Predicting the future behavior of steep slopes and the potential effects of development on their stability is an inexact and imperfect science that is currently based mostly on the past behavior of slopes with similar characteristics. Landslides and soil movement can occur on steep slopes before, during, or after the development of property. The owner of any property containing or located close to steep slopes must ultimately accept the possibility that some slope movement could occur, resulting in possible loss of ground or damage to the facilities around the proposed residence.

This report has been prepared for the exclusive use of John Kahan and his representatives, for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with our understanding of current local standards of practice, and within the scope of our services. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew, and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

In addition to reviewing the final plans, Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

The following plates are attached to complete this report:

Plate 1	Vicinity Map
Plate 2	Site Exploration Plan
Plates 3 - 5	Test Boring Logs
Plate 6	Typical Shoring Drainage Detail
Plate 7	Typical Footing Drain Detail
Plate 8	Typical Underslab Drainage Detail
Appendix A	Adjacent Boring Logs

We appreciate the opportunity to be of service on this project. Please contact us if you have any questions, or if we can be of further assistance.

Respectfully submitted,

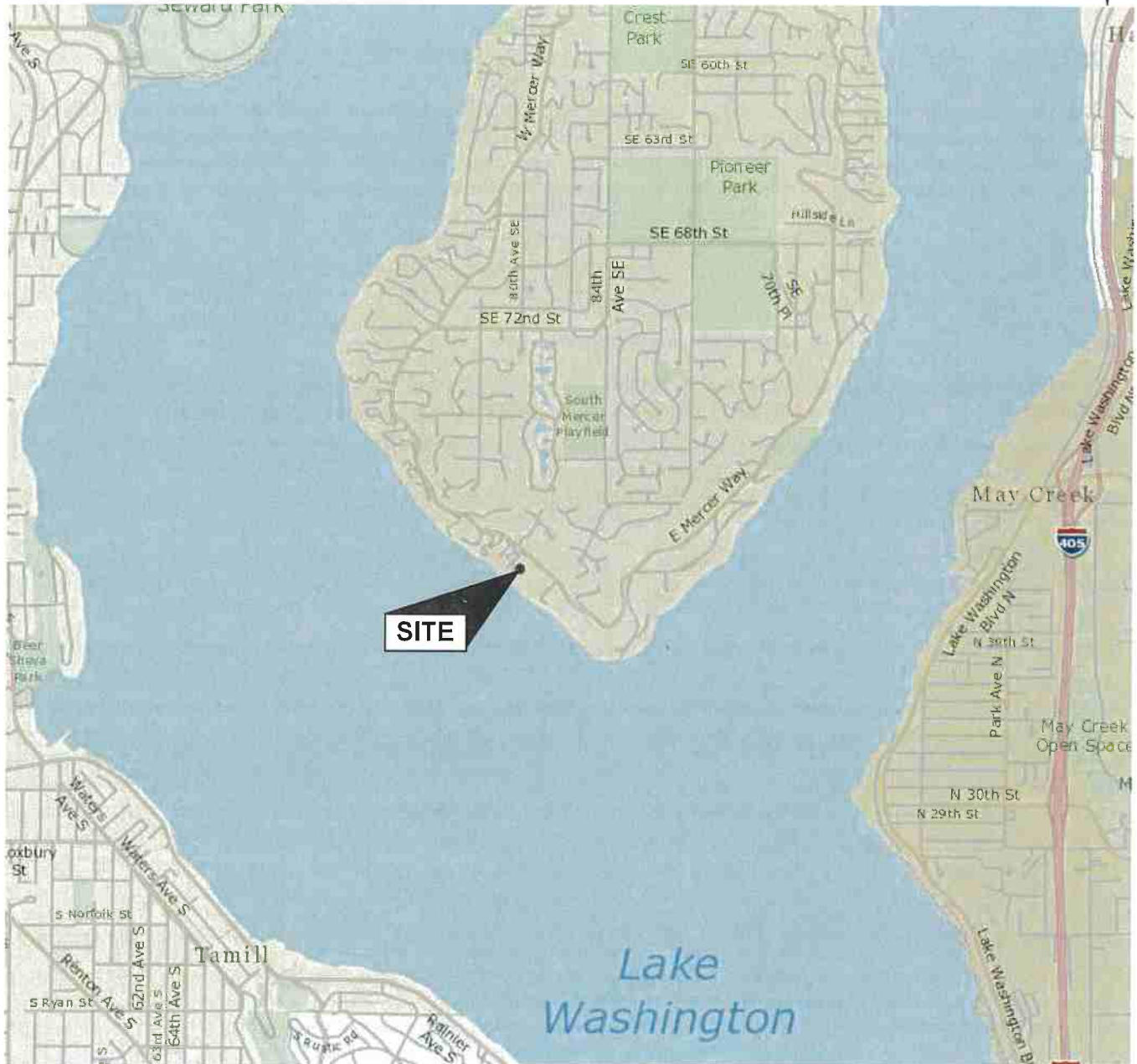
GEOTECH CONSULTANTS, INC.



10/06/2020

Marc R. McGinnis, P.E.
Principal

NORTH



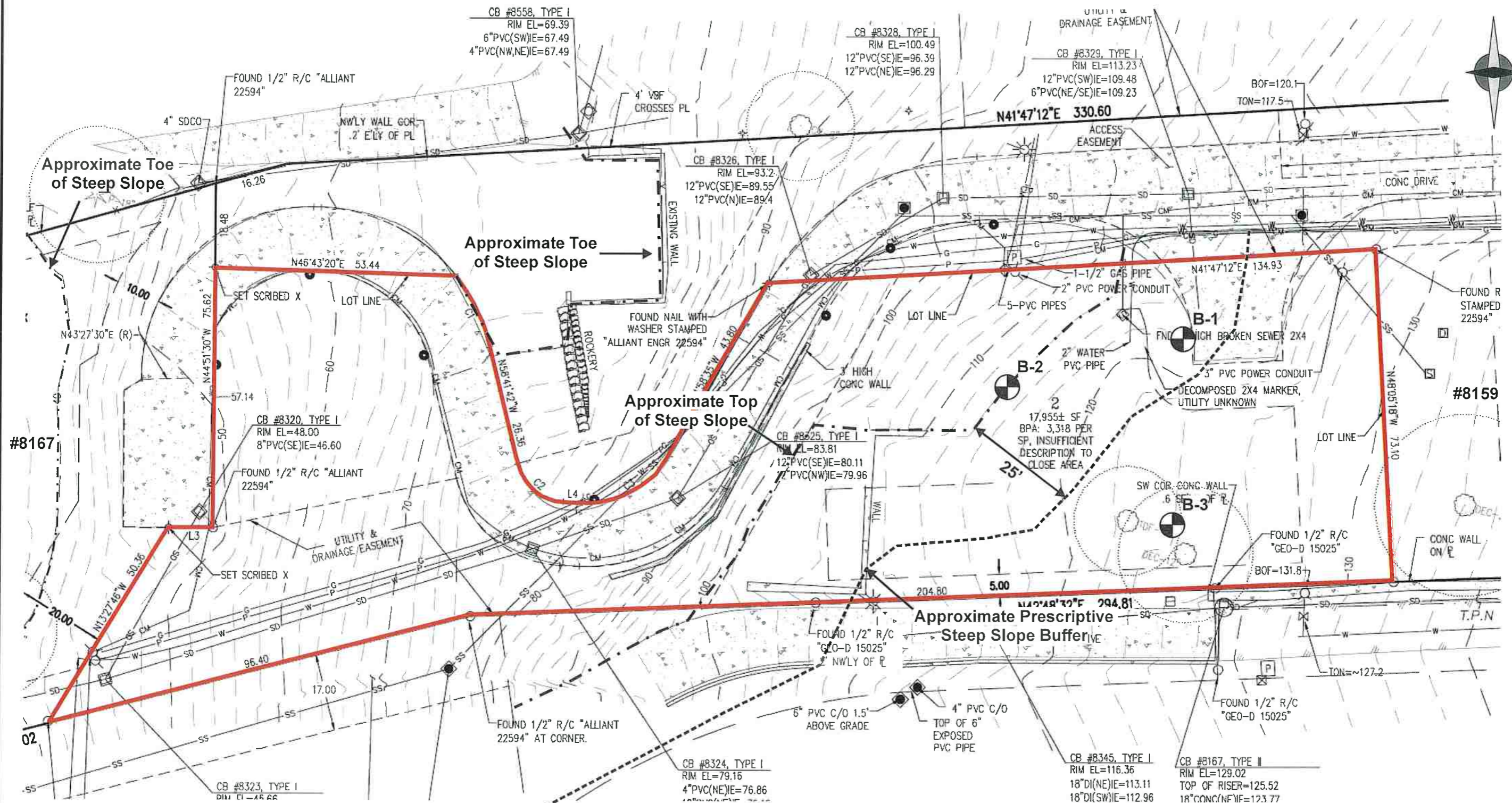
(Source: King County iMap)



