FACET

Formerly DCG/Watershed

Drainage Report

ADDRESS: 4045 West Mercer Way, Mercer Island, WA 98040
PARCEL: 3623500395
DATE: May 2025

OWNER:
Scott Chancellor
4045 W Mercer Way Mercer Island
Mercer Island, WA 98040

FOR SUBMITTAL TO:
CITY OF MERCER ISLAND

CERTIFICATE OF ENGINEER

The technical material and data contained within this report has been prepared by or under the direction of the following registered professional engineer(s), licensed in accordance with the laws of the State of Washington to practice in the State of Washington.

Table of Contents

Tables

Figures

Appendices

Quick Reference Project Information

GENERAL PROJECT INFORMATION

Project Description	The project proposes to construct a new single-family residence. Site improvements include drainage, grading, paving, utilities, and landscaping to support the construction of the proposed development.
Project Address	4045 W Mercer Way Mercer Island, WA 98040
Project Size	Developed Site = 12,405 SF (0.285 Acres)
Owner/Developer	Scott Chancellor 4045 W Mercer Way Mercer Island, WA 98040
Consulting Engineer	Ben, Iddins, PE Facet 9706 4th Ave NE, Suite 300 Seattle, WA 98115 Phone: (206) 523-0024 ext. 115

DRAINAGE SUMMARY

Drainage Requirements	2019 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW) & the City of Mercer Island site specific amendments. • Minimum Requirements #1-#5	
Tributary Drainage Area & Land Cover Summary	Predeveloped Conditions: Impervious Surface = 1,315 SF PGIS = 0 SF Pervious Surface = 11,090 SF Total = 12,405 SF (0.285 Acres)	Developed Conditions: Total Impervious = 4,939 SF Total PGIS = 626 SF Pervious Surface = 2,059 SF Total = 12,405 SF (0.285 Acres)
Soils	A Geotechnical Engineering Study and Critical Area Study was compiled in a report dated June 18, 2021 by Geotech Consultants, Inc. See Appendix A for this report.	
Stormwater BMPs	N/A	
ESC Measures	TESC plan required per the Stormwater Manual. TESC measures include (but are not limited to) storm drain inlet protection, perimeter protection, construction entrance, construction fencing, straw wattles, and street cleaning.	

1. Project Overview

The project proposes to construct a new single-family residence on the currently vacant lot. The project is located at 4045 West Mercer Way, Mercer Island, WA 98040 (Parcel #3623500395). Improvements include site grading, drainage, water services, sewer utilities, and power and gas utilities. The project site is bound by single-family residences to the west, a private access roadway to the north, and by E Mercer Way to the east and south.

The project location is shown in Figure 1. The City of Mercer Island has site specific amendments which adopt the 2019 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SWMMWW), the combination of which is hereafter referred to as "the Manual".

Figure 1. Site Location (via King County iMap)

1.1 Predeveloped Site Conditions

The existing parcel currently has a foundation with a driveway to access West Mercer Way. The site slopes from northeast to southwest with an average gradient of approximately 37% and a total elevation change of approximately 46 feet. There are steep slopes, landslide hazard area and seismic hazard environmentally critical areas on the site according to the City of Mercer Island online mapping tool. Table 1 summarizes the existing site conditions and land cover characteristics of the project site's on-site areas.

1.2 Developed Site Conditions

The developed parcel conditions, shown in the Civil Plans (under separate cover), include a new single-family residence with a driveway, walkways, utilities, and landscaping necessary to support the development. The project proposes sending all collected stormwater to an existing 8'' outfall pipe onsite that sends water directly into Lake Washington. Table 1 summarizes the developed site conditions and land cover characteristics of the project site's on-site areas.

1.3 Site Area and Size of Improvements

The total project site contains 12,405 SF (0.285 acres) of improvements, located on West Mercer Way. The drainage basin for this site is the project parcel, the ROW improvements, and the downstream drainage system. The site area and size of improvements are shown in the project plans and summarized in Table 1. See Section 8 of this report for the Drainage Plan for the project.

Table 1. On-Site Project Areas and Size of Improvements

Description of On-site Areas	Ex Areas		Dev Areas	
	SF	Acres	SF	Acres
EX Buildings	865	0.020		
EX Walls/Stairs/Concrete	450	0.010		
New Buildings			3,330	0.076
New Driveway			626	0.014
New Walkways/Walls/Pool/Hot Tub			796	0.018
Drip Through Decking			187	0.004
Total EX Impervious Surface:	1,315	0.030		
Total New/Replaced Impervious Surface:			4,752	0.109
Total New/Replaced Pollution Generating Impervious Surface:			626	0.014
Total Impervious Surface (Minus Decking):	1,315	0.030	4,752	0.109
Total Impervious Surface (Decking Included):	1,315	0.030	4,939	0.113
EX Onsite Pervious Surface:	11,090	0.255	2,059	0.047
New/Replaced Onsite Pervious Surface:			5,407	0.124
Total Pervious Surface:	11,090	0.255	7,466	0.172
Total Onsite Project Site Area	12,405	0.285	12,405	0.285

1.4 Pre-developed Stormwater Runoff Conditions

The site is a lakefront property that slopes steeply to moderately from the north to the south towards Lake Washington. Existing stormwater runoff conditions are not entirely known as all that remains onsite is a building foundation, however it is believed that stormwater is connected and drained to an 8″ outfall that is located near the bulkhead in the southeastern property corner.

1.5 Post-developed Stormwater Runoff Conditions

Roof runoff for the SFR and the at-grade surfaces will be collected via downspouts, trench drains, area drains and catch basins and conveyed to an 8″ outfall pipe on the southeastern corner of the property that drains to Lake Washington.

1.6 Soils

A geotechnical analysis was performed by Geotech Consultants, Inc ("Geo") on February 5, 2021, with the accompanying report dated June 18th, 2021. Geo excavated three boring tests. The soil encountered on-site included loose fill and colluvium soils below the ground surface, dense glacially compressed silty sand (from about 7-9.5' below ground surface), and very dense soils below that (10-18' below ground surface). Perched groundwater seepage was encountered within the compressed sand layer, but Geo notes that "It should be noted that groundwater levels vary seasonally with rainfall and other factors. We anticipate that groundwater could be found in the loose near-surface soils, perched on top of and in sand seams within the relatively impervious underlying dense glacially compressed soils. This is most likely to occur following extended wet weather."

Geo conducted a critical areas study where they acknowledged that the site is located within a seismic hazard, potential landslide hazard, steep slope hazard, and erosion hazard area. Geo noted that because of the potential for near surface soil movement, catchment walls should be constructed and recommended that catchment walls be constructed along the garage and along the "middle" area of the house with the walls extending 7' or 6' above the adjacent grade respectively. Geo added other recommendations within the report for certain building foundation techniques and construction stormwater best management practices to mitigate the identified hazards and ultimately deemed that the project, if their recommendations are followed, is constructable. Please see Appendix A for further information.

Additionally, Geo noted:

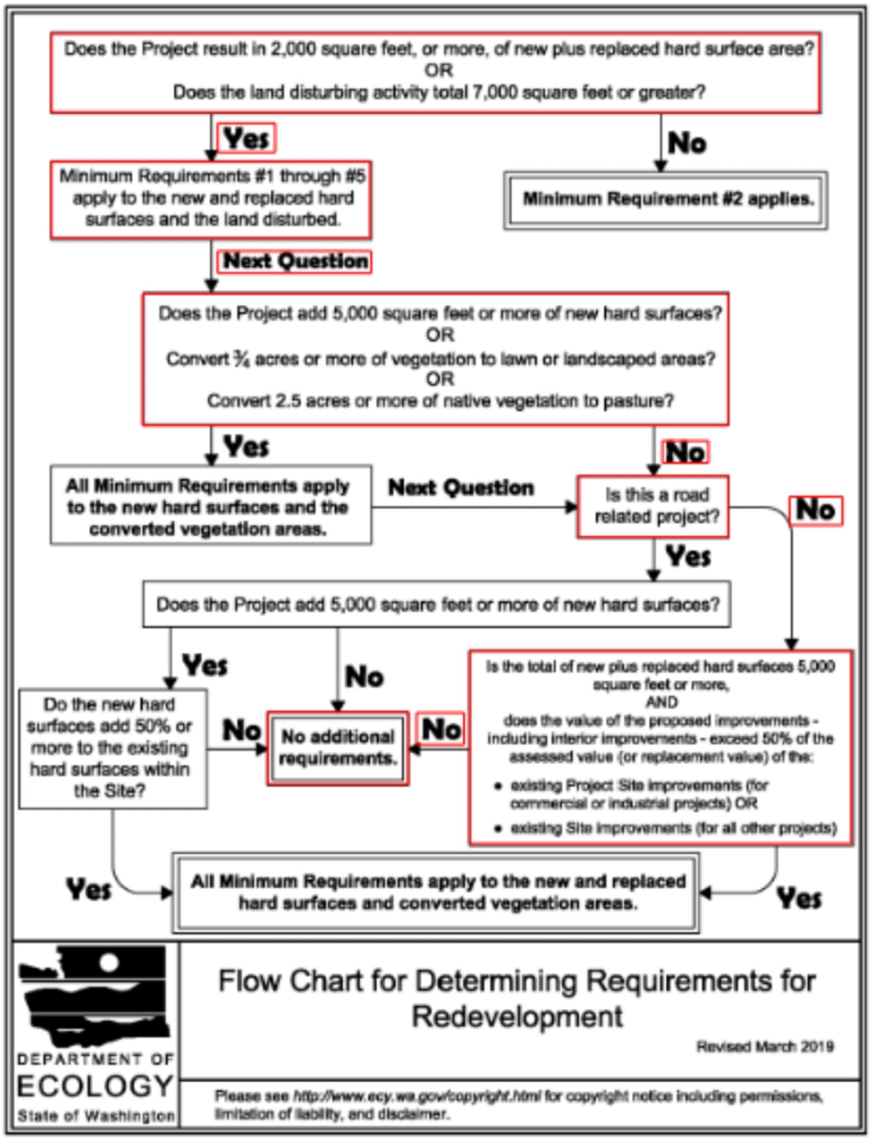
> *We anticipate that onsite stormwater infiltration will be considered for the project. However, the underlying glacially compressed soils are essentially impervious and will stop downward percolation of large volumes of water infiltrated above it. This is a common problem throughout the Pacific Northwest. Also, the upper soils at the site are loose and could be destabilized by the infiltration of stormwater into them. Considering this, it is our professional opinion that onsite infiltration of stormwater is not feasible for the subject site.*

Therefore, infiltration techniques will not be utilized on-site.

2. Minimum Requirements

The Minimum Requirements applicable to this project were determined using *Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment* from the Stormwater Manual, as shown on the next page.

Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment



2019 Stormwater Management Manual for Western Washington

Volume I - Chapter 3 - Page 90

As shown in Figure I-3.2, Minimum Requirements #1-#5 apply to the new and replaced hard surfaces and converted vegetation areas. The project meets the Stormwater Manual's minimum requirements as summarized in the following sections.

2.1 Minimum Requirement #1: Preparation of Stormwater Site Plans

The Stormwater Site Plan was prepared in accordance with Volume 1 Section I-3.4.1 of the Stormwater Manual and includes the minimum requirements applicable to the subject site based on thresholds of new and replaced site impervious coverage.

2.2 Minimum Requirement #2: Construction Stormwater Pollution Prevention Plan

The Construction Stormwater Pollution Prevention Plan (SWPPP) was prepared in accordance with Volume 1 Section I-3.4.2 of the Stormwater Manual, utilizing the Department of Ecology's (DOE) Construction Stormwater General Permit SWPPP template, and is described further in Section 4. The Temporary Erosion and Sediment Control Plan (TESC Plan) can be seen in Section 8 of this report and serves as a guide for the contractor to implement a final TESC Plan. As the site disturbance is less than one acre, a Construction Stormwater General Permit through the DOE is not required.

2.3 Minimum Requirement #3: Source Control of Pollution

The proposed storm drains, area drains, and cleanouts serve as source control of pollution for the project site prior to being detained and released from the project site. To control pollutants, proper maintenance and cleaning of debris, sediments, and oil from stormwater collection and conveyance systems is required per the operation and maintenance recommendations found in Volume 5 Appendix A of the Stormwater Manual in addition to the BMPs in Volume IV Section IV-1. Appendix F for Operation and Maintenance requirements pertaining to the project.

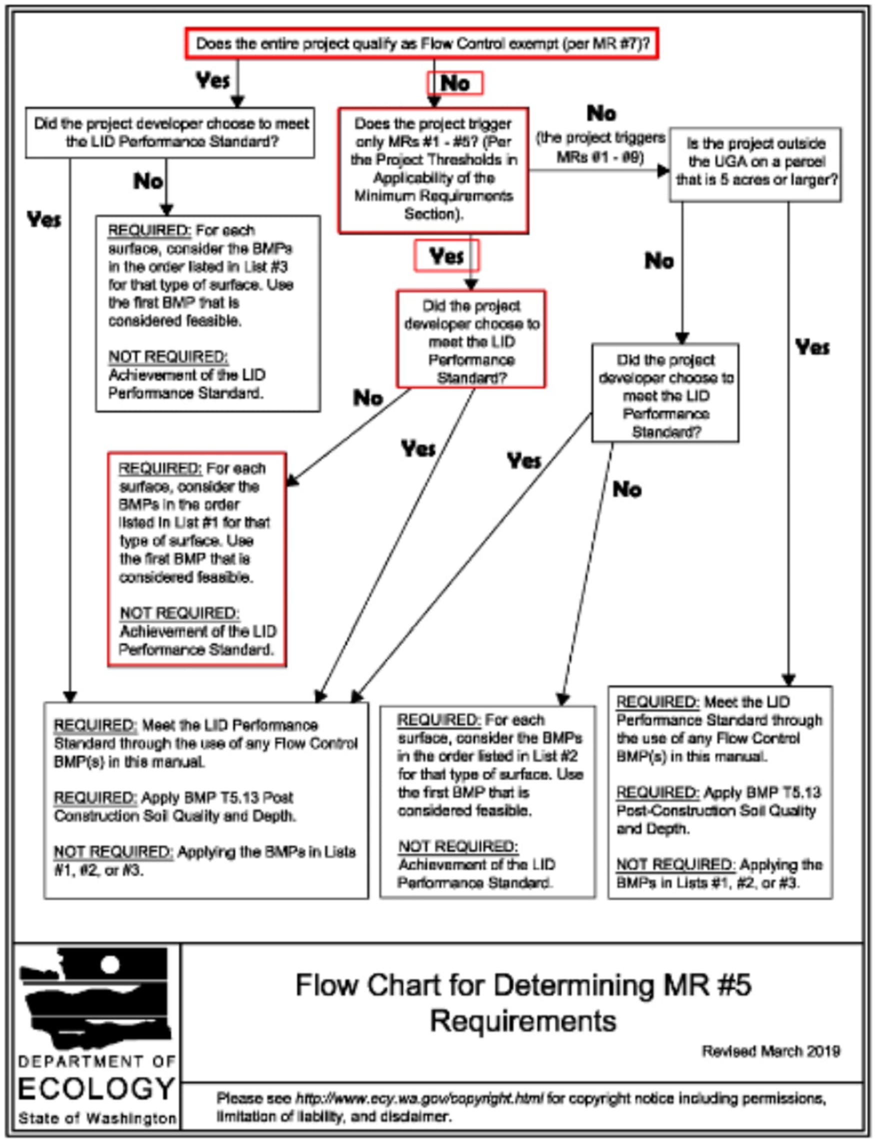
2.4 Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

The proposed drainage system will emulate the natural pre-developed conditions of the site as much as possible as runoff from all new and replaced impervious surfaces will be collected and discharged directly to Lake Washington. This maintains the natural drainage course.

2.5 Minimum Requirement #5: On-Site Stormwater Management

The On-Site Stormwater Management requirements applicable to this project were determined using *Figure I-3.3 – Flow Chart for Determining LID MR #5 Requirements* from the Stormwater Manual, as shown on the next sheet.