**GEOTECH
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VICINITY MAP
8163 West Mercer Way
Mercer Island, Washington

Job No: 20279	Date: Oct. 2020	Plate: 1
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- Legend:**
- Test Boring Location
 - Lot Boundary

* The City of Mercer Island GIS tool maps the subject site as a Seismic Hazard Area, Potential Landslide Hazard Area, and an Erosion Hazard Area in its entirety. The prescriptive buffers for shallow Potential Landslide Hazard Areas under MICC 19.07 extend beyond the property boundaries.



SITE EXPLORATION PLAN		
8163 West Mercer Way Mercer Island, Washington		
Job No: 20279	Date: Sept. 2020	Plate: 2

BORING 1

	Moisture Water Table	Blows per Foot	Sample	USCS	Description
					Topsoil
5		6	1	ML	Gray and brown, heavily mottled SILT with organics, low plasticity, moist, fractured, medium-stiff (Colluvium) -with pockets of brown, gravelly sand
		6	2		-becomes gray mottled orange and dark-brown, soft
10		16	3	SM	Gray-brown mottled orange, gravelly, silty SAND, fine to medium-grained, very moist, medium-dense
		23	4		Gray mottled orange, SILT with seams of very gravelly sand, low plasticity, moist, fractured, very stiff (Colluvium?)
15		14	5	ML	-becomes gray, slightly gravelly, slightly plastic, stiff
20		26	6		-becomes gray-brown mottled orange and gray, slightly sandy, slightly fractured, very stiff -less fractured at tip of sampler
					-driller noted stiffer drilling action at 22 feet
25		33	7		Gray with light-gray streaks, slightly sandy SILT, low plasticity, moist, massive, hard
30		47	8	ML	-becomes bluish-gray, horizontally bedded
35		32	9		

* Test boring was terminated at 36.5 feet on September 14, 2020.
 * No groundwater seepage was encountered during drilling.



BORING LOG

8163 West Mercer Way
Mercer Island, Washington

Job 20279	Date: Sept. 2020	Logged by: MKM	Plate: 3
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BORING 2

	Moisture Water Table	Blows per Foot	Sample USCS	Description
5		15	1	Grass over; Brown silty SAND with decayed organics and roots, fine-grained, moist to dry, loose (FILL)
		**	2	4-inch layer of asphalt
10		5	3	Gray-brown mottled orange, slightly clayey SILT with organics and pieces of hard silt, slightly plastic, moist, fractured and blocky, soft (Colluvium)
		10	4	-becomes mottled orange, brown, and gray with thin gravelly seams, medium-stiff
15		11	5	ML -becomes gray-brown, slightly gravelly with a lense of very moist to wet, gravelly, silty sand
20		**44	6	-becomes very stiff with a 6-inch layer of wet, gravelly, silty sand (**Overstated blow counts - rock in tip of sampler)
25		34	7	Bluish-gray SILT, slightly plastic, moist, massive, bedded, hard
30		94 11"	8	ML -becomes gray-brown mottled orange, slightly blocky -layer of gray, gravelly, silty SAND, fine-grained, moist, very dense
35		50 5"	9	-becomes gray with trace rusting, low plasticity, very dense

* Test boring was terminated at 36.5 feet on September 14, 2020.
 * No groundwater seepage was encountered during drilling.



BORING LOG
 8163 West Mercer Way
 Mercer Island, Washington

Job 20279	Date: Sept. 2020	Logged by: MKM	Plate: 4
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BORING 3

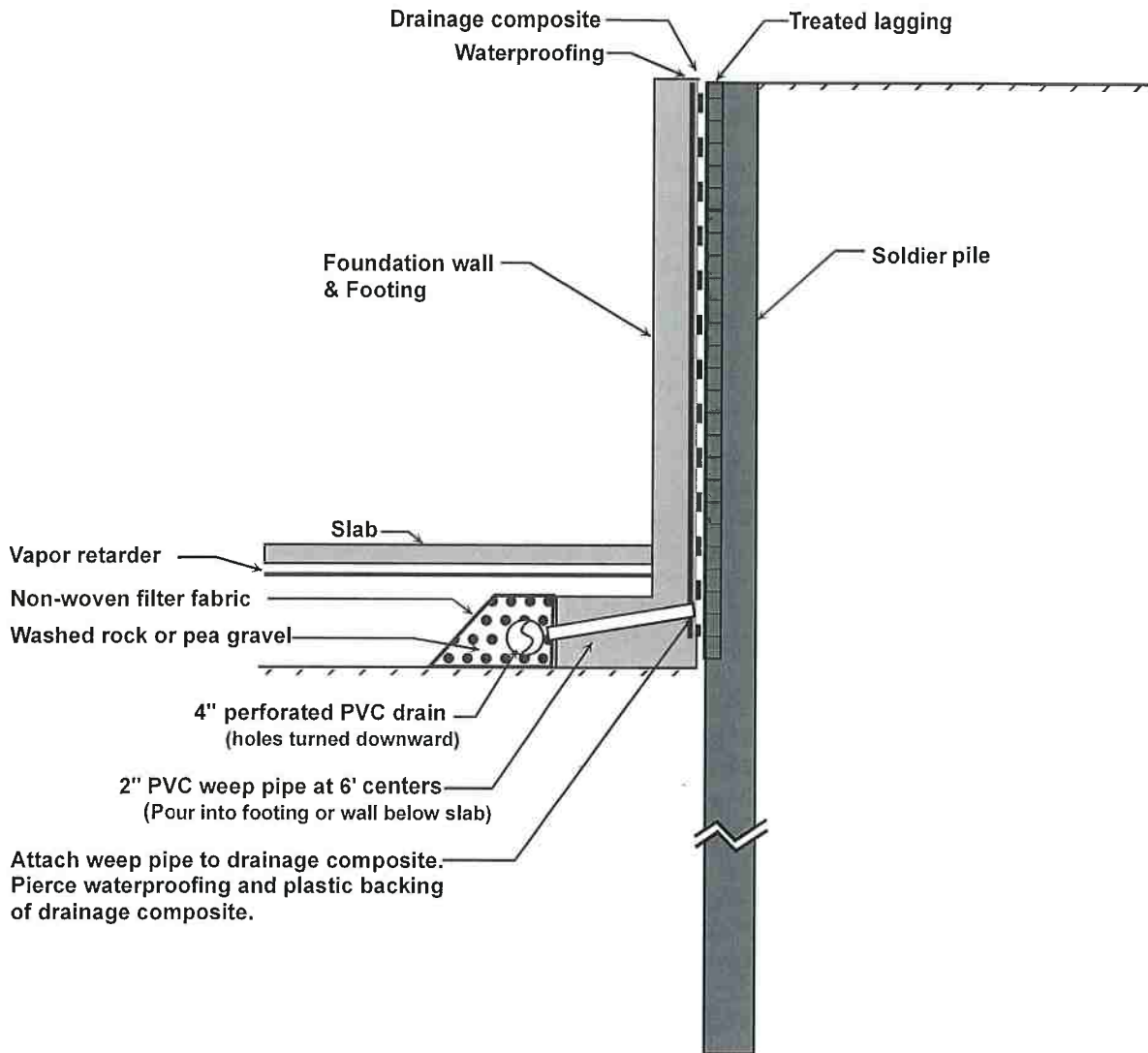
	Moisture Water Table	Blows per Foot	Sample USCS	Description
5		**	1	<div style="border: 1px solid black; padding: 2px;"> FILL Brown silty SAND with organics, fine-grained, moist, loose -abundant large rocks </div>
10				
15				
20				
25				
30				
35				
40				

* Test boring was terminated at 4 feet on September 14, 2020 due to auger refusal on numerous rocks. Numerous attempts made to drill through rocks.
 * No groundwater seepage was encountered during drilling.



BORING LOG
 8163 West Mercer Way
 Mercer Island, Washington

<i>Job</i> 20279	<i>Date:</i> Sept. 2020	<i>Logged by:</i> MKM	<i>Plate:</i> 5
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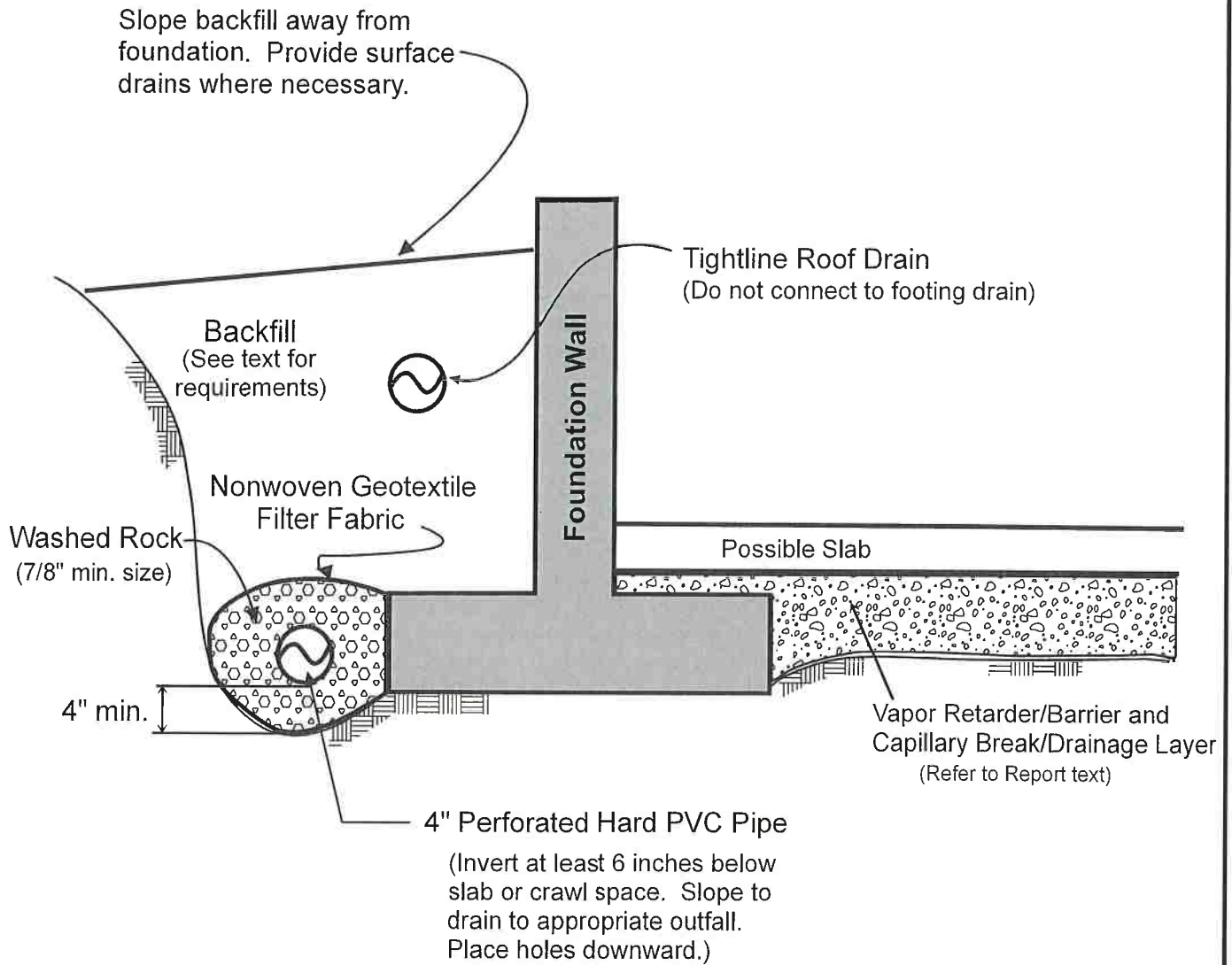


Note - Refer to the report for additional considerations related to drainage and waterproofing.



SHORING DRAIN DETAIL
 8163 West Mercer Way
 Mercer Island, Washington

Job No: 20279	Date: Oct. 2020	Plate: 6
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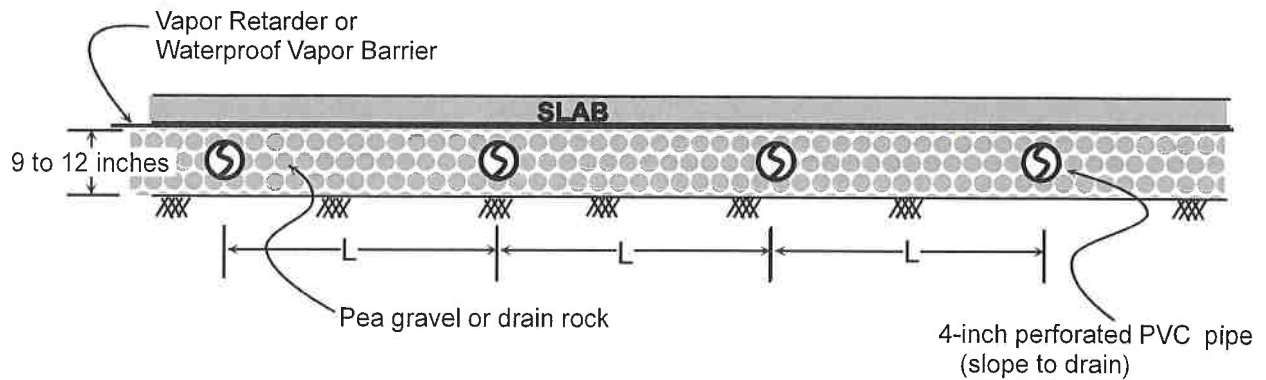
NOTES:

- (1) In crawl spaces, provide an outlet drain to prevent buildup of water that bypasses the perimeter footing drains.
- (2) Refer to report text for additional drainage, waterproofing, and slab considerations.