Figure I-3.3: Flow Chart for Determining MR #5 Requirements



2019 Stormwater Management Manual for Western Washington

Volume I - Chapter 3 - Page 118

As shown in Figure I-3.3, List #1 applies to this project. This project complies with List #1 as described below:

Lawn and landscaped areas:
All disturbed pervious surfaces not covered by an impervious surface in the developed condition will be amended in accordance with the Post-Construction Soil Quality and Depth requirements as listed under BMP T5.13 in Chapter 5 of Volume V.

Roof:

- **Full Dispersion/Downspout Dispersion Systems:** Infeasible. Full dispersion cannot be utilized as the site is located on a steep slope, landslide, and erosion hazard area and dispersion flow path length are unavailable onsite.
- **Downspout Full Infiltration:** Infeasible. Full Infiltration cannot be utilized as the Geotechnical report states: "the underlaying glacially compressed soils are essentially impervious and will stop downward percolation of large volumes of water above it. This is a common problem throughout the Pacific Northwest. Also, the upper soils at the site are loose and could be destabilized by the infiltration of stormwater into them. Considering this, it is our professional opinion that onsite infiltration of stormwater is not feasible for the subject site".
- **Bioretention:** Infeasible since infiltration on-site is infeasible.
- **Perforated Stub-out Connections:** Infeasible since infiltration on-site is infeasible.
- **On-Site Detention**: N/A. Per City of Mercer Island Drainage Requirements, if a project directly discharges to Lake Washington, detention need not be utilized.

Other Hard Surfaces:

- **Full, Sheet and Concentrated Flow Dispersion:** Infeasible. See rationale for roofs above.
- **Bioretention and Rain Gardens.** Infeasible. See rationale for roofs above.
- **Permeable Pavement**: Infeasible. Permeable pavement surfacing is considered an infiltration technique and infiltration is not feasible onsite.
- **On-site Detention**: N/A. See rationale for roofs above.

Using amended soils, and directly discharging into Lake Washington, Minimum Requirement #5 is satisfied.

See Section 1.5 and 5.1 of this report for additional information on the proposed storm system.

3. Off-Site Analysis Report

The offsite analysis performed begins at the project site. Stormwater discharged from the site flows to the southeastern corner of the project site where it is directly discharged into Lake Washington via an 8" outfall pipe.

There was no visual indication of conveyance system capacity problems, localized flooding, erosion impacts, or violations of surface water quality standards. Additionally, there was no evidence of any damage to the drainage system. See Appendix E of this report for the Downstream Drainage Exhibit and Downstream Analysis Photos.

4. Construction Stormwater Pollution Prevention Plan (SWPPP)

This section summarizes the construction stormwater pollution prevention plan (CSWPPP) analysis and design. The two components of the CSWPPP are the erosion and sediment control (ESC) and the stormwater pollution prevention and spill (SWPPS) plans. Both the ESC Plan and SWPPS serve as guides as the contractor is required to design a working CSWPPP for the site. The analysis and design of these plans are discussed in the following sections.

4.1 ESC Plan Analysis and Design

The ESC design follows the guidelines provided in Appendix D of The Manual and is intended to satisfy Core Requirement #5 Erosion and Sediment Control.

A stabilized construction entrance will be maintained throughout the construction of the site improvements. Perimeter protection such as silt fence, straw wattles, or compost socks will be installed downslope of the improvements. Street cleaning on West Mercer Way will occur daily or as needed to remove any sediment tracked from the site. Site surface drainage will be maintained to prevent any ponding and inlet protection will be provided at all existing and proposed inlets that may receive runoff during construction. All disturbed areas that will not be paved will be stabilized by planting and mulching in accordance with BMP T5.13 of the 2019 Washington State DOE Stormwater Management Manual for Western Washington immediately after construction. The proposed ESC measures are shown on the Temporary Erosion and Sediment Control Plan in Section 8 and summarized in Table 2.

An ESC supervisor will be designated for the project and must be a Certified Professional in Erosion and Sediment Control or a Certified Erosion and Sediment Control Lead, as recognized by King County. The ESC supervisor will be responsible for the performance, maintenance, and review of all

ESC measures, as well as the compliance with all permit conditions relating to ESC as described in The Manual.

4.2 SWPPS Plan Design

The SWPPS plan is intended to prevent pollutants from encountering stormwater runoff, surface waters, or groundwater, during construction. Vehicles, construction equipment, materials, chemical storage, and sediment from clearing and grading all have the potential to pollute stormwater during construction. The following BMPs are required during the construction of this project:

- Maintain good housekeeping.
- Designate vehicle, equipment, and chemical storage areas.
- Inspect vehicle, equipment, and petroleum product storage and dispensing areas regularly to detect any leaks or spills.
- Store and contain liquid materials in such a manner that if the tank leaks, the contents will not discharge into the storm drainage system, surface waters, or groundwater.
- Provide maintenance and cleaning of the storm drainage system regularly by removing sediment and debris.
- All spills will be cleaned up immediately and disposed of correctly. Do not hose down spill areas to a storm drainage system.
- All toxic materials will be stored under cover when not in use or during a rain event.
- Use storm drain covers or other similarly effective runoff control measures to prevent sediment and other pollutants from entering catch basins.

All ESC and SWPPS BMPs will be inspected routinely by the ESC supervisor. All ESC measures will be removed, the site stabilized, and the drainage system cleaned once construction is completed.

4.3 Rainy Season Requirements

The construction of this project will be managed to minimize the amount of time that exposed soil is receptive to rainfall. This will help minimize stormwater runoff and erosion. Compost socks, silt fencing, and/or straw wattles will be placed around the site where needed to control the flow rate and disperse stormwater leaving the site. Mulching will be used to help stabilize the soil, especially when rain is anticipated.

4.4 Seasonal Suspension Plan

N/A. Construction is not expected to come to a halt at any time during the year unless specifically directed by the City of Mercer Island construction inspector.

Table 2. Proposed ESC Measures

(All ESC Measures Shall Comply with the Stormwater Manual)

	ESC Measure	Comment
1	Identify Project Limits	Mark by fencing or other means to contain the grubbing and grading activities.
2	Catch Basin Inlet Protection	Install catch basin inlet protection in any drainage structures that may collect any stormwater flowing from the construction site.
3	Phase Grubbing and Grading	Phase clearing so that only those areas that are actively being worked are uncovered. From October 1 through April 30, no soils shall remain exposed for more than 2 days. From May 1 through September 30, no soils shall remain exposed for more than 7 days.
4	Install Straw Wattles	Install straw wattles around disturbed areas where sediment could be transported off-site. Adjust straw wattles as required by site conditions and construction sequencing.
5	Sod/Seed Exposed Areas	Cleared areas will be sod/seeded as soon as possible after grading completed (few weeks).
6	Soil Removal	Remove excess soil from the site as soon as possible after backfilling.
7	Protect Adjacent Properties	Adjacent properties shall be protected from sediment deposition by appropriate use of vegetative buffer strips, sediment barriers or filters, dikes or mulching, or by a combination of these measures and other appropriate BMPs.
8	Street Cleaning	Provide for periodic street cleaning to remove any sediment that may have been tracked out. Sediment should be removed by shoveling or sweeping and carefully removed to a suitable disposal area where it will not be re-eroded.
9	Inspect ESC BMPs	Inspect all erosion and sediment control BMPs installed regularly, especially after any large storm. Maintenance, including removal and proper disposal of sediment should be done as necessary.

5. Permanent Stormwater Control

Total areas and land-cover characteristics for all proposed surfaces are shown in Table 1 for the developed site. Please see the Site Assessment and Summary Exhibit Included in Section 8 of this report for tributary areas to the proposed stormwater network elements. The stormwater requirement thresholds are as follows:

- On-site stormwater management BMPs per Table I-3.2 of the Stormwater Manual. See Section 5.1 of this report for more information.
- Flow Control - Minimum Requirement #7 does not trigger for this project.
- Runoff Treatment – Minium Requirement #6 does not trigger for this project.

Table 3. Stormwater Facilities Summary

Facilities Summary
(1) Type 1 Catch Basin
(1) Type 2 Catch Basin
(3) Area Drains
(2) Cleanouts

5.1 On-Site Stormwater Management (LID BMPs)

The project proposes to utilize post amended soils per BMP T5.13 in Chapter 5 of Volume V of the manual. The project also proposes to directly to discharge into Lake Washington through an existing 8'' outfall pipe on the southeastern corner of the site. See Section 2.5 for a more detailed explanation on BMP usage on this project.

5.2 Conveyance System Analysis and Design

The onsite conveyance system is comprised of 6-to-8-inch storm drainpipes, area drains, and catch basins. All stormwater collected onsite will be routed to the existing 8'' outfall pipe located on the Southeastern corner of the property. All proposed storm structures have been sized to handle the anticipated runoff from greater than a 100-year storm event. The pipe specifically analyzed is the proposed 6'' pipe connecting to the existing 8'' outfall pipe where all stormwater will flow through. Using the rational method, the entire project site was sent to this 6" pipe yielding flows a 0.653-cfs. This pipe has a capacity of 0.862-cfs and therefore it has sufficient capacity to handle greater than a 100-year peak storm flow. See Appendix C for this calculation.

6. Special Reports and Studies

A Geotechnical Engineering Study and Critical Area Study were both put together by Geotech Consultants, Inc. in a report dated June 18th, 2021. See Appendix A for this report.

An Arborist dated August 27, 2020, was created for this project by Russell and Lambert Landscape Architecture. See Appendix D for this report.

7. Other Permits

No other permits or approvals are expected to be required for this project.

8. Additional Figures

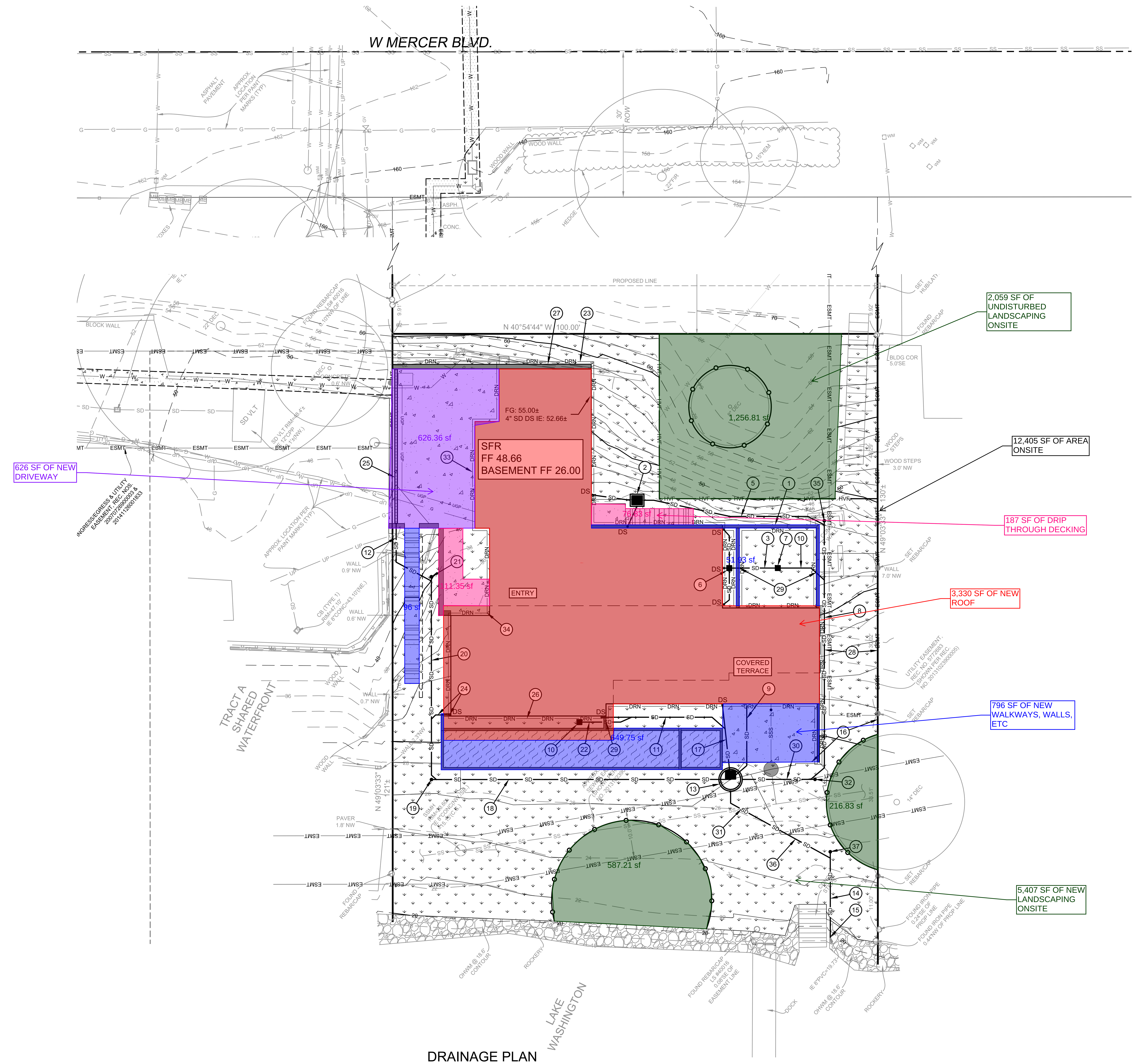
Figure 2. Vicinity Map

Figure 3. Site Assessment and Summary

SCALE IN FEET

LEGEND:

- ASPHALT
- CONCRETE
- LANDSCAPE (F / C09)
- DECK
- HVF — HIGH VISIBILITY FENCING
- TREE PROTECTION FENCING



DRAINAGE PLAN

FACET
9706 4th Ave NE
Suite 300
Seattle, WA 98115
P: 206.523.0024
www.facetnw.com
FEDERAL WAY | KIRKLAND | MOUNT VERNON | SEATTLE | SPOKANE | WHIDBEY ISLAND

NO.	DATE	BY	REVISION

BASE MAP/TOPOGRAPHY PROVIDED BY OTHERS. FACET CANNOT BE HELD LIABLE FOR ACCURACY. CONTRACTOR SHALL FIELD VERIFY GRADES, UTILITIES, AND ALL OTHER EXISTING FEATURES AND CONDITIONS. IF CONDITIONS ARE NOT AS SHOWN AND/OR PLANS CANNOT BE CONSTRUCTED AS SHOWN, CONTACT FACET PRIOR TO CONSTRUCTION.

CALL 811
2 BUSINESS DAYS BEFORE YOU DIG
(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

4045 WEST MERCER WAY
MERCER ISLAND, WA 98040
2105.0080

PERMIT PLAN

DRAINAGE PLAN

DATE: 5/5/2025

PLAN NUMBER:

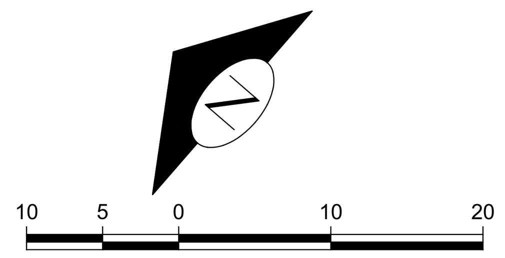
C02

SHEET 2 OF 10

FILE LOCATION: Z:\SHARED\PROJECTS\ACTIVE\2021\05\2105.0080_MCT ARCH_4045 WEST MERCER WAY MERCER ISLAND\DWG\DRAWING\4045 W MERCER WAY MERCER ISLAND_BP PLANS.DWG - ORIGINAL SHEET SIZE: ARCH FULL BLEED D (36.00 X 24.00 INCHES) - LAST MODIFIED BY: RANDY ANDERSON

PRINCIPAL: BI PROJECT MANAGER: JR DESIGNED BY: RA DRAWN BY: GS, CK CHECKED BY: BI

Figure 4. Drainage Plan



LEGEND:

- ASPHALT
- CONCRETE
- LANDSCAPE (F / C09)
- DECK
- POOL & HOT TUB
- HVF — HIGH VISIBILITY FENCING
- TREE PROTECTION FENCING

DRAINAGE NOTES:

ROOF DRAINS:
1. NUMBER AND SIZE SHALL BE IN CONFORMANCE WITH THE UNIFORM PLUMBING CODE.
2. DOWNSPOUTS SHALL BE TIED INTO A NON-PERFORATED, RIGID, SMOOTH-BORE PIPE, WHICH DRAINS TO AN APPROVED STORM SYSTEM.
3. DRAINPIPE SHALL MEET MATERIAL STANDARDS FOR D2729 FOR P.V.C. PIPE, GR F-405 FOR SMOOTH-BORE H.D.P.E. PIPE.
4. PROVIDE CLEANOUTS AT THE UPPER END OF THE SYSTEM AND AT EACH CUMULATIVE CHANGE OF DIRECTION IN EXCESS OF 135 DEGREES.
5. ALL PIPE FITTINGS SHALL BE MADE OF THE SAME MATERIAL AS THE STRAIGHT PIPE. GLUED JOINTS SHALL USE A BONDING AGENT RECOMMENDED BY THE PIPE MANUFACTURER.