FOOTING DRAIN DETAIL
8163 West Mercer Way
Mercer Island, Washington

Job No: 20279	Date: Oct. 2020	Plate: 7
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NOTES:

- (1) Refer to the report text for additional drainage and waterproofing considerations.
- (2) The typical maximum underslab drain separation (L) is 15 to 20 feet.
- (3) No filter fabric is necessary beneath the pipes as long as a minimum thickness of 4 inches of rock is maintained beneath the pipes.
- (4) The underslab drains and foundation drains should discharge to a suitable outfall.



TYPICAL UNDERSLAB DRAINAGE
 8163 West Mercer Way
 Mercer Island, Washington

<i>Job No:</i> 20279	<i>Date:</i> Oct. 2020	<i>Plate:</i> 8
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Appendix A
Nearby Explorations

Geotech Consultants, Inc.
November 15, 1999 Proposed
Residence – 8229 West Mercer Way

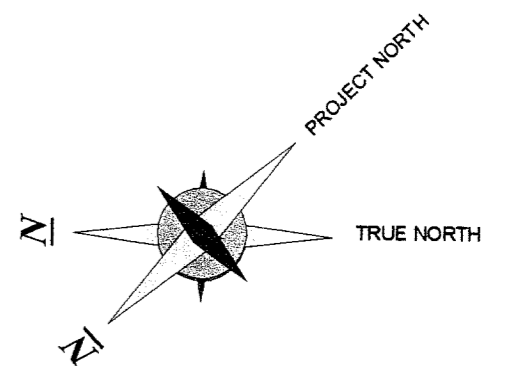
PanGEO, Inc. March 15, 2016
8167 West Mercer Way

W. MERCER WAY

103.48°E
S46 314.33'

LOT 27

EXISTING HOME
8235 WEST MERCER WAY



-  FIRE HYD.
 -  WATER VALVE
 -  POWER POLE
 -  EXISTING CATCH BASIN
 -  SET 1" BY 2' STAKE
 -  SET "PK" NAIL WITH SHINER
 -  FOUND REBAR & CAP 18077
 -  FOUND REBAR
 -  FOUND PLAT MONUMENT
 -  MAPLE TREE 1 TO 2 FEET
 -  ALDER TREE 18" +/-
 -  MADONNA TREE 18" +/-
- B-1** APPROXIMATE LOCATION
of GEOTECH CONSULTANTS
BORING SEPTEMBER 1999

CONTOUR INTERVAL = 2 FEET

00'00"
S42.44°02'W
M70.84' S45

EXISTING HOME

ROCK WALL

GARAGE

EXISTING HOME

STEEL "I" BEAM &
WOOD RETAINING WALL

Wood shed

Wood ret. wall

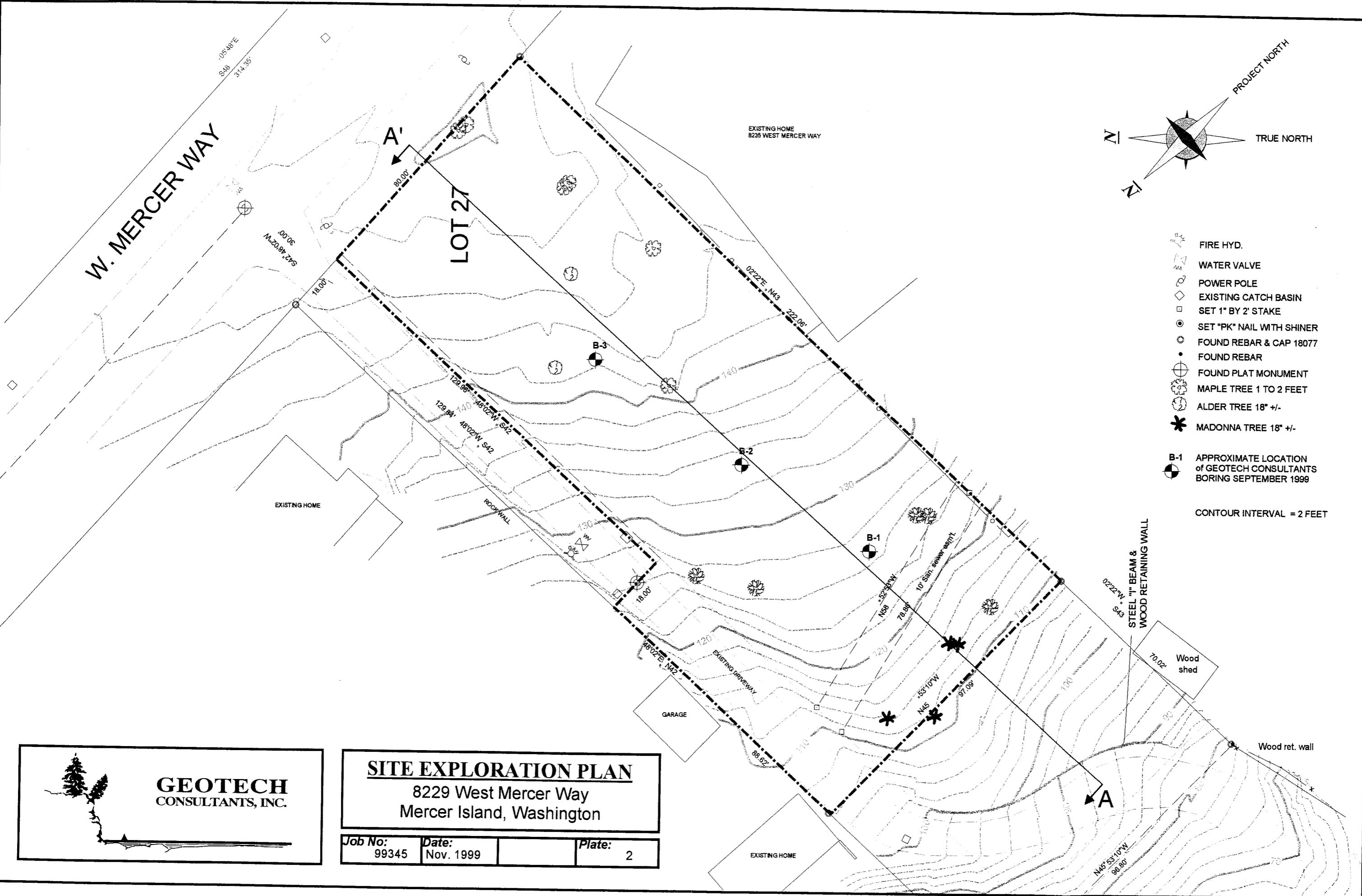


GEOTECH
CONSULTANTS, INC.

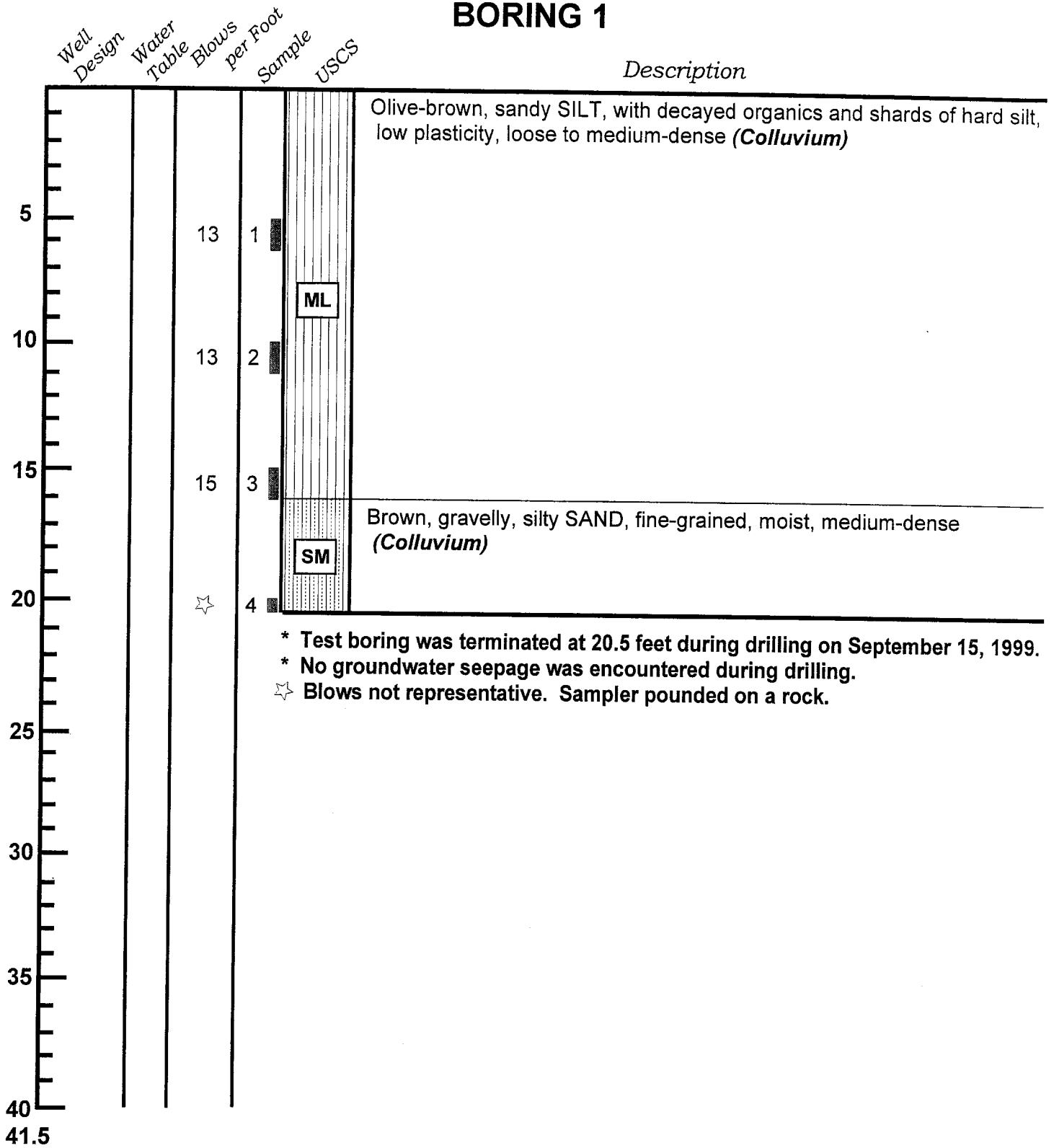
SITE EXPLORATION PLAN

8229 West Mercer Way
Mercer Island, Washington

Job No: 99345	Date: Nov. 1999	Plate: 2
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BORING 1



BORING LOG

8229 West Mercer Way
Mercer Island, Washington

Job No: 99345	Date: 9-99	Logged by: SES	Plate: 3
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BORING 2

Well Design	Water Table	Blows per Foot	Sample	USCS	Description
		20	1	ML	Light brown, sandy SILT, with some organics, medium-dense, moist, (<i>Colluvium</i>) - becomes gravelly
		10	2		Olive-brown, clayey SILT, with trace sand, medium-plasticity, very moist, loose (<i>Colluvium</i>)
		11	3	ML	- becomes gravelly
		50/1"	4		Brown with gray and orange mottling, silty SAND, with gravel, fine-grained, very moist, very dense
		50/5"	5	SM	
		50/5"	6		Gray SILT, massive, low plasticity, moist, very dense
		60	7	ML	
		48	8		

* Test boring was terminated at 41.5 feet during drilling on September 15, 1999.

* No groundwater seepage was encountered during drilling.



GEOTECH
CONSULTANTS, INC.

BORING LOG

8229 West Mercer Way
Mercer Island, Washington

Job No: 99345	Date: 9-99	Logged by: SES	Plate: 4
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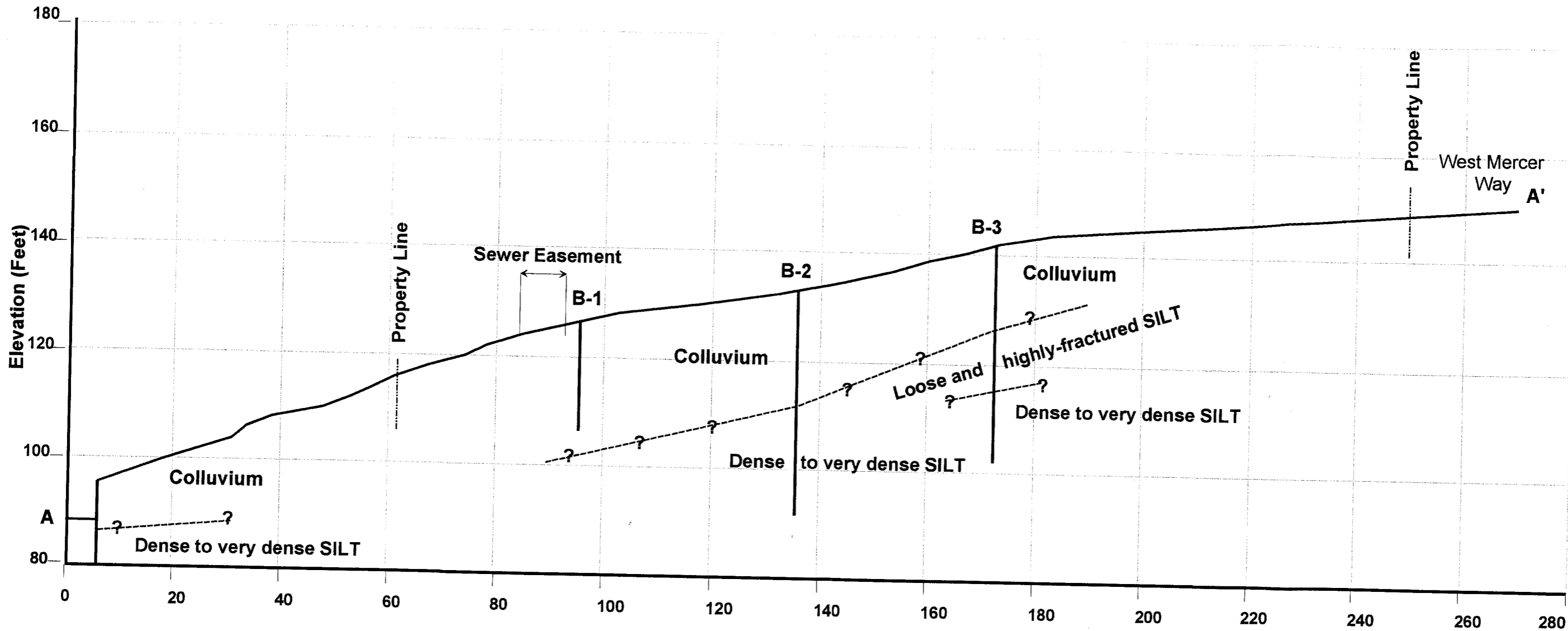
BORING 3



Well Design	Water Table	Blows per Foot	Sample	USCS	Description
					Brown, gravelly, sandy SILT, non-plastic, moist, loose (<i>Colluvium</i>)
		73	1	ML	- gravelly layer
					Olive-brown SILT, low plasticity, very moist, loose (<i>Colluvium</i>)
		11	2	ML	
					Olive-brown SILT, massive, non-plastic, very moist, loose
		10	3	ML	
					Dark gray, slightly clayey SILT, heavily-fractured, low plasticity, stiff to very stiff
		16	4		
					- becomes thinly bedded, slightly fractured
		26	5	ML	
					- becomes olive-brown, moderately fractured
		53	6		
					Dark gray SILT, massive, low plasticity, very moist, dense to very dense
		32	7	ML	
		64	8		

* Test boring was terminated at 41.5 feet during drilling on September 15, 1999.
 * No groundwater seepage was encountered during drilling.