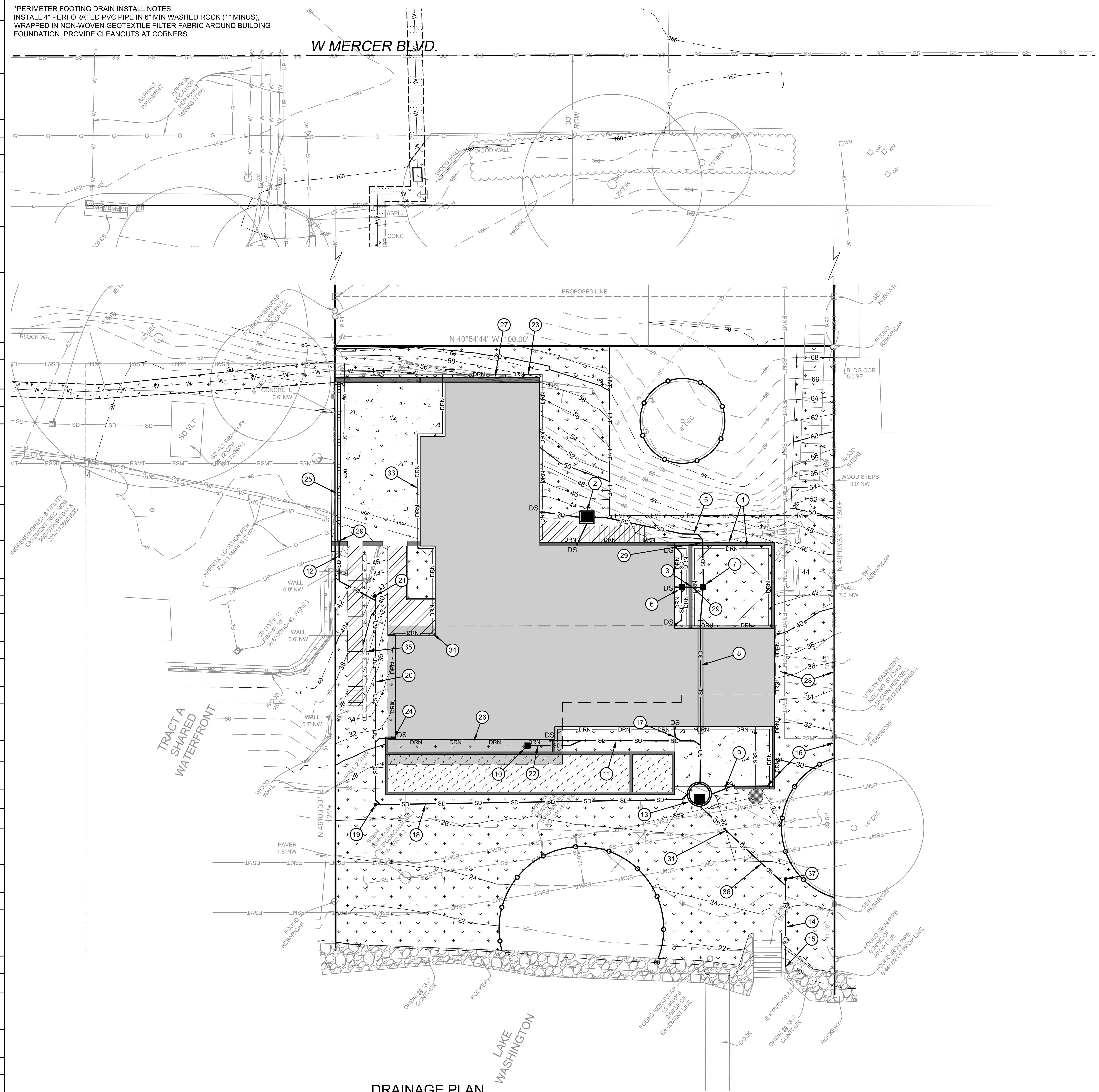
FOOTING DRAINS:
1. FOOTING DRAINS SHALL BE INSTALLED AROUND ALL FOUNDATIONS WHICH ENCLOSE A CRAWL SPACE, CELLAR, BASEMENT, GARAGE OR OTHER BUILDING SPACE.
2. DRAINS SHALL BE CONSTRUCTED OF PERFORATED PIPE INSTALLED AT THE BASE OF THE FOOTING.
3. DRAIN PIPE SHALL MEET MATERIAL STANDARDS FOR D2729 FOR P.V.C. PIPE, WITH THE PERFORATIONS DIRECTED DOWNWARD.
4. GRANULAR BACKFILL SHALL BE PLACED AROUND AND ABOVE THE FOOTING DRAIN TO A DEPTH OF 2/3 OF THE HEIGHT OF THE WALL.

GENERAL:
1. SLOPE ALL DRAIN LINES AT 2% MINIMUM TOWARD THE OUTLET.
2. PROVIDE CLEANOUTS OR CONTROL STRUCTURES AS APPROPRIATE.
3. ALL DRAINAGE PIPING AND STRUCTURES ARE SUBJECT TO INSPECTION PRIOR TO BACKFILLING.
4. ROOF AND FOOTING DRAINS MAY BE COMBINED BEYOND THE LOWEST POINT OF THE FOOTING DRAIN.
5. USE SAND COLLARS AT CB CONNECTIONS TO P.V.C. PIPE.
6. UNLESS OTHERWISE SPECIFIED, 6" STORM DRAIN PIPE FOR ROOF DRAINS AND SEWER PIPE SHALL BE SDR35 PVC PIPE.
7. ALL FOOTING DRAIN AND PERFORATED PIPE SHALL BE D2729 PVC PIPE WITH THE PERFORATIONS DIRECTED DOWNWARDS.
8. ALL PERF PIPE SHALL BE 4" DIAMETER UNLESS OTHERWISE SHOWN.
9. CONTRACTOR TO VERIFY INVERTS OF STORM DRAIN IN ROW AND ADJUST ONSITE STORM SYSTEM AS NECESSARY.
10. CONTRACTOR TO FIELD LOCATE AND REROUTE ANY POTENTIAL UTILITY CONFLICTS WITH DETENTION FACILITY PRIOR TO CONSTRUCTION
11. THE LAWN AND LANDSCAPE AREAS ARE REQUIRED TO PROVIDE POST-CONSTRUCTION SOIL QUALITY AND DEPTH IN ACCORDANCE WITH BMP T5.13. THE PROJECT CIVIL ENGINEER MUST PROVIDE A LETTER OF CERTIFICATION TO ENSURE THAT THE LAWN AND LANDSCAPE AREAS ARE MEETING THE POST-CONSTRUCTION SOIL QUALITY AND DEPTH REQUIREMENTS SPECIFIED ON THE APPROVED PLAN SET PRIOR TO FINAL INSPECTION OF THE PROJECT. CONTRACTOR MUST PROVIDE CIVIL ENGINEER W/ INFORMATION PROVING THE POST-CONSTRUCTION SOILS MEET THESE REQUIREMENTS.

KEY NOTES:

KEY	NOTE	DETAIL/ SHEET
1	PERMANENT SHORING & CATCHMENT WALL. INSTALL PLASTIC BACKED DRAINAGE COMPOSITE (MIRADRAIN OR EQUIVALENT) AND INSTALL WEEP PIPES MIN 6' ON CENTER DRAINING TO THE FOOTING DRAIN. SEE GEOTECHNICAL REPORT FOR FURTHER INFORMATION 4" IE 26.50±	K/C10
2	TYPE 1 CB W/ OPEN GRATE LID RIM 41.90 6" IE (W) 39.90 6" IE (E) 39.90 6" IE (S) 39.90	G/C09
3	4 LF 6" SD @ 2.00% MIN	-
4	NOT USED	-
5	38 LF 6" SD @ 2.00% MIN	-
6	AREA DRAIN RIM 33.92 6" IE (N) 24.00 6" IE (S) 24.00 6" IE (W) 24.00 6" IE (E) 24.00	-
7	AREA DRAIN RIM 25.90 6" IE (W) 23.90 6" IE (S) 23.90 6" IE (N) 23.90	-
8	39 LF 6" SD PIPE IN 12" DI SLEEVE UNDER BUILDING SLAB. CONTRACTOR TO INSTALL @ MIN 6" OF COVER FROM BUILDING FOUNDATION (ELEV ± 24.50) & @ 2.00% MIN SLOPE. CONTRACTOR TO PROVIDE CASING SPACERS AND RUBBER END SEAL ON BOTH ENDS BETWEEN CARRIER PIPE AND CASING PIPE AND IS TO FILL ANNULAR SPACE WITH APPROVED MATERIAL PIPE WITHIN CASING TO BE RESTRAINED JOINT	-
9	FOOTING DRAIN TIGHTLINE @ 2.00% MIN	-
10	AREA DRAIN RIM 25.25 6" IE (E) 23.25	-
11	30 LF 6" SD @ 2.00% MIN	-
12	16 LF 6" SD @ 2.00% MIN	-
13	TYPE 2 CB W/ OPEN GRATE LID & OIL/WATER SEPARATOR RIM 25.75 6" IE (N) 21.50 6" IE (W) 21.50 6" IE (E) 21.50 6" IE (S) 21.00	E/C09 R/C10
14	17 LF 6" SD @ 2.00% MIN	-
15	CONNECT TO EX PVC OUTFALL ON HIGH SIDE OF BULKHEAD/ROCKERY. RESTORE DISTURBED SURFACES IN KIND. 6" TO 8" ADAPTER 8" PVC IE 19.73	-
16	DRAINAGE LATERALS FROM ADJACENT SITES MAY CONNECT TO EX LAKE OUTFALL. CONTRACTOR TO DETERMINE IN FIELD AND CONNECT EX TO PROPOSED PIPE (IF PIPES DISCOVERED)	-
17	3 LF 6" SD @ 2.00% MIN	-
18	60 LF 6" SD @ 2.00% MIN	-
19	6" SDCO RIM 26.82 6" IE 23.50	H/C09
20	42 LF 6" SD @ 2.00% MIN	-
21	6" SDCO RIM 40.30 6" IE 35.00	H/C09
22	11 LF 6" SD @ 2.00% MIN	-
23	CATCHMENT WALL. INSTALL FOOTING DRAIN AT BASE OF WALL. SEE GEOTECHNICAL REPORT FOR FURTHER INFORMATION* 4" IE 47.15±	-
24	ROOF DS AND TIGHTLINE W/ 1.5' OF COVER AND 2.00% MIN SLOPE (TYP)	-
25	6" TRENCH DRAIN W/ 6" OUTLET. RIM TO FOLLOW EG ALONG PROPERTY LINE 6" IE 47.00	-
26	LOWER LEVEL PERIMETER FOOTING DRAIN* 4" IE 24.50±	-
27	TEMPORARY SHORING WALL. SEE STRUCTURAL & ARCHITECTURAL PLANS FOR FURTHER INFORMATION	-
28	EX INFRASTRUCTURE (FROM NEIGHBORING PROPERTIES) MAY BE LOCATED WITHIN EASEMENT. LOCATE IN FIELD, AND PROTECT EX UTILITIES. CONTACT CIVIL ENGINEER IF NEEDED	-
29	PIPE TO PENETRATE WALL. INSTALL CASING PIPE (CONSULT CIVIL ENGINEER IF NEEDED)/ VERTICAL BENDS AS NECESSARY	-
30	NOT USED	-
31	STORM AND SEWER MAIN CROSSING ENSURE 1' MIN CLEARANCE BETWEEN STORM (ABOVE) AND SEWER (BELOW) IS SATISFIED 6" STORM IE 20.75± 8" SEWER MAIN IE (ASSUMED) 16.00±	-
32	NOT USED	H/C09
33	GARAGE LEVEL FOOTING DRAIN* 4" IE 47.00±	-
34	CONNECT FOOTING DRAINS FROM GARAGE LEVEL/MID LEVEL TO LOWER LEVEL/CATCHMENT WALL FOOTING DRAIN ELEVATION. INSTALL VERTICAL BENDS AS NECESSARY	-
35	APPROX. LOCATION OF TEMPORARY SHORING WALL. SEE STRUCTURAL & ARCHITECTURAL PLANS FOR FURTHER INFORMATION	-
36	24 LF 6" SD @ 2.00% MIN	-
37	6" SDCO RIM 25.23 6" IE 20.25	H/C09

*PERIMETER FOOTING DRAIN INSTALL NOTES:
INSTALL 4" PERFORATED PVC PIPE IN 6" MIN WASHED ROCK (1" MINUS), WRAPPED IN NON-WOVEN GEOTEXTILE FILTER FABRIC AROUND BUILDING FOUNDATION. PROVIDE CLEANOUTS AT CORNERS



DRAINAGE PLAN

NO. | DATE | BY | REVISION

BASE MAP/TOPOGRAPHY PROVIDED BY OTHERS. FACET CANNOT BE HELD LIABLE FOR ACCURACY. CONTRACTOR SHALL FIELD VERIFY GRADES, UTILITIES, AND ALL OTHER EXISTING FEATURES AND CONDITIONS. IF CONDITIONS ARE NOT AS SHOWN AND/OR PLANS CANNOT BE CONSTRUCTED AS SHOWN, CONTACT FACET PRIOR TO CONSTRUCTION.