BORING LOG			
8229 West Mercer Way Mercer Island, Washington			
Job No: 99345	Date: 9-99	Logged by: SES	Plate: 5



LEGEND:
 **Approximate water table**
 **Test Borings completed by Geotech Consultants on September 15, 1999**



SUBSURFACE CROSS SECTION
 8229 West Mercer Way
 Mercer Island, Washington

Job No: 99345	Date: Nov. 1999	Plate: 6
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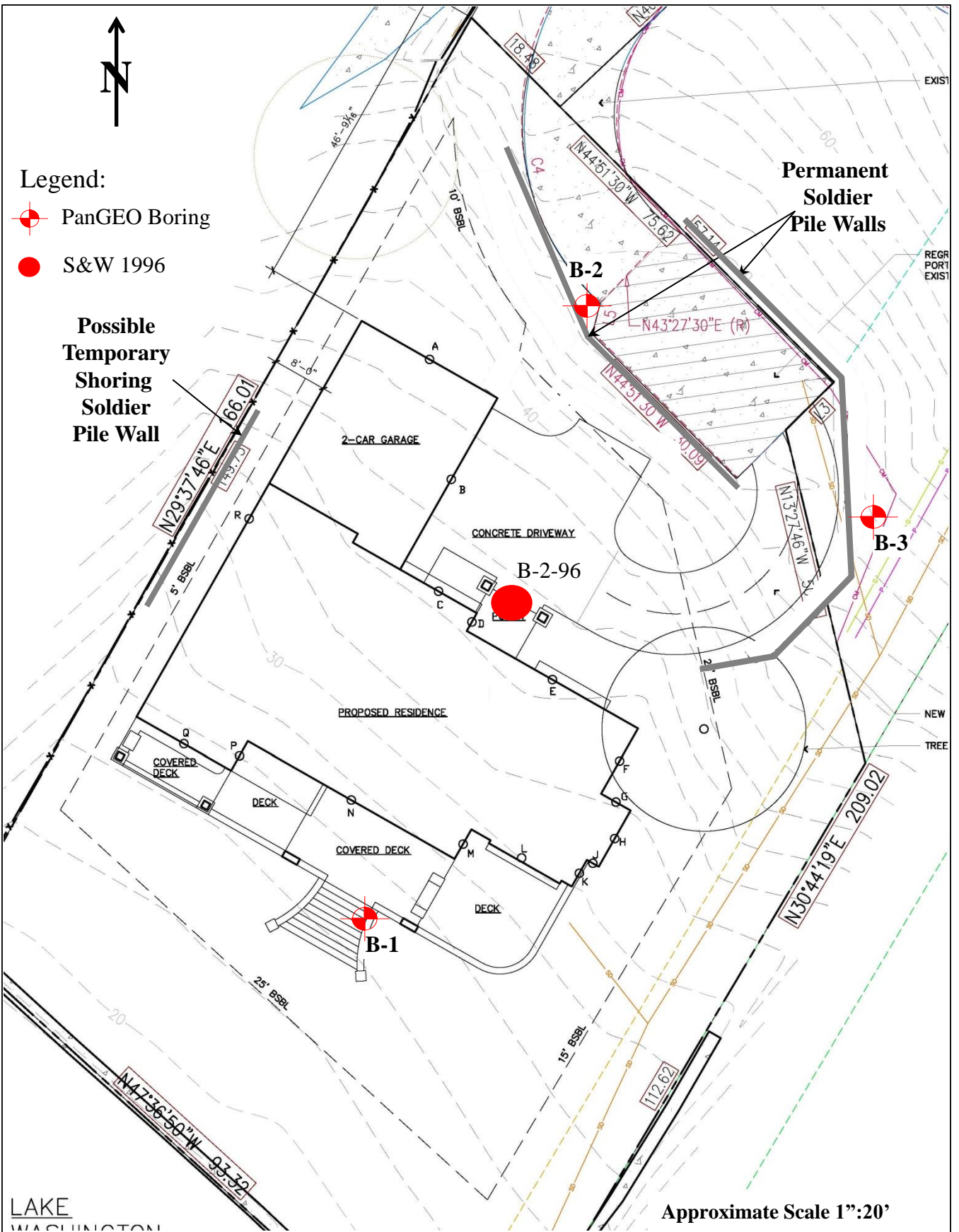
Legend:

⊕ PanGEO Boring

● S&W 1996

Possible
Temporary
Shoring
Soldier
Pile Wall

Permanent
Soldier
Pile Walls



Approximate Scale 1":20'

15-099.100_Figure-1 - 2.ppt 3/4/2016(10:12 AM) SHE

LAKE
WASHINGTON



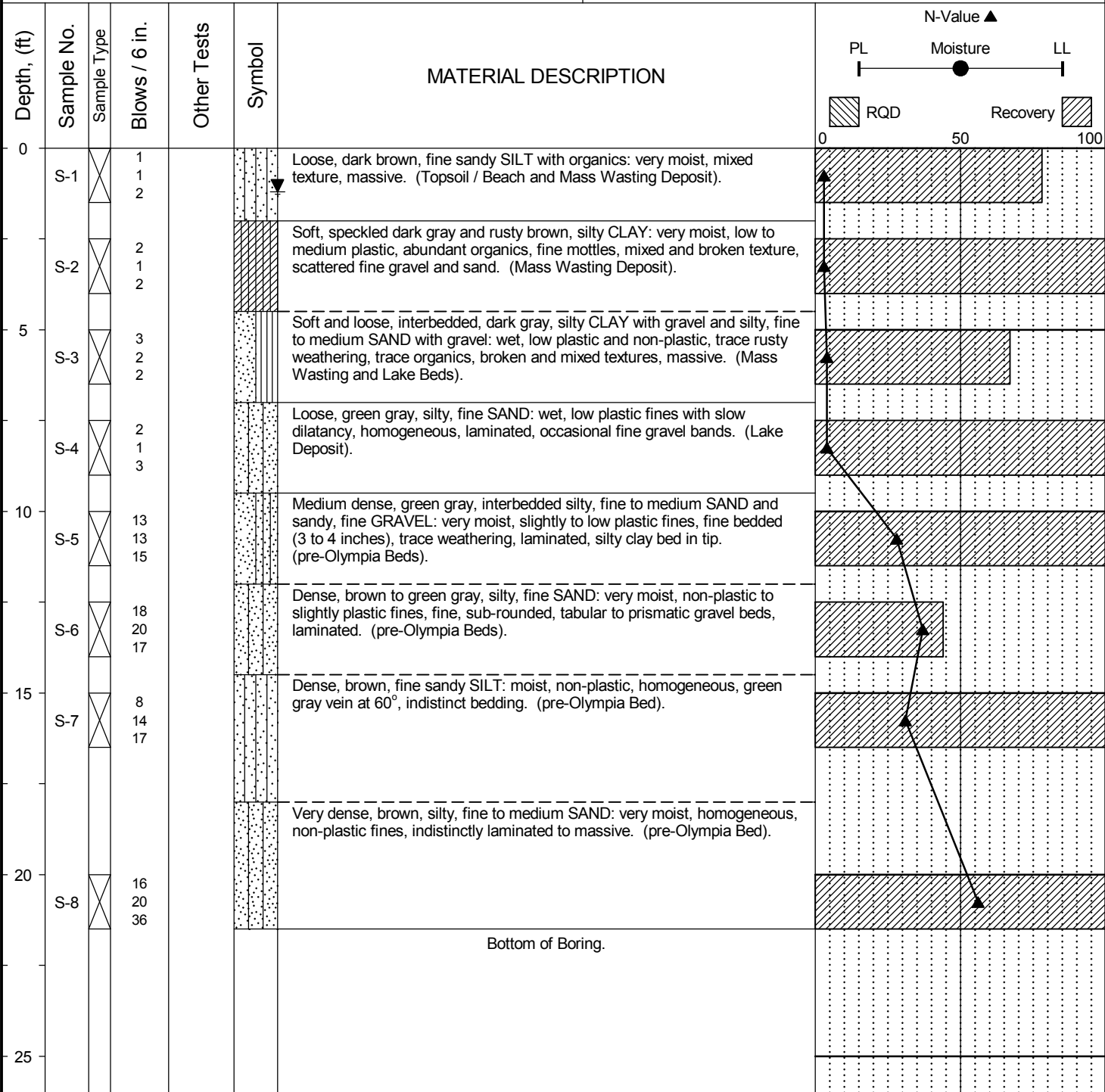
Proposed New Residence
8167 W. Mercer Way
Mercer Island, Washington

SITE AND EXPLORATION PLAN

Project No. 15-099.100

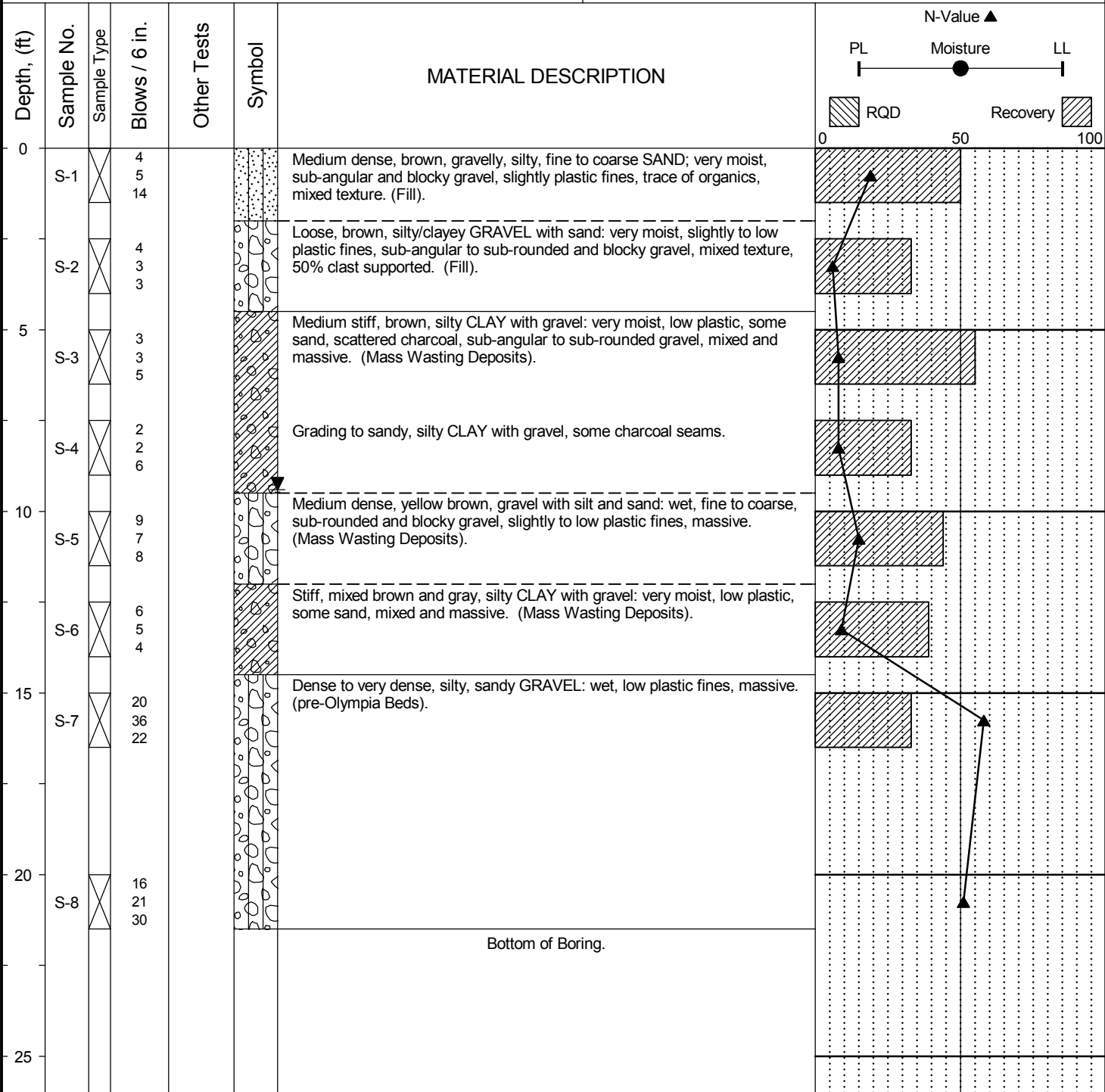
Figure No. 2

Project:	Proposed New Residence	Surface Elevation:	26.0ft
Job Number:	15-099.100	Top of Casing Elev.:	
Location:	8167 West Mercer Way, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: , Easting:	Sampling Method:	SPT



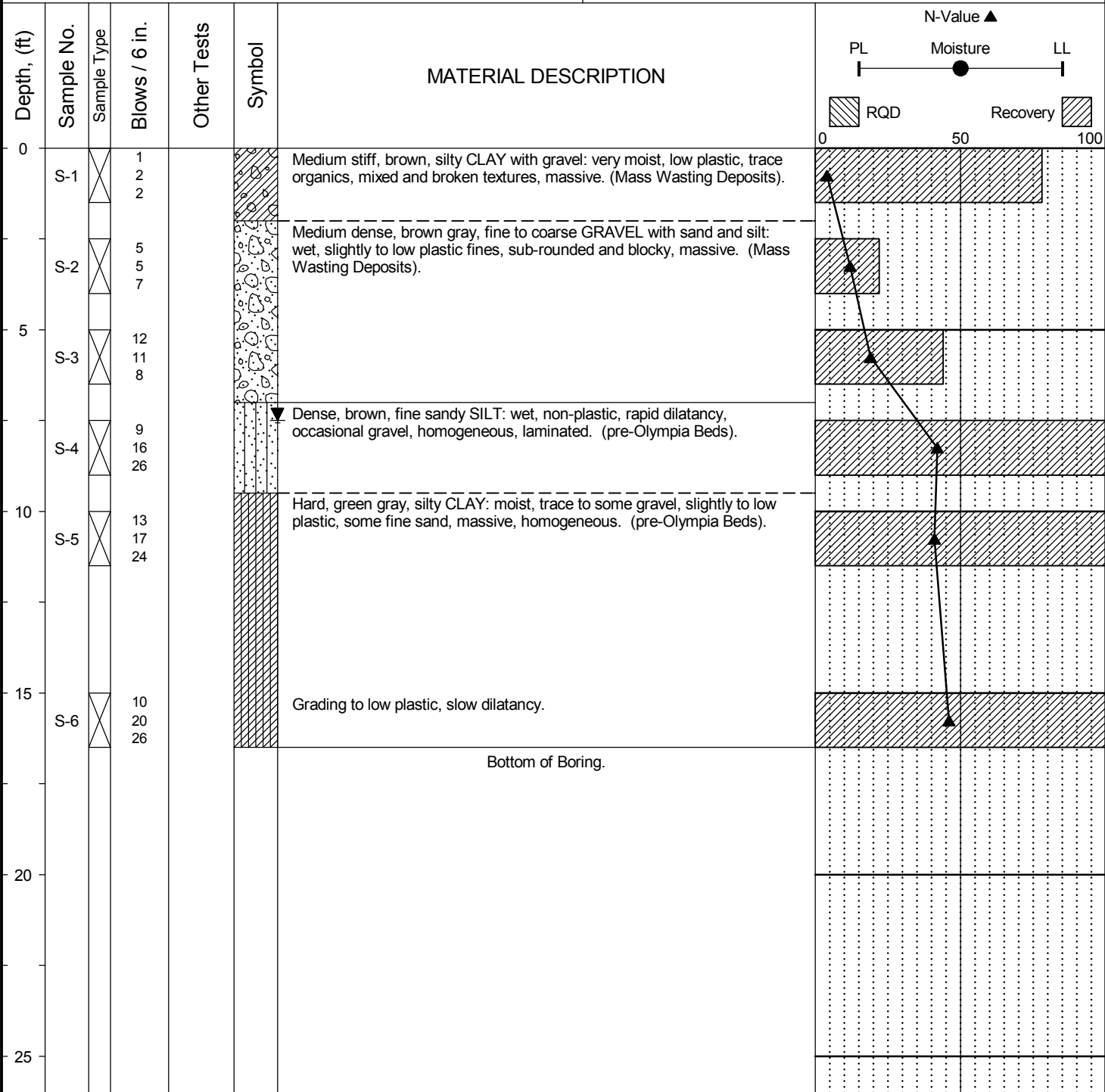
Completion Depth:	21.5ft	Remarks: Groundwater measured in open boring roughly 3 hours following extraction of augers. May not represent static groundwater level.
Date Borehole Started:	2/12/16	
Date Borehole Completed:	2/12/16	
Logged By:	S. Evans	
Drilling Company:	CN Drilling	