FACET
9706 4th Ave NE
Suite 300
Seattle, WA 98115
P: 206.523.0024
www.facetnw.com
FEDERAL WAY | KIRKLAND | MOUNT VERNON | SEATTLE | SPOKANE | WHIDBEY ISLAND

BENJAMIN J. IDDINGS — STATE OF WASHINGTON — REGISTERED PROFESSIONAL ENGINEER
Digitally Signed by Ben Iddings
Date: 2025.05.21 20:01 -07'00'

CALL 811
2 BUSINESS DAYS BEFORE YOU DIG
(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

SCOTT CHANCELLOR
4045 WEST MERCER WAY
MERCER ISLAND, WA 98040
2105.0080

PERMIT PLAN

DRAINAGE PLAN

DATE: 5/20/2025
PLAN NUMBER:
C02
SHEET 2 OF 10

FILE LOCATION: Z:\SHARED\PROJECTS\ACTIVE\2021\2105.0080_MCT ARCH_4045 WEST MERCER WAY MERCER ISLAND\DWG\DRAWINGS\4045 W MERCER WAY MERCER ISLAND_BP PLANS.DWG - ORIGINAL SHEET SIZE: ARCH FULL BLEED D (36.00 X 24.00 INCHES) - LAST MODIFIED BY: RANDY ANDERSON
PRINCIPAL: BI PROJECT MANAGER: JR DESIGNED BY: RA DRAWN BY: GS, CK CHECKED BY: BI

Figure 5. TESC Plan

SMALL PARCEL ESC PLAN

KEY NOTES:

KEY	NOTE:	DETAIL/ SHEET
SDI	INSTALL TEMPORARY INLET PROTECTION ON EX SD INLET OR CLOSEST SD INLET DOWNSTREAM OF SITE	D/C09
CE	INSTALL TEMPORARY STABILIZED CONSTRUCTION ENTRANCE. CONTRACTOR TO DETERMINE FINAL LOCATION IN FIELD	A/C09
PP	INSTALL APPROX 260 LF PERIMETER PROTECTION* SEE KEYNOTE 11 FOR ADDITIONAL INFORMATION	B/C01 B/C09
VEG	TREE PROTECTION FENCING	A/C01
SP	PROPOSED STOCKPILE LOCATION. CONTRACTOR TO DETERMINE FINAL LOCATION IN FIELD	-
SW	CONTRACTOR TO SWEEP ROAD DAILY OR MORE OFTEN IF NECESSARY TO REMOVE TRACKED SEDIMENT	-
RE	ALL EX ONSITE HARD SURFACES (INCLUDING STAIRS/FENCE/WALLS) TO BE REMOVED UNLESS OTHERWISE NOTED	-
SA	SOIL AMENDMENT (TYP)	F/C09
1	TREE TO REMAIN	-
2	CONTRACTOR TO PROTECT EX STORM INFRASTRUCTURE (TYP)	-
3	CUT AND CAP EX GAS SERVICE AT PROPERTY LINE FOR REUSE. COORDINATE WITH UTILITY OWNER (BY OTHERS)	-
4	POWER TRANSFORMER VAULT TO BE RELOCATED. COORDINATE WITH UTILITY OWNER (BY OTHERS)	-
5	WALL TO BE REMOVED	-
6	EX ROCKERY BULKHEAD AND STAIRS TO REMAIN	-
7	LOCATION OF EX SSS CONNECTION TO SEWER MAIN IS SHOWN APPROXIMATELY PER CITY GIS INFORMATION. CONTRACTOR TO LOCATE FOR POTENTIAL REUSE. PROJECT CAN REUSE EXISTING STUB IF IN ADEQUATE CONDITION. SEE GENERAL NOTE 2 THIS SHEET	J/C10
8	INTERCEPTOR SWALE PER DOE BMP C200. INSTALLATION REQUIRED FOR WET WEATHER WORK ONLY TOP WIDTH: 2' MIN HEIGHT: 1.5' MIN SIDE SLOPE: 2H:1V BOTTOM ELEV (HIGH ELEV END) 26.50± APPROX BOTTOM ELEV (LOW ELEV END AT SEDIMENT TRAP) 26.00±	-
9	120 SF (MIN SURFACE AREA) SEDIMENT TRAP WITH OUTLET TO LAKE. INSTALLATION REQUIRED FOR WET WEATHER WORK ONLY BOTTOM ELEV: 21.50± OVERFLOW ELEV 24.00± TOP ELEV 25.00± (CONSTRUCT W/ BERM (I.E. SANDBAGS) AS NEEDED)	C/C09
10	MINIMAL CONSTRUCTION DISTURBANCE TO OCCUR WITHIN THIS AREA. REMOVE WOOD STEPS BY HAND	-
11	CONSTRUCT WIRE-BACKED SILT FENCE BEDDED IN COMPOST, NOT NATIVE SOIL OR SAND, AS CLOSE AS POSSIBLE TO THE PLANNED WORK AREA. EXISTING VEGETATION BETWEEN FENCE AND LAKE SHORE TO BE LEFT IN PLACE TO MAXIMUM EXTENT FEASIBLE DURING CONSTRUCTION	-

PROJECT INFORMATION:

ADDRESS:
4045 W MERCER WAY
MERCER ISLAND, WA 98040

OWNER/APPLICANT:
4045 W MERCER WAY
MERCER ISLAND, WA 98040
CONTACT: SCOTT CHANCELLOR

ARCHITECT:
MCCLELLAN ARCHITECTS
3309 WALLINGFORD AVE N
SEATTLE, WA 98103
PH: (206) 728.0480
CONTACT: JOEY PASQUINELLI

CIVIL ENGINEER:
FACET
9706 4TH AVE NE, SUITE 300
SEATTLE, WA 98115
PH: (206) 523.0024
CONTACT: BEN IDDINS, P.E.

SURVEYOR:
TERRANE
10801 MAIN STREET, SUITE 102,
BELLEVUE, WA 98004
PH: (425) 458.4488

GEOTECHNICAL ENGINEER:
GEOTECH CONSULTANTS, INC.
2401 10TH AVE E
SEATTLE, WA 98102
PH: (435) 747.5618
CONTACT: ADAM MOYER

LEGEND:

- STABILIZED CONSTRUCTION ENTRANCE
- SOIL AMENDMENT (F / C09)
- —x— PERIMETER PROTECTION
- —HVF— HIGH VISIBILITY FENCING
- TREE PROTECTION FENCING
- STOCKPILE LOCATION

* INSTALL PERIMETER PROTECTION, SUCH AS SILT FENCING, COMPOST SOCKS, OR STRAW WATTLES IN ACCORDANCE WITH 2019 DEPARTMENT OF ECOLOGY MANUAL

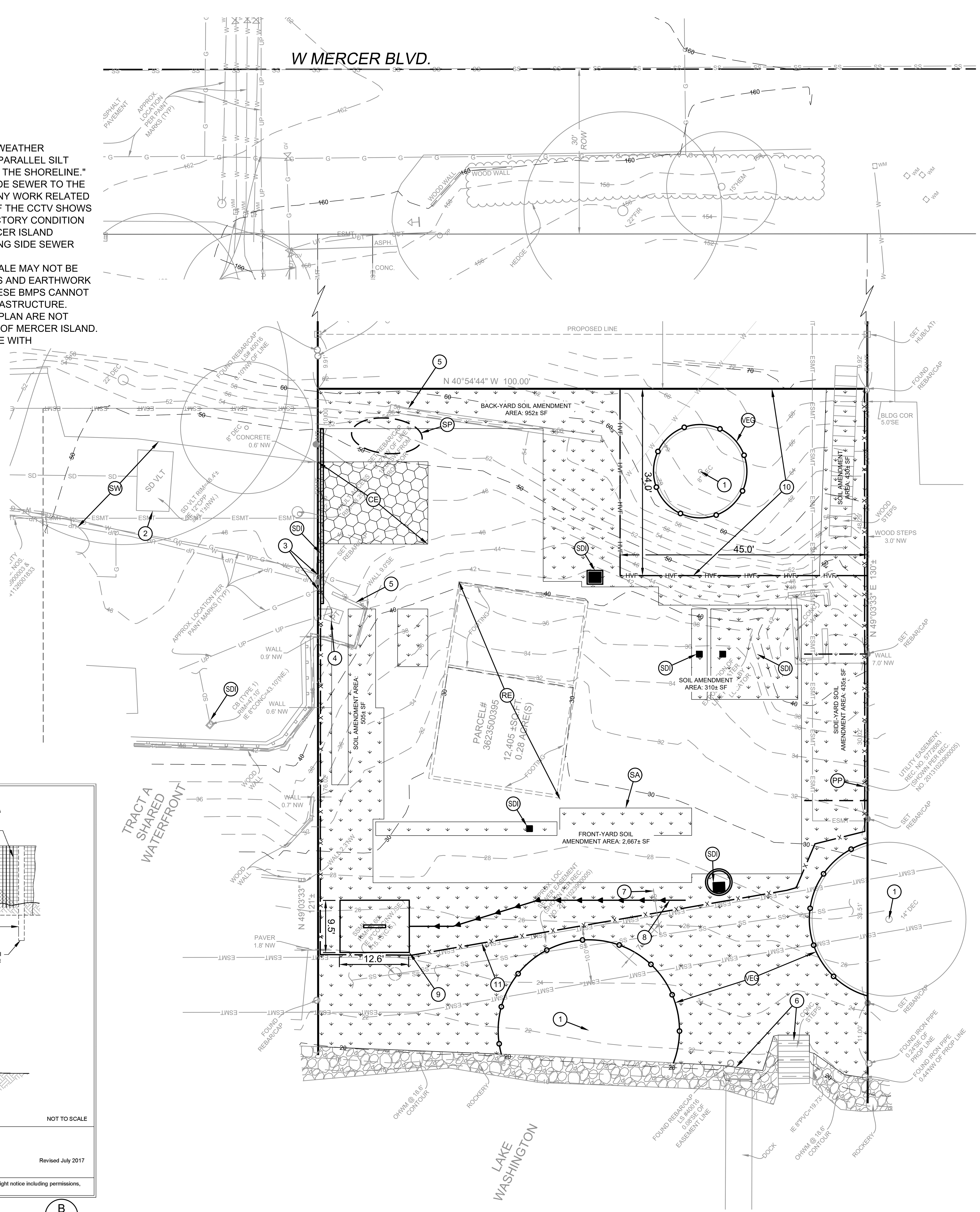
10 5 0 10 20
SCALE IN FEET

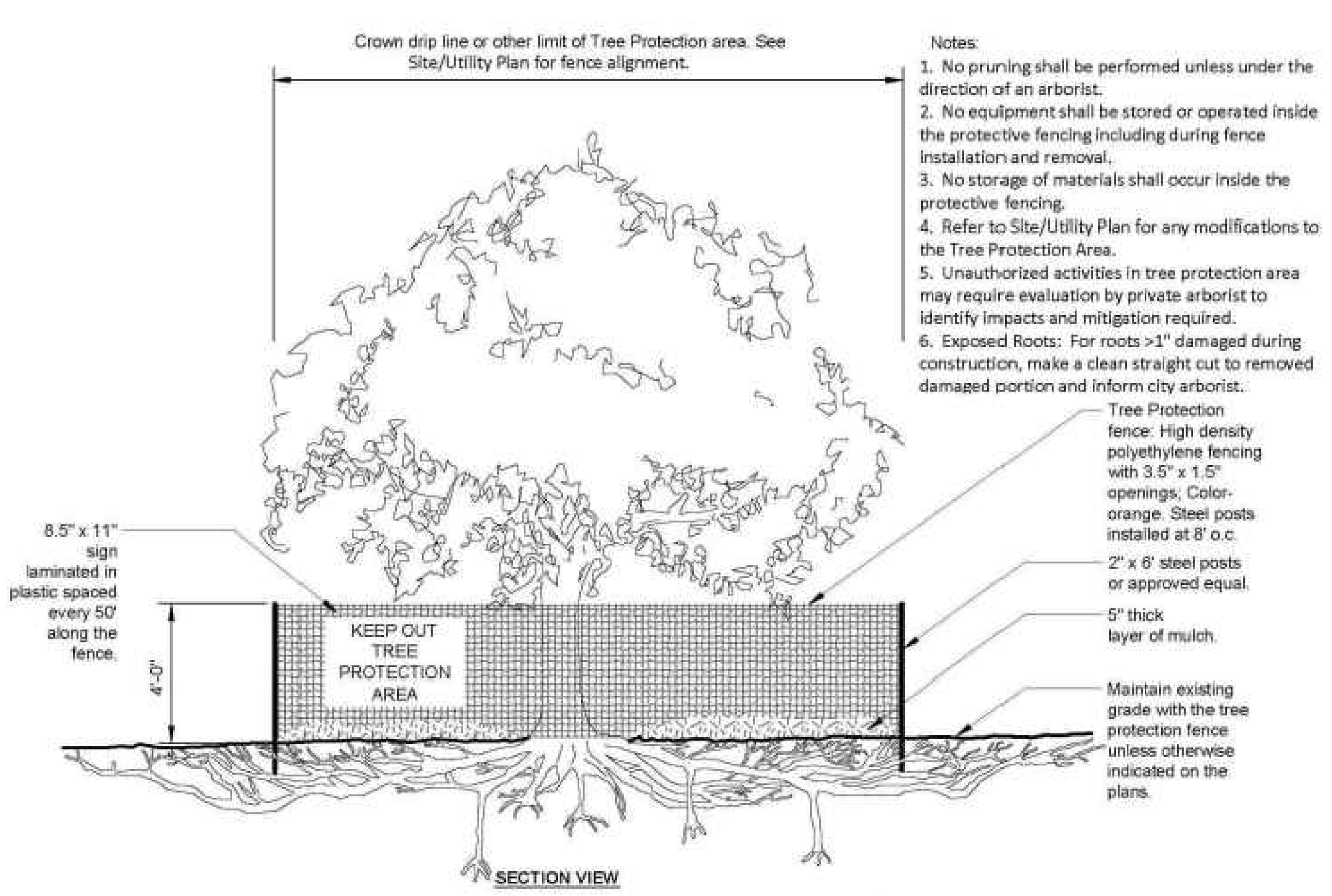
GENERAL NOTES:

1. PER GEOTECHNICAL REPORT, "IF WET WEATHER CONSTRUCTION IS ANTICIPATED, TWO PARALLEL SILT FENCES SHOULD BE INSTALLED ALONG THE SHORELINE."
2. CCTV INSPECTION OF THE EXISTING SIDE SEWER TO THE SEWER MAIN IS REQUIRED PRIOR TO ANY WORK RELATED TO THE SIDE SEWER. IF THE RESULT OF THE CCTV SHOWS THE SIDE SEWER TO BE IN UNSATISFACTORY CONDITION (AS DETERMINED BY THE CITY OF MERCER ISLAND INSPECTOR), REPLACEMENT OF EXISTING SIDE SEWER STUB TO MAIN IS REQUIRED.
3. LOCATION OF SEDIMENT TRAP AND SWALE MAY NOT BE LOCATED WITHIN EXISTING EASEMENTS AND EARTHWORK ASSOCIATED WITH CONSTRUCTING THESE BMPS CANNOT IMPACT EASEMENTS OR EXISTING INFRASTRUCTURE.
4. FRANCHISE UTILITIES SHOWN ON THIS PLAN ARE NOT REVIEWED OR APPROVED BY THE CITY OF MERCER ISLAND. CONTRACTOR/OTHERS TO COORDINATE WITH APPROPRIATE UTILITY OWNER.

ABBREVIATIONS:

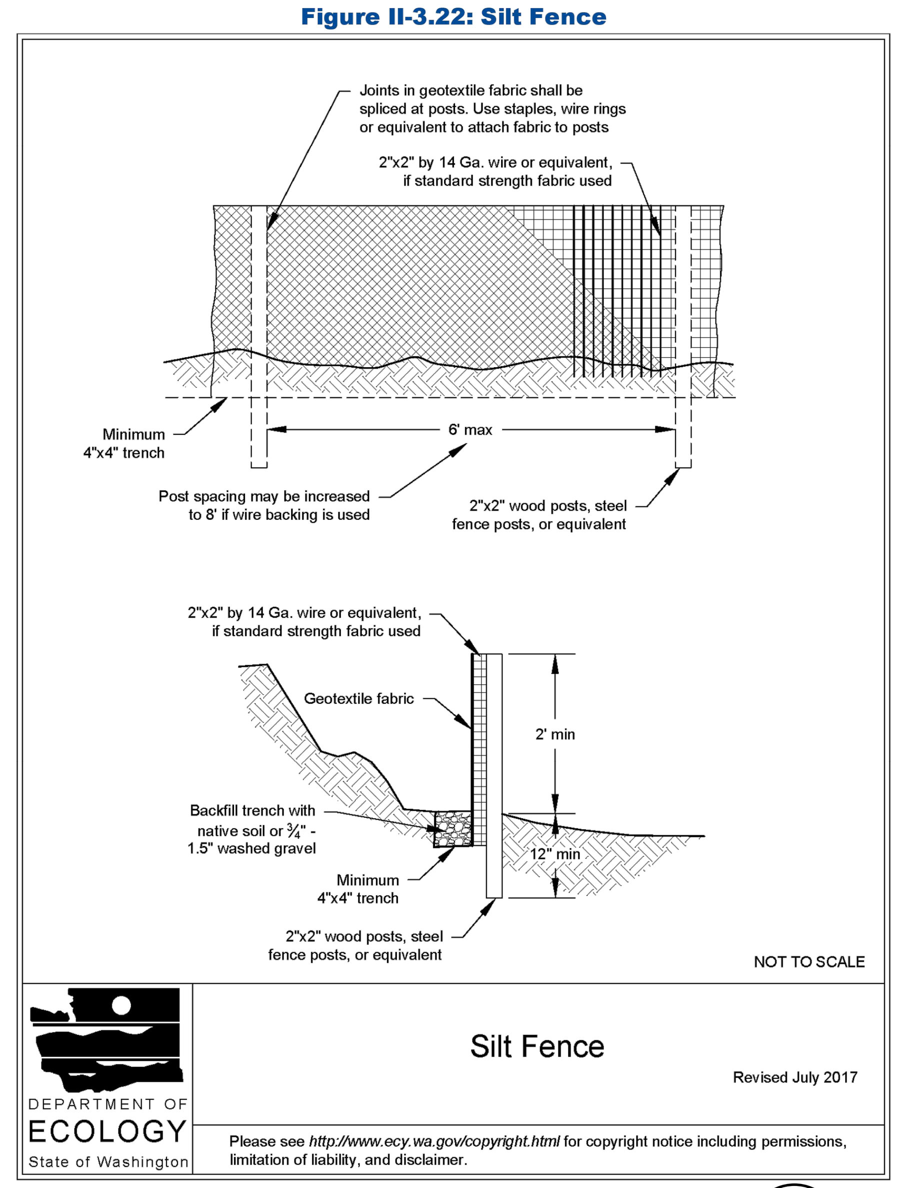
BM	= BENCHMARK
BOTS	= BOTTOM OF STAIR
CB	= CATCH BASIN
CONC	= CONCRETE
DOE	= DEPARTMENT OF ECOLOGY
EX	= EXISTING
EG	= EXISTING GRADE
FF	= FINISHED FLOOR
FG	= FINISHED GRADE
FL	= FLOWLINE
IE	= INVERT ELEVATION
LSCAPE	= LANDSCAPING
M.I.C.	= MONUMENT IN CASE
NO.	= NUMBER
STD	= STANDARD
TOC	= TOP OF CURB
TOP	= TOP OF PAVEMENT
TOPS	= TOP OF STAIR
TYP	= TYPICAL
W/	= WITH





TREE PROTECTION FENCING (A / C01)
NOT TO SCALE

Figure II-3.22: Silt Fence



SILT FENCE (B / C01)
NOT TO SCALE
2019 Stormwater Management Manual for Western Washington
Volume II - Chapter 3 - Page 371

NOTE: THIS PLAN IDENTIFIES THE MINIMUM MEASURES REQUIRED; ADDITIONAL MEASURES MAY BE REQUIRED BASED ON CONSTRUCTION METHODS AND ACTUAL AREA OF DISTURBANCE.

SMALL PARCEL ESC PLAN

FILE LOCATION: Z:\SHARED\PROJECTS\ACTIVE\2021\2105.0080_MCT ARCH_4045 WEST MERCER WAY MERCER ISLAND\DWG\DRAWINGS\4045 W MERCER WAY MERCER ISLAND_BP PLANS.DWG - ORIGINAL SHEET SIZE: ARCH FULL BLEED D (36.00 X 24.00 INCHES) - LAST MODIFIED BY: RANDY ANDERSON

PRINCIPAL: BI PROJECT MANAGER: JR DESIGNED BY: RA DRAWN BY: GS, CK CHECKED BY: BI

NO.	DATE	BY	REVISION

BASE MAP/TOPOGRAPHY PROVIDED BY OTHERS. FACET CANNOT BE HELD LIABLE FOR ACCURACY. CONTRACTOR SHALL FIELD VERIFY GRADES, UTILITIES, AND ALL OTHER EXISTING FEATURES AND CONDITIONS. IF CONDITIONS ARE NOT AS SHOWN AND/OR PLANS CANNOT BE CONSTRUCTED AS SHOWN, CONTACT FACET PRIOR TO CONSTRUCTION.

FACET
P: 206.523.0024
www.facetnw.com
9706 4th Ave NE
Suite 300
Seattle, WA 98115
FEDERAL WAY | KIRKLAND | MOUNT VERNON | SEATTLE | SPOKANE | WHIDBEY ISLAND

Digitally Signed by Ben Iddins
Date: 2025.05.21

CALL 811
2 BUSINESS DAYS BEFORE YOU DIG
(UNDERGROUND UTILITY LOCATIONS ARE APPROX.)

SCOTT CHANCELLOR
4045 WEST MERCER WAY
MERCER ISLAND, WA 98040
2105.0080

PERMIT PLAN

SMALL PARCEL ESC PLAN

DATE: 5/20/2025
PLAN NUMBER:
C01
SHEET 1 OF 10

APPENDIX A. Geotech Report

GEOTECH
CONSULTANTS, INC.

2401 10th Ave E
Seattle, Washington 98102
(425) 747-5618

June 18, 2021

JN 21026

Mist LLC
7683 Southeast 27th Street, #418
Mercer Island, Washington 98040

Attention: Feras Alrouk
via email: mist_llc@hotmail.com

Subject: **Transmittal Letter – Geotechnical Engineering Study and Critical Area Study**
Proposed Single-Family Residence
4045 West Mercer Way
Mercer Island, Washington

Dear Mr. Alrouk:

Attached to this transmittal letter is our geotechnical engineering report and Critical Area Study related to geologic hazards for the proposed single-family 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, stormwater infiltration considerations, and design considerations for foundations, retaining walls, subsurface drainage, and temporary excavations/shoring. This work was authorized by your acceptance of our proposal, P-10755, dated November 24, 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.

Adam S. Moyer
Geotechnical Engineer

cc: **McClellan Architects** – Joey Pasquinelli & Regan McClellan
via email: joey@mccarch.com & regan@mccarch.com

ASM/DRW:kg

GEOTECHNICAL ENGINEERING STUDY AND CRITICAL AREA STUDY
Proposed Single-Family Residence
4045 West Mercer Way
Mercer Island, Washington

This report presents the findings and recommendations of our geotechnical engineering study and Critical Area Study for the site of the proposed single-family residence to be located in Mercer Island. The scope of the Critical Area Study is intended to satisfy the requirements of the recently-adopted section 19.07.110 of the Mercer Island City Code (MICC), which applies to Critical Area Studies.

We were provided with preliminary plans and a topographic map. McClellan Architects developed the provided plans, which are dated May 10, 2021. The topographic map was developed by Terrane and dated February 12, 2021. For clarity, this report will reference Project North depicted on the provided plans and our attached Exploration Plan (Plate 2), in which Lake Washington is located directly south of the subject site.

Based on the provided preliminary plans, an L-shaped single-family residence will be constructed near the center of the property. The main portion of the residence will be roughly rectangular, with a width of 18 to 26 feet, and will span east to west through the center of the parcel; this three-story portion of the residence will have a lowest floor (daylight basement) with a finished floor elevation near 28 feet. The main (second) and upper (third) floors of the residence will also extend north (stepping up the subject site's sloping ground surface) from the western perimeter of the main residence to create the building's L shape. The northern end of this northwestern wing of the residence will contain a garage with a floor slab matching the residence's upper (third) floor, the existing ground surface, and western adjacent access driveway at an elevation of 48 feet. The western and eastern ends of the building will have 7- and 10-foot setbacks from the adjacent property lines. The residence will be offset approximately 50 feet from Lake Washington along the southern property line, and the northern perimeter of the garage will have a setback of 11 feet from the northern property line. Access to the property will come from the shared access road on the tract parcel that borders the site to the west.

As discussed above, the proposed residence will generally match existing ground surface which slopes downwards to the south across the property towards Lake Washington. However, the upslope northern perimeter of the garage will be cut approximately 4 to 6 feet beneath the existing ground surface; the upslope northern perimeter of the main residence's daylight basement will be cut 8 to 14 feet into the sloping ground surface.

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 on the center of the western perimeter of Mercer Island. The subject site is located on Lake Washington and is separated from West Mercer Way by several parcels. The rectangular-shaped subject site has a width of 100 feet in the east-west direction and a depth of approximately 121 to 130 feet in the north-south direction along the western and eastern property lines, respectively. The concrete foundation of a previous small residence is located in the center of the property. The remainder of the property is predominantly covered by grass and small brush.

The subject site is located along the toe of the slope that descends from West Mercer Way down to Lake Washington. The northern third of the parcel contains the toe of a steep slope, which continues to rise to the north onto the northern adjacent property. Based on the contour lines on the City of Mercer Island's online GIS mapping tool, this steep slope has an overall inclination of approximately 70 to 80 percent over a height of 50 to 60 feet. This area would be considered a steep slope landslide hazard area under Mercer Island's Municipal Code; this is discussed further below. However, in the northeast corner of the subject site, the steep slope rises 23 to 24 feet to a relatively flat "bench" in the center of the aforementioned steep slope.

The southern two-thirds of the subject site continues to slope moderately downwards to the south (at an inclination of approximately 20 to 25 percent) from the toe of the steep slope to a 4- to 5-foot-tall rock bulkhead along Lake Washington and the southern property line. Based on the provided topographic survey, a sewer easement passes through the southern end of the subject site and a second utility easement is located on the property along its eastern property line. The eastern utility easement is 10 feet wide, but expands to 25 feet wide along the southern end of the eastern property line.

The City of Mercer Island's GIS tool maps the subject site within several geologically hazardous areas. The majority of the site is mapped to lie within a seismic hazard area, a potential landslide hazard area and an erosion hazard area. These three hazard areas all encompass the generally vicinity between West Mercer Way and Lake Washington. The northern end of the subject site is also mapped as the toe of a steep slope which rises to the north onto the adjacent property. The southern-facing steep slope continues to the east and west onto the neighboring parcels.

We did not observe any indications of recent slope instability on or around the site during our recent visit to the property. However, on the Mercer Island Landslide Hazard Map (Troos and Wisher, 2009) the subject site is located a just downslope of a historic landslide scarp and within the downslope mass wasting deposit that extends into Lake Washington. This headscrap/mass wasting area extends continuously several blocks to the north and south of the site.

The subject site is bordered by residential properties to the north and east. As discussed above, the upper half of a steep slope covers the southern end of the northern adjacent parcel. A residence is located on the eastern adjacent property with an approximate 10-foot-setback from the subject site. A tract parcel containing an access road, small parking area, utilities, and shoreline access borders the subject site to the west. The driveway and parking area are elevated above the original ground surface; a soldier pile retaining wall is located along the downslope perimeter of the parking area. The soldier pile wall along the downslope perimeter of the raised parking area, with a height of up to 6 feet, is offset approximately 0.6 to 0.9 feet from the subject site's western property line. However, a power transformer associated with the tract parcel is located east of the parking area on the subject site. A small wooden retaining wall wraps around the downslope edges of the power transformer and extends approximately 9 feet into subject site. As discussed above, the subject site is bordered by Lake Washington to the south.

SUBSURFACE

The subsurface conditions 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 test borings were drilled on February 4, 2021 using both a track-mounted, hollow-stem auger drill and a portable Acker drill. The Acker drill system utilizes a small, gasoline-powered engine to advance a hollow-stem auger to the sampling depth. Samples were taken at approximate 2.5- or 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

The test borings conducted on the subject site encountered variable depths of loose fill and colluvium soils beneath the ground surface; colluvium is the geologic term for landslide soils. Dense, interbedded layers of glacially compressed silty sand, sand, and silt soils were revealed at depths of 7 to 9.5 feet below the ground surface (and the loose soils). Very dense glacially compressed sandy silt was encountered below depths of 18 to 10 feet beneath the upslope northern and downslope southern ends of the site, respectively.

Groundwater Conditions

Perched groundwater seepage was encountered within the cleaner sand seams in our test borings. Thin perched groundwater seams were revealed at 8.5 and 17.5 feet in Test Boring 1, conducted on the upslope, northern end of the property; Test Boring 3, conducted in the southeast quadrant of the property, encountered a groundwater seam from 6.3 to 7.7 feet, perched above the underlying very dense glacially compressed sandy silt. The test borings were left open for only a short time period. Therefore, the seepage levels on the logs represent the location of transient water seepage and may not indicate the static groundwater level. Groundwater levels encountered during drilling can be deceptive, because seepage into the boring can be blocked or slowed by the auger itself. It should be noted that groundwater levels vary seasonally with rainfall and other factors. We anticipate that groundwater could be found in the looser near-surface soils, perched on top of and in sand seams within the relatively impervious underlying dense glacially compressed soils. This is most likely to occur following extended wet weather.

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.

CONCLUSIONS AND RECOMMENDATIONS, AND CRITICAL AREAS STUDY INFORMATION

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 dense to very dense, glacially compressed silty sand/sandy silt underlying the subject site. However, loose fill soils and loose colluvium in the range of 7 to 9 feet thick were encountered above these competent underlying soils. The dense to very dense soil is very competent to support building loads and is resistant to soil movement.

Based on the test borings and the depth of excavations needed at the north and northwestern portions of the lower basement and at the northern edge of the garage, the use of footing foundations could be done provided they bear on competent soil or structural fill placed over the competent soil. Some relatively minor overexcavations may be needed in some areas to reach the competent soil; other recommendations regarding the preparation of footings are given in the ***Conventional Foundations*** section of this report. However, due to the depth of loose upper soils and the sloping ground surface, overexcavations to reach competent soil for footings would be significant beneath the rest of the building's footprint; therefore, we recommend the remainder of the residence and attached garage be supported on deep foundations embedded into the dense glacially compressed soils below. Driven small-diameter pipe piles are typically the most economical deep foundation system for relatively lightly-loaded residences. We recommend any settlement sensitive elements such as floor slabs in living areas and exterior stairs, retaining walls, or patios also be supported on small-diameter pipe piles. If some risk of cracking of the garage floor slab can be tolerated, it may be constructed on grade over the existing soils; however, if no cracking due to settlement can be tolerated, it should also be supported on piles.

Excavation for the proposed residence's basement and the upslope northern perimeter of the garage will be an important geotechnical consideration for the project. Based on the provided plans, the excavation for the upslope perimeter of the proposed basement will extend approximately 8 to 14 feet beneath the existing ground surface; excavations along the northern perimeter of the garage will extend 4 to 6 feet below grade into the toe of the slope to the north. Temporary open cut slopes may be excavated at an inclination no steeper than 1:1 (Horizontal:Vertical) in the onsite soils. These cuts also cannot extend below a 2:1 (H:V) from existing retaining walls, utilities, driveways, etc. Slope cuts may be feasible along the southern and eastern perimeters of the proposed residence. It should be determined if the presence of the existing utility easements onsite will affect excavations. However, excavation along the northern perimeter of the garage, and the northern and western perimeters of the proposed basement will require temporary shoring to make the cuts into the toe of the slope and to protect the neighboring property. It will be important not to undermine the existing retaining walls on the adjacent tract parcel to the west of the subject site. The site and soil conditions make cantilevered soldier piles the most appropriate shoring system for this project. The soldier piles could also be used to provide permanent vertical and lateral support for the new residence.