Project:	Proposed New Residence	Surface Elevation:	48.0ft
Job Number:	15-099.100	Top of Casing Elev.:	
Location:	8167 West Mercer Way, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: , Easting:	Sampling Method:	SPT

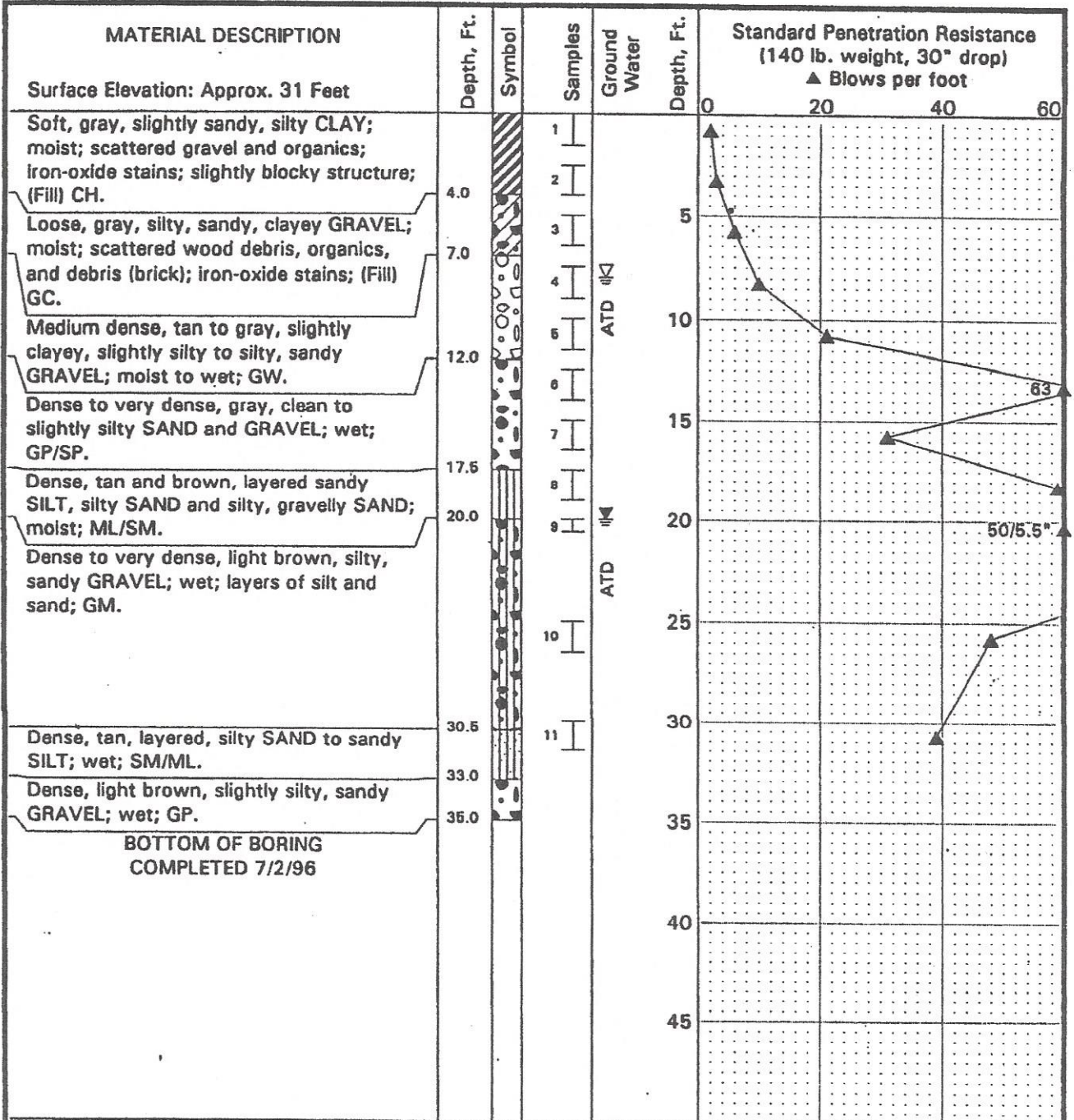


Completion Depth:	21.5ft	Remarks: Groundwater measured in open boring roughly 2.5 hours following extraction of augers. May not represent static groundwater level.
Date Borehole Started:	2/12/16	
Date Borehole Completed:	2/12/16	
Logged By:	S. Evans	
Drilling Company:	CN Drilling	

Project:	Proposed New Residence	Surface Elevation:	50.0ft
Job Number:	15-099.100	Top of Casing Elev.:	
Location:	8167 West Mercer Way, Mercer Island, WA	Drilling Method:	HSA
Coordinates:	Northing: , Easting:	Sampling Method:	SPT



Completion Depth:	16.5ft	Remarks: Groundwater measured in open boring roughly 0.5 hours following extraction of augers. May not represent static groundwater level.
Date Borehole Started:	2/12/16	
Date Borehole Completed:	2/12/16	
Logged By:	S. Evans	
Drilling Company:	CN Drilling	



LEGEND

- Sample Not Recovered
- I 2" O.D. Split Spoon Sample
- II 3" O.D. Shelby Tube Sample
- [Symbol] Surface Seal
- [Symbol] Annular Sealant
- [Symbol] Piezometer Screen
- [Symbol] Grout
- ▽ Water Level

- % Water Content
- Plastic Limit —●— Liquid Limit
- Natural Water Content

NOTES

1. The stratification lines represent the approximate boundaries between soil types, and the transition may be gradual.
2. The discussion in the text of this report is necessary for a proper understanding of the nature of subsurface materials.
3. Water level, if indicated above, is for the date specified and may vary.
4. Refer to KEY for explanation of "Symbols" and definitions.
5. USC letter symbol based on visual classification.

8225 W. Mercer Way Short Plat
Mercer Island, Washington

LOG OF BORING B-2 -96

October 1996

W-7358-01

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

Fig. 7