Another very significant geotechnical engineering consideration for this project is the proximity of the proposed residence to the steep slope that rises to the north; it will impact the design and construction of the residence. As previously discussed, the core of the steep slope is comprised of dense to very dense glacially compressed silty sand and sandy silt not susceptible to deep-seated movement. However, as with any steep slope on Mercer Island and in the Puget Sound region, there is the possibility of movement of the loose near-surface soils, particularly after periods of extended precipitation. Therefore, because of the potential for near-surface soil movement, we recommend a catchment wall be constructed along the full northern perimeter of the residence and garage exposed to the adjacent steep slope. A catchment wall is a heavily reinforced concrete wall extending above the finished grade along the toe of the slope to retain soil conveyed to the base of the slope by landslides. The necessary height of the catchment wall depends on the height, inclination, and soil stratigraphy of the adjacent slope, as well as the proximity of the residence to the toe of the slope. Because of this, the required height of the catchment wall varies across the northern perimeter of the residence. Based on our analysis, it is our professional opinion that the top of the catchment wall should extend a minimum of 7 feet above the existing grade along the northern perimeter of the proposed garage. The catchment wall height can be reduced to 6 feet above the existing grade along the remainder of the northern perimeter of the residence to It will be necessary to remove any landslide soil if it accumulates behind the catchment structure -- the freeboard of the catchment wall must be maintained to provide continued protection from future landslides. The wall only needs to extend the length of the new residence. Note that the wall can only offer protection in its downslope shadow and slides can flow around the ends of the wall. The intention of the catchment wall is to provide a reasonable degree of protection from a reasonable amount of soil that descends the hillside. The catchment wall is not intended to provide protection from large trees that can descend the hillside with a slide or on their own.

CRITICAL AREAS STUDY (MICC 19.07)

Seismic Hazard and Potential Landslide Hazard Areas: The entire subject site is located within both a mapped Seismic Hazard Area and a Potential Landslide Hazard area. Both geologic hazard areas cover much of the general vicinity. As previously discussed, the core of the subject site consists of dense to very dense, glacially compressed, native silty sand, sand, and silt that has a low potential for deep-seated landslides. The mapping of the Potential Landslide Hazard Area is due to the inference by geologists that the site lies within an ancient landslide, which most likely occurred following the recession of the last glaciers approximately 13,000 years ago. No recent large-scale movement has been documented in this area. The proposed development will be supported on conventional footings or deep foundations embedded into the glacially compressed soils which are not liquefiable, due to their dense nature and the absence of near-surface groundwater. This mitigates the Seismic Hazard.

Steep Slope Hazard Areas: The southern two-thirds of the site slopes downwards towards Lake Washington to the south at an inclination of 20 to 25 percent. However, based on the provided topographic map of the subject site and the contour lines on the City of Mercer Island's GIS mapping tool, approximately the northern third of the subject site has an inclination of at least 40 percent over a horizontal distance of 30 feet (which the City of Mercer Island code defines as a Steep Slope). A Steep Slope is a qualification as a Landslide Hazard Area under the Mercer Island Code. The Steep Slope continues onto the northern adjacent property, and has an overall height of approximately 50 to 60 feet based on the contour lines on Mercer Island's GIS map. The new residence will be constructed into the sloping ground surface along the toe of the steep slope to the north, and will be supported on either conventional footings bearing directly on the underlying dense to very dense glacially compressed soils, or on deep foundations embedded into these competent glacially compressed soils, which are not susceptible to deep-seated movement per the recommendations in this report. 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 slope onsite.

Erosion Hazard Areas: The site also meets the City of Mercer Island's criteria for an Erosion Hazard Area. We have worked on numerous waterfront projects on Mercer Island that have avoided siltation of the lake 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. The location of the site on the shore of Lake Washington will make proper erosion control implementation important to prevent adverse impacts to the lake. 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 to the lake, 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 between the silt fence and the lake left in place. Typically, if wet weather construction is anticipated, two parallel silt fences should be installed along the shoreline. 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. It will also be important to cap any existing drain lines found running toward the lake until excavation is completed. This will reduce the potential for silty water finding an old pipe and flowing into the lake. 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. Utilities reaching between the house and the lake should not be installed during rainy weather, and any disturbed area caused by the utility installation should be minimized by using small equipment. Cut slopes and soil stockpiles should be covered with plastic during wet weather. Soil stockpiles should be minimized. 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: Under MICC 19.07.160(C), a prescriptive buffer of 25 feet is indicated from all sides of a shallow landslide-hazard area (we believe that the landslide hazard on this site is only shallow). 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. It is our professional opinion that the location of the proposed development is sufficient without any buffer from the Steep Slope, provided the recommendations presented in this report are followed. In particular, the inclusion of a catchment wall along the upslope perimeter of the proposed residence and the use of foundations that bear on or into dense to very dense core soils are intended to address the proximity to the Steep Slope. We recognize that the planned development will occur within the Landslide Hazard area; 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 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 alterations 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.

Wet weather construction (October 1 through March 31) on this site should be possible without adverse impacts to the surrounding properties. The above section entitled **Erosion Hazard Areas** covers temporary erosion control measures that would be prudent. In preventing erosion control problems on any site, it is most important that any disturbed soil areas be immediately protected. This requires diligence and frequent communication on the part of the general contractor and earthwork subcontractor. As with all construction projects undertaken during potentially wet conditions, it is important that the contractor's on-site personnel are familiar with erosion control measures and that they monitor their performance on a regular basis. It is also appropriate for them to take immediate action to correct any erosion control problems that may develop, without waiting for input from the geotechnical engineer or representatives of the City.

All, or the vast majority, of the excavated soil will be unsuitable for reuse on the site because they are very silty, fine-grained, and overly moist. Because of this, they have poor drainage characteristics and low compacted strength, and will present an erosion control problem. As a result, we expect that excavated soils will be hauled off the site, and imported granular fill will be needed for the project.

We anticipate that onsite stormwater infiltration will be considered for the project. However, the underlying glacially compressed soils are essentially impervious and will stop downward percolation of large volumes of water infiltrated above it. This is a common problem throughout the Pacific Northwest. Also, the upper soils at the site are loose and could be destabilized by the infiltration of stormwater into them. Considering this, it is our professional opinion that onsite infiltration of stormwater is not feasible for the subject site.

The drainage and/or 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 build up of excessive water vapor within the planned structure.

Projects involving small-diameter pipe piles often include the need for lateral resistance from fill placed against the foundations. If this is the case for this project, it is important that the structural engineer indicate this requirement on the plans for the general and earthwork contractor's information. Compaction requirements for this fill are discussed below in ***Pipe Piles***. The building department may require that we verify suitable compaction of this fill prior to completion of the project.

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 1.42g and 0.50g, 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 0.67g. The proposed residence will be supported on conventional footings or on deep foundations embedded into the dense to very dense underlying glacially compressed soils beneath the subject site, which are not susceptible to seismic liquefaction under the ground motions of the MCE because of their dense nature.

CONVENTIONAL FOUNDATIONS

The northern perimeter foundation of the proposed basement and attached garage may be supported on conventional continuous footings bearing on native, undisturbed, dense, silty sand/sandy silt, or on structural fill. Prior to placing structural fill beneath foundations, the excavation should be observed by the geotechnical engineer to document that adequate bearing soils have been exposed. We recommend any structural fill placed beneath the footings consist of 2- to 4-inch quarry spalls placed in maximum 12-inch lifts and compacted with either a hoe pack or tamping with a large excavator bucket. Excavation using a toothed bucket usually leaves several inches of disturbed soils. The loosened soil must be entirely scraped out of the base of the footing excavations. This should be accomplished with a flat-bladed bucket, a grade bar that is dragged with the bucket, or by hand-shoveling the loose soil out of the excavation. The competent bearing soils beneath the site are very moisture sensitive due to their high fines content; thus, if the footing subgrade soil is wet, or becomes wet at the time of foundation construction, we recommend covering the bearing surfaces with several inches of clean crushed rock immediately after the excavation is completed. This is intended to protect the footing subgrade soils from becoming softened by foot traffic during the footing forms and rebar placement, which will be a particular concern during wet conditions.

We recommend that continuous footings have a minimum width of 16 inches. Exterior footings should also be bottomed at least 18 inches below the lowest adjacent finish ground surface for protection against frost and erosion. The local building codes should be reviewed to determine if different footing widths or embedment depths are required. Footing subgrades must be cleaned of loose or disturbed soil prior to pouring concrete. Depending upon site and equipment constraints, this may require removing the disturbed soil by hand.

Depending on the final site grades, overexcavation may be required below the footings to expose competent native soil. Unless lean concrete is used to fill an overexcavated hole, the overexcavation must be at least as wide at the bottom as the sum of the depth of the overexcavation and the footing width. For example, an overexcavation extending 2 feet below the bottom of a 2-foot-wide footing must be at least 4 feet wide at the base of the excavation. If lean concrete is used, the overexcavation need only extend 6 inches beyond the edges of the footing.

An allowable bearing pressure of 3,000 pounds per square foot (psf) is appropriate for footings supported on native, dense silty sand/sandy silt or on structural fill (consisting of compacted 2- to 4-inch quarry spalls) placed on top of these c0mpetent native soils. A one-third increase in this design bearing pressure may be used when considering short-term wind or seismic loads. For the above design criteria, it is anticipated that the total post-construction settlement of footings founded on competent native soil, or on structural fill up to 5 feet in thickness, will be about one inch, with differential settlements on the order of one-half inch in a distance of 50 feet along a continuous footing with a uniform load.

Lateral loads due to wind or seismic forces may be resisted by friction between the foundation and the bearing soil, or by passive earth pressure acting on the vertical, embedded portions of the foundation. For the latter condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level, well-compacted fill. We recommend using the following ultimate values for the foundation's resistance to lateral loading:

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.40
Passive Earth Pressure	300 pcf

Where: pcf is Pounds per Cubic Foot, and Passive Earth Pressure is computed using the Equivalent Fluid Density.

If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. The above ultimate values for passive earth pressure and coefficient of friction do not include a safety factor.

PIPE PILES

Three-, 4-, or 6-inch-diameter pipe piles driven with a 1,100-, 2,000-, or 3,000-pound hydraulic jackhammer to the following final penetration rates may be assigned the following compressive capacities.

INSIDE PILE DIAMETER	FINAL DRIVING RATE (1,100-pound hammer)	FINAL DRIVING RATE (2,000-pound hammer)	FINAL DRIVING RATE (3,000-pound hammer)	ALLOWABLE COMPRESSIVE CAPACITY
3 inches	6 sec/inch	2 sec/inch	n/a	
4 inches	10 sec/inch	4 sec/inch	n/a	10 tons
6 inches	20 sec/inch	10 sec/inch	6 sec/inch	15 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.

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 300 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.

If lateral resistance from fill placed against the foundations is required for this project, the structural engineer should indicate this requirement on the plans for the general and earthwork contractor’s information. Compacted fill placed against the foundations can consist of imported soil that is tamped into place using the backhoe or is compacted using a jumping jack compactor. It is necessary for the fill to be compacted to a firm condition, but it does not need to reach even 90 percent relative compaction to develop the passive resistance recommended above. Due to their small diameter, the lateral capacity of vertical pipe piles is relatively small. However, if lateral resistance in addition to passive soil resistance is required, we recommend driving battered piles in the same direction as the applied lateral load. The lateral capacity of a battered pile is equal to one-half of the lateral component of the allowable compressive load. The allowable vertical capacity of battered piles does not need to be reduced if the piles are battered steeper than 1:5 (Horizontal:Vertical).

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 * - Northern perimeter foundation walls (sloped backfill) - All other walls (level backfill)	 60 pcf 40 pcf
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.40
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. We can provide appropriate surcharge loads once more detailed plans have been developed. It may be possible for the excavation shoring to be designed to withstand this surcharge. 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.

Wall Pressures Due to Landslides

As discussed in the ***General*** section, we recommend the design of the northern perimeter of the proposed residence be designed with a catchment wall; a permanent shoring wall could be used for this purpose. Based on our analysis, it is our professional opinion that the top of the catchment wall should extend a minimum of 7 feet above the existing grade along the northern perimeter of the proposed garage and 6 above the existing along the remainder of the northern perimeter of the residence. We anticipate that future slides would occur as a mudflow striking the catchment wall. We recommend that an active equivalent fluid pressure of 80 pounds per cubic foot (pcf) should be used in the design of the catchment wall to account for the impact force. Because this impact load is temporary, the safety factor against sliding and overturning of 1.2 is needed for the catchment wall.

Wall Pressures Due to Seismic Forces

The surcharge wall loads that could be imposed by the design earthquake can be modeled by adding a uniform lateral pressure to the above-recommended active pressure. The recommended surcharge pressure is 9**H** 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.

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 passive pressure given is appropriate only for a shear key poured directly against undisturbed native soil, or for the depth of level, well-compacted fill placed in front of a retaining or foundation wall. 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.

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 on-site soils are not free-draining, and should not be reused as wall backfill. For increased protection, drainage composites should be placed along cut slope faces, and the walls should be backfilled entirely with free-draining soil. The later section entitled ***Drainage Considerations*** should also be reviewed for recommendations related to subsurface drainage behind foundation and retaining walls.

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.

The ***General***, ***Floor Slabs***, and ***Drainage Considerations*** sections should be reviewed for additional recommendations related to the control of groundwater and excess water vapor for the anticipated construction.

FLOOR SLABS

As discussed in the ***General*** section, the floor slabs of the pile-supported residence and the exterior patios should be designed as structural slabs spanning between the pile-supported grade beams. If some risk of cracking of the garage slab can be tolerated, the garage slab may be constructed on grade over existing soils. We do recommend placing these concrete slabs over at least 1 foot of structural fill to provide more uniform support for the slab where the subgrade is soft or settles more rapidly than the surrounding ground. Also, slabs in the pipe pile areas should be reinforced with a minimum mat of number 4 rebar at 16 inches each way to reduce slab cracking and breakage. Isolation joints should be provided where the slabs intersect columns and walls. Control and expansion joints should also be used to control cracking from expansion and contraction. Saw cuts or preformed strip joints used to control shrinkage cracking should extend through the upper one-fourth of the slab. The spacing of control or expansion joints depends on the slab shape and the amount of steel placed in it. Reducing the water-to-cement ratio of the concrete and curing the concrete, by preventing the evaporation of free water until cement hydration occurs, will also reduce shrinkage cracking. If no cracking due to settlement can be tolerated in these, slabs, they would need to be structurally supported on the piles.

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.

The ***General***, ***Foundation and Retaining Walls***, and ***Drainage Considerations*** sections should be reviewed for additional recommendations related to the control of groundwater and excess water vapor for the anticipated construction.

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. Unless approved by the geotechnical engineer of record, it is important that vertical cuts not be made at the base of sloped cuts. Based upon Washington Administrative Code (WAC) 296, Part N, the soil at the subject site would generally be classified as Type B. Therefore, temporary cut slopes greater than 4 feet in height should not be excavated at an inclination steeper than 1:1 (Horizontal:Vertical), extending continuously between the top and the bottom of a cut.

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 sand or 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 native soil should be inclined no steeper than 2:1 (H:V). Fill slopes should not be constructed with an inclination greater than 2.5:1 (H:V). To reduce the potential for shallow sloughing, fill must be compacted to the face of these slopes. This can be accomplished by overbuilding the compacted fill and then trimming it back to its final inclination. Adequate compaction of the slope face is important for long-term stability and is necessary to prevent excessive settlement of patios, slabs, foundations, or other improvements that may be placed near the edge of the slope.

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.

EXCAVATION SHORING

Information regarding a cantilevered soldier pile system is given in this section. This system has proven to be an efficient and economical method for providing excavation shoring where the depth of excavation is less than 15 feet.

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. 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 or permanent 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 40 pounds per cubic foot (pcf). However, for shoring walls along the northern perimeter of the residence and garage along toe of the slope to the north, this active pressure should be increased to 60 pcf to account for the slope. If the soldier piles will permanently restrain soil loads, a uniform seismic surcharge load of 9**H** pounds per square foot (psf), where **H** is the design retention height of the wall should also be included in the design. Using this increased pressure, the safety factor against sliding and overturning can be reduced to 1.2 for the seismic analysis. Traffic surcharges can typically be accounted for by increasing the effective height of the shoring wall by 2 feet.

As discussed in the ***General*** section, we recommend the design of the northern perimeter of the proposed residence be designed with a catchment wall; a permanent shoring wall could be used for this purpose. Based on our analysis, it is our professional opinion that the top of the catchment wall should extend a minimum of 7 feet above the existing grade along the northern perimeter of the proposed garage and 6 above the existing along the remainder of the northern perimeter of the residence. We anticipate that future slides would occur as a mudflow striking the catchment wall. We recommend that an active equivalent fluid pressure of 80 pounds per cubic foot (pcf) should be used in the design of the catchment wall to account for the impact force. Because this impact load is temporary, the safety factor against sliding and overturning of 1.2 is needed for the catchment wall.

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.

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 450 pcf. No safety factor is included in the given value. For permanent walls, we recommend a minimum factor of safety of 1.5 be applied to overturning and sliding calculations when using this ultimate value (temporary installations may use a factor of safety of 1.2) 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. This includes temporary cuts necessary to install internal braces or rakers. The minimum embedment below the floor of the excavation for cantilever soldier piles should be equal to the height of the "stick-up."

The soldier piles embedded into the dense underlying glacially compressed soils may also be used to provide permanent vertical support of the residence. The vertical capacity of soldier piles will be developed by frictional shaft resistance along the embedded length.

PARAMETER	DESIGN VALUE (Allowable)
Pile Shaft Friction	2,000 psf

Where: psf is Pounds per Square Foot.

The above value is for the portion of the pile embedded into the dense underlying glacially compressed soils. The concrete surrounding the embedded portion of the pile must have sufficient bond and strength to transfer the vertical load from the steel section through the concrete into the soil.

Tieback Anchors

We recommend installing tieback anchors at inclinations between 20 and 30 degrees below horizontal. The tieback will derive its capacity from the soil-grout strength developed in the soil behind the no-load zone. The minimum grouted anchor length should be 10 feet. The no-load zone is the area behind which the entire length of each tieback anchor should be located. To prevent excessive loss-of-ground in a drilled hole, the no-load section of the drilled tieback hole should be backfilled with a sand and fly ash slurry, after protecting the anchor with a bond breaker, such as plastic casing, to prevent loads from being transferred to the soil in the no-load zone. The no-load section could be filled with grout after anchor testing is completed.

During the design process, the possible presence of foundations or utilities close to the shoring wall must be evaluated to determine if they will affect the configuration and length of the tiebacks.

Based on the results of our analyses and our experience at other construction sites, we suggest using an adhesion value of 2000 psf in the dense native soil to design temporary anchors, if the mid-point of the grouted portion of the anchor is more than 10 feet below the overlying ground surface. For permanent anchors, this adhesion value should be decreased to 1700 psf. These values apply to non-pressure-grouted anchors. Pressure-grouted or post-grouted anchors can often develop adhesion values that are two to three times higher than that for non-pressure-grouted anchors. These higher adhesion values must be verified by load testing.

Soil conditions, soil-grout adhesion strengths, and installation techniques typically vary over any site. This sometimes results in adhesion values that are lower than anticipated. Therefore, we recommend substantiating the anchor design values by load-testing all tieback anchors. At least two anchors in each soil type encountered should be performance-tested to 200 percent of the design anchor load to evaluate possible anchor creep. Wherever possible, the no-load section of these tiebacks should not be grouted until the performance tests are completed. Unfavorable results from these performance tests could require increasing the lengths of the tiebacks. The remaining anchors should be proof-tested to at least 135 percent of their design value before being "locked off." After testing, each anchor should be locked off at a prestress load of 80 to 100 percent of its design load.

If caving or water-bearing soil is encountered, the installation of tieback anchors will be hampered by caving and soil flowing into the holes. It will be necessary to case the holes, if such conditions are encountered. Alternatively, the use of a hollow-stem auger with grout pumped through the stem as the auger is withdrawn would be satisfactory, provided that the injection pressure and grout volumes pumped are carefully monitored.

All drilled installations should be grouted and backfilled immediately after drilling. No drilled holes should be left open overnight.

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 every other soldier pile 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. Plate 6 presents typical considerations for foundation drains at shoring walls.

Footing drains should be placed inside the building for shored areas noted above, outside of the building in non-shored areas, or behind backfilled walls. Footing drains outside of the building 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. The footing drains should consist of 4-inch, perforated PVC pipe surrounded by at least 6 inches of 1-inch-minus, washed rock wrapped in a 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 level of a crawl space or the bottom of a floor slab, and it should be sloped slightly for drainage. All roof and surface water drains must be kept separate from the foundation drain system. A typical footing drain detail is attached to this report as Plate 7. Clean-outs should be provided for potential future flushing or cleaning of footing drains.

As a minimum, a vapor retarder, as defined in the ***Floor Slabs*** 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 a building 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. 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. As discussed in the ***General*** section, the native on-site soils are not suitable for reuse as structural fill, due to their high fines content and moisture sensitivity. The onsite gravelly, slightly silty sand fill soils could potentially be re-used as structural fill provided they can be placed and compacted near their optimum moisture content.

Fills placed on sloping ground should be keyed into the medium-dense to dense native soils. This is typically accomplished by placing and compacting the structural fill on level benches that are cut into the competent soils. 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 footings, slabs or 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).

Structural fill that will be placed in wet weather should consist of a coarse, granular soil with a silt or clay content of no more than 5 percent. The percentage of particles passing the No. 200 sieve should be measured from that portion of soil passing the three-quarter-inch sieve.

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 subsurface explorations 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 and test holes. 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 proposed structures 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. However, such movement will not affect the development if the recommendations in this report are followed.

This report has been prepared for the exclusive use of Mist LLC and their 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	Shoring Foundation Drain Detail
Plate 7	Typical Footing Drain Detail

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.

Adam S. Moyer
Geotechnical Engineer

D. ROBERT WARD
STATE OF WASHINGTON
29740
REGISTERED
PROFESSIONAL ENGINEER

06/18/2021

D. Robert Ward, P.E.
Principal

ASM/DRW:kg

NORTH

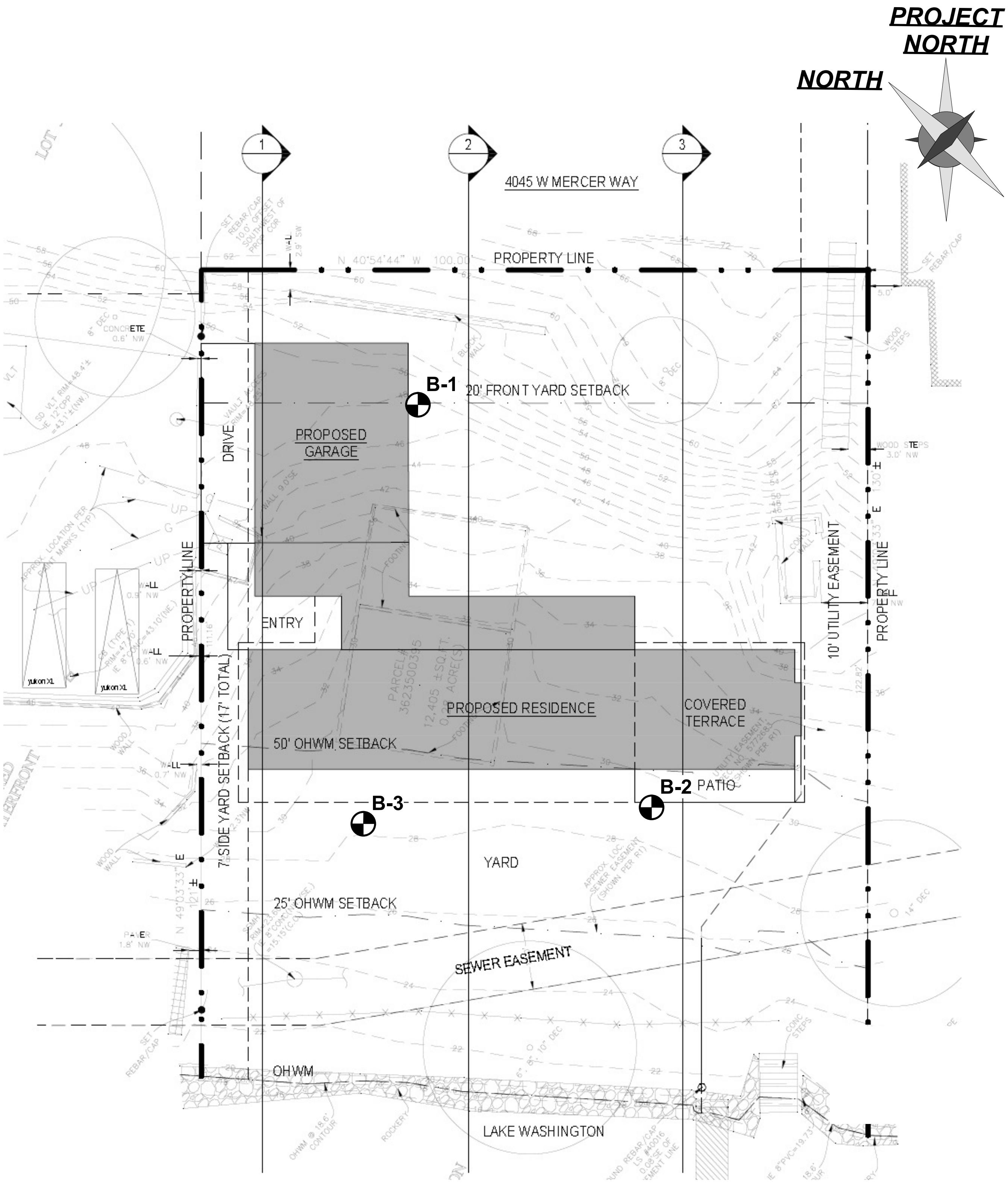
(Source: Microsoft MapPoint, 2013)

GEOTECH
CONSULTANTS, INC.

VICINITY MAP

4045 West Mercer Way
Mercer Island, Washington

Job No:	Date:		Plate:
21026	May 2021		1



Legend:

Test Boring Location

GEOTECH CONSULTANTS, INC.

SITE EXPLORATION PLAN

4045 West Mercer Way
Mercer Island, Washington

Job No:	Date:		Plate:
21026	May 2021	No Scale	2

BORING 1

Elevation ±48 feet

Depth (ft.)	Moisture	Water Table	Blows per Foot	Sample	USCS	Description
					FILL	Dark-brown gravelly silty SAND with organics and wood debris, fine- to medium-grained, moist, loose **(FILL)**
			6	1	SP	Gray-brown SAND with silt, fine-grained, moist to very moist, loose (Colluvium)
5			19	2	ML	Gray sandy SILT with trace fine-grained gravel, non-plastic, very fine-grained, moist, medium-dense **(Colluvium)** -with occasional sand lenses -with piece of wood
		▽	41	3	SM	Gray silty SAND with gravel, fine- to medium-grained, moist, dense -with wet sand seam
10			45	4	SP	Gray SAND with silt and occasional gravel, fine- to medium-grained, very moist, dense -with decomposed wood fragments
15		▽	29 37	5 6	SM	Gray silty SAND with gravel, fine-grained, moist, dense -with occasional rust mottling -with thin wet sand seam
20 25			68 50/5" 83	7 8 9	ML	Gray SILT, non-plastic, moist, very dense -becomes sandy in part

*** Test boring was terminated at 26.5 feet on February 4, 2021.**
*** Slight perched groundwater seepage was observed at 8.5 and 17.5 feet during drilling.**

GEOTECH
CONSULTANTS, INC.

TEST BORING LOG

4045 West Mercer Way
Mercer Island, Washington

Job No:	Date:	Logged by:	Plate:
21026	May 2021	ASM	3

BORING 2

Elevation ±29 feet

Depth (ft.)	Moisture	Water Table	Blows per Foot	Sample	USCS	Description
0–3					FILL	Dark-brown gravelly silty SAND with organics, fine- to medium-grained, moist, loose **(FILL)**
3–4			5	1	FILL	Brown gravelly SAND, fine- to coarse-grained, moist, loose **(FILL)**
4–9.5			17	2	ML	Gray-brown sandy SILT with decomposed wood, non-plastic, jumbled, moist, loose **(Colluvium)** -becomes very moist to wet, with occasional gravel and reduced wood content
			12	3		-with occasional rootlets -becomes fractured, reduced sand content -becomes loose, with occasional gravel, increased sand content
9.5–11.5			27	4	ML	Gray slightly sandy SILT, non-plastic, moist, medium-dense to dense

* **Test boring was terminated at 11.5 feet due to refusal on February 11, 2021.**
* **No groundwater seepage was observed during drilling.**

GEOTECH
CONSULTANTS, INC.

TEST BORING LOG

4045 West Mercer Way
Mercer Island, Washington

Job No:	Date:	Logged by:	Plate:
21026	May 2021	ASM	4

BORING 3

Elevation ±29 feet

Depth (ft.)	Moisture	Water Table	Blows per Foot	Sample	USCS	Description
0–4.5			7	1	FILL	Brown SAND with trace gravel and organics, fine- to medium-grained, moist, loose **(FILL)**
4.5–7.7		▽ (6.3–7.7)	7	2	SP/SM	Gray-brown with rust mottling, slightly silty SAND, fine-grained, very moist, loose **(Colluvium)** -grades to SAND with silt and gravel, becomes wet
7.7–11.5			43	3	ML	Gray sandy SILT with occasional organics, non-plastic, fine-grained, jumbled, moist, medium-dense -becomes dense, massive, reduced organics and sand content
			72	4		-becomes very dense

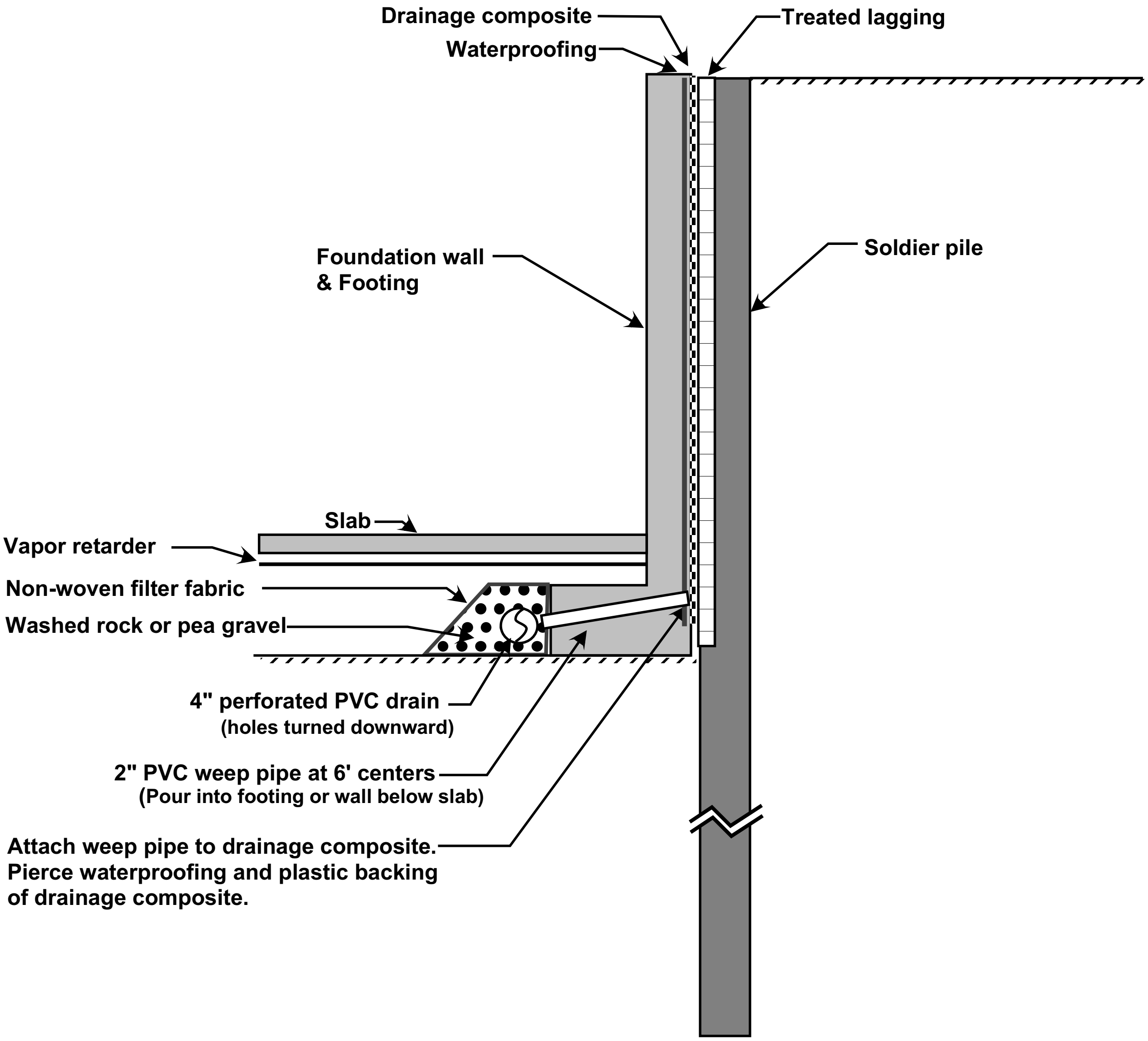
*** Test boring was terminated at 11.5 feet due to refusal on February 11, 2021.**
*** Slight perched groundwater seepage was observed from 6.3 to 7.7 feet during drilling.**

Depth scale: 5, 10, 15, 20, 25

GEOTECH
CONSULTANTS, INC.

TEST BORING LOG
4045 West Mercer Way
Mercer Island, Washington

Job No:	Date:	Logged by:	Plate:
21026	May 2021	ASM	5



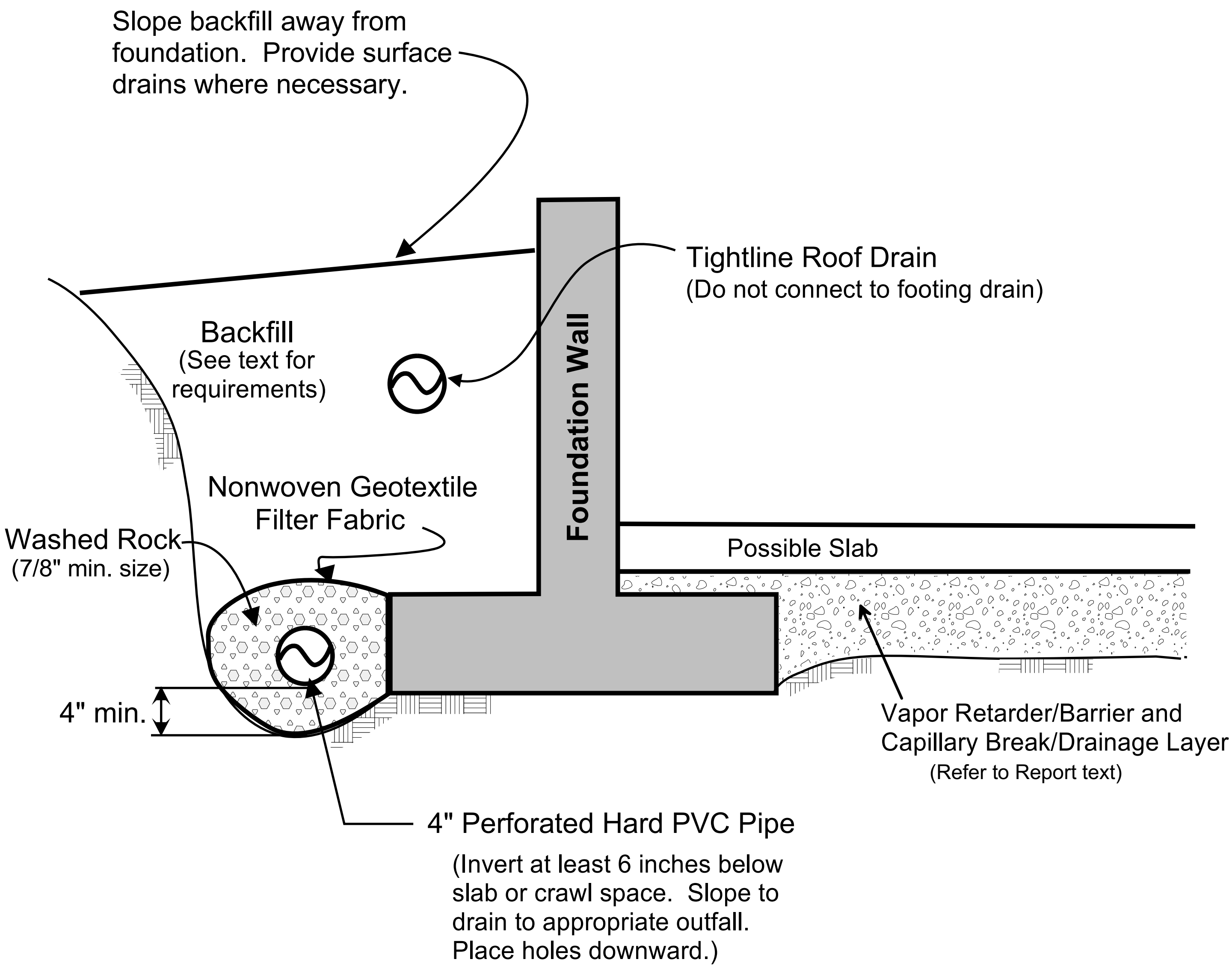
Note - Refer to the report for additional considerations related to drainage and waterproofing.

GEOTECH
CONSULTANTS, INC.

SHORING DRAIN DETAIL

4045 West Mercer Way
Mercer Island, Washington

Job No:	Date:		Plate:
21026	May 2021		6



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.

GEOTECH
CONSULTANTS, INC.

FOOTING DRAIN DETAIL

4045 West Mercer Way
Mercer Island, Washington

Job No:	Date:		Plate:
21026	May 2021		7

APPENDIX B. Sediment Trap Sizing

<u>Sizing Calculations for the Sediment Trap</u>

Per Volume II of the 2019 DOE Manual:

To determine the sediment trap geometry, first calculate the design surface area (SA) of the trap, measured at the invert of the weir (Figure 19). Use the following equation:

SA = FS(Q2/Vs)

Where:

Q2 = Design inflow based on the peak discharge from the developed 2-year runoff event from the contributing drainage area as computed in the hydrologic analysis. The 10-year peak flow should be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection. The design flows may be determined using either single-event or continuous simulation hydrologic modeling. If continuous simulation methods are used, use the 50 percent annual probability or 10 percent annual probability flows (2-year or 10-year recurrence interval respectively) as outlined above, and modeled using a 15-minute time step or less. If no hydrologic analysis is required for the other portions of the site design (conveyance, flow control, and/or water quality control), the Rational Method may be used for sediment trap design. Refer to Appendix F for additional guidelines.

Vs = the settling velocity of the soil particle of interest. The 0.02 millimeter (mm) (medium silt) particle with an assumed density of 2.65 grams per cubic centimeter (g/cm^3) has been selected as the particle of interest and has a settling velocity (Vs) of 0.00096 ft/sec.

FS = A safety factor of 2 to account for non-ideal settling.

Therefore, the equation for computing surface area becomes:

SA = 2 x Q2/0.00096 or
2,080 square feet per cfs of inflow

WWHM2012 was utilized to find the 2-year runoff rate which was 0.058 CFS (see WWHM report attached). Following the above equation, the required storage of the Temporary Sedimentation Trap is calculated below:

SA = 2 x (.058cfs)/.00096 ft/s

SA = 120 ft^2

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	4045 W Mercer Way
Site Name:	4045 W Mercer Way
Site Address:	4045 W Mercer Way
City:	Mercer Island
Report Date:	7/19/2022
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2021/08/18
Version:	4.2.18

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Steep	0.285
Pervious Total	0.285
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.285

Total site area = 12,405 SF

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Steep	0.19
Pervious Total	0.19
Impervious Land Use	acre
ROOF TOPS FLAT	0.075
DRIVEWAYS STEEP	0.02
Impervious Total	0.095
Basin Total	0.285

Total landscape area = 8,278 SF
NOTE there are some areas on-site that are to be undisturbed (remain as pasture standard). The flow rate results presented by this model are conservative.

3,276 SF

Remaining surfaces (not roof) = 876 SF

Element Flows To:

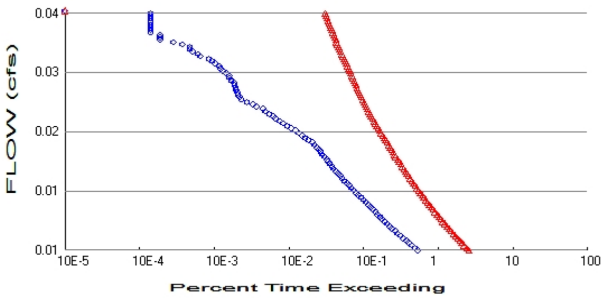
Surface	Interflow	Groundwater

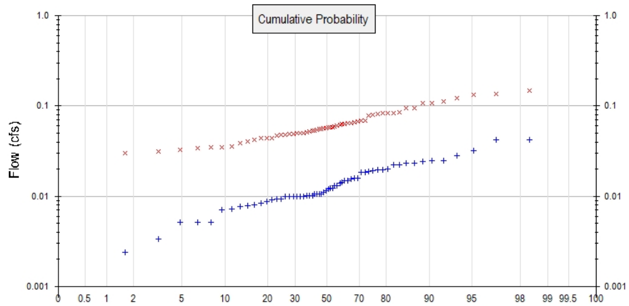
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.285
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.19
Total Impervious Area: 0.095

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.012753
5 year	0.020315
10 year	0.025224
25 year	0.031162
50 year	0.035355
100 year	0.039343

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.058124
5 year	0.081819
10 year	0.098943
25 year	0.122233
50 year	0.140799
100 year	0.160423

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.014	0.094
1950	0.016	0.084
1951	0.025	0.053
1952	0.009	0.035
1953	0.007	0.034
1954	0.010	0.049
1955	0.018	0.050
1956	0.014	0.048
1957	0.013	0.065
1958	0.012	0.042

1959	0.010	0.035
1960	0.018	0.058
1961	0.010	0.049
1962	0.007	0.035
1963	0.009	0.055
1964	0.012	0.045
1965	0.009	0.068
1966	0.008	0.039
1967	0.019	0.086
1968	0.011	0.081
1969	0.011	0.064
1970	0.010	0.057
1971	0.010	0.066
1972	0.020	0.083
1973	0.010	0.032
1974	0.010	0.064
1975	0.015	0.068
1976	0.010	0.050
1977	0.002	0.047
1978	0.010	0.057
1979	0.005	0.063
1980	0.023	0.107
1981	0.008	0.058
1982	0.019	0.096
1983	0.013	0.058
1984	0.009	0.040
1985	0.005	0.056
1986	0.022	0.055
1987	0.020	0.062
1988	0.008	0.032
1989	0.005	0.044
1990	0.042	0.149
1991	0.024	0.112
1992	0.011	0.044
1993	0.010	0.030
1994	0.003	0.027
1995	0.012	0.048
1996	0.028	0.079
1997	0.025	0.059
1998	0.008	0.053
1999	0.022	0.134
2000	0.011	0.061
2001	0.002	0.051
2002	0.012	0.083
2003	0.016	0.078
2004	0.023	0.123
2005	0.015	0.053
2006	0.015	0.050
2007	0.032	0.136
2008	0.042	0.108
2009	0.019	0.068

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0422	0.1493
2	0.0421	0.1363
3	0.0318	0.1344

4	0.0280	0.1230
5	0.0249	0.1123
6	0.0249	0.1077
7	0.0245	0.1073
8	0.0234	0.0957
9	0.0230	0.0944
10	0.0224	0.0858
11	0.0221	0.0841
12	0.0199	0.0834
13	0.0196	0.0827
14	0.0194	0.0814
15	0.0191	0.0793
16	0.0188	0.0780
17	0.0184	0.0685
18	0.0183	0.0682
19	0.0157	0.0680
20	0.0157	0.0658
21	0.0154	0.0649
22	0.0148	0.0639
23	0.0147	0.0635
24	0.0143	0.0629
25	0.0138	0.0623
26	0.0132	0.0610
27	0.0130	0.0589
28	0.0123	0.0582
29	0.0123	0.0579
30	0.0120	0.0576
31	0.0116	0.0568
32	0.0111	0.0565
33	0.0106	0.0559
34	0.0105	0.0553
35	0.0105	0.0546
36	0.0105	0.0535
37	0.0101	0.0530
38	0.0101	0.0527
39	0.0101	0.0511
40	0.0100	0.0503
41	0.0099	0.0501
42	0.0099	0.0496
43	0.0099	0.0488
44	0.0099	0.0486
45	0.0099	0.0481
46	0.0093	0.0475
47	0.0093	0.0473
48	0.0091	0.0445
49	0.0088	0.0441
50	0.0084	0.0440
51	0.0080	0.0418
52	0.0079	0.0400
53	0.0076	0.0390
54	0.0072	0.0353
55	0.0071	0.0348
56	0.0051	0.0347
57	0.0051	0.0345
58	0.0051	0.0325
59	0.0034	0.0315
60	0.0024	0.0303
61	0.0018	0.0275

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0064	11407	54884	481	Fail
0.0067	10365	51055	492	Fail
0.0070	9441	47547	503	Fail
0.0073	8633	44318	513	Fail
0.0075	7940	41494	522	Fail
0.0078	7270	38778	533	Fail
0.0081	6669	36297	544	Fail
0.0084	6098	33901	555	Fail
0.0087	5608	31720	565	Fail
0.0090	5150	29730	577	Fail
0.0093	4770	27912	585	Fail
0.0096	4408	26201	594	Fail
0.0099	4072	24640	605	Fail
0.0102	3767	23228	616	Fail
0.0105	3546	21881	617	Fail
0.0108	3292	20561	624	Fail
0.0111	3078	19344	628	Fail
0.0114	2862	18204	636	Fail
0.0116	2669	17194	644	Fail
0.0119	2481	16219	653	Fail
0.0122	2306	15278	662	Fail
0.0125	2158	14455	669	Fail
0.0128	1976	13717	694	Fail
0.0131	1830	12996	710	Fail
0.0134	1683	12290	730	Fail
0.0137	1573	11665	741	Fail
0.0140	1461	11028	754	Fail
0.0143	1367	10472	766	Fail
0.0146	1269	9937	783	Fail
0.0149	1175	9435	802	Fail
0.0152	1103	8992	815	Fail
0.0155	1030	8547	829	Fail
0.0157	962	8168	849	Fail
0.0160	905	7758	857	Fail
0.0163	851	7407	870	Fail
0.0166	802	7060	880	Fail
0.0169	750	6735	897	Fail
0.0172	715	6406	895	Fail
0.0175	681	6085	893	Fail
0.0178	638	5786	906	Fail
0.0181	605	5574	921	Fail
0.0184	572	5328	931	Fail
0.0187	542	5095	940	Fail
0.0190	504	4851	962	Fail
0.0193	469	4622	985	Fail
0.0195	435	4404	1012	Fail
0.0198	391	4211	1076	Fail
0.0201	351	4036	1149	Fail
0.0204	321	3839	1195	Fail
0.0207	293	3677	1254	Fail
0.0210	264	3506	1328	Fail
0.0213	230	3343	1453	Fail
0.0216	203	3195	1573	Fail
0.0219	177	3069	1733	Fail

0.0222	160	2924	1827	Fail
0.0225	142	2819	1985	Fail
0.0228	130	2704	2080	Fail
0.0231	116	2599	2240	Fail
0.0234	103	2490	2417	Fail
0.0236	95	2400	2526	Fail
0.0239	79	2323	2940	Fail
0.0242	71	2237	3150	Fail
0.0245	58	2156	3717	Fail
0.0248	49	2078	4240	Fail
0.0251	46	2007	4363	Fail
0.0254	44	1935	4397	Fail
0.0257	43	1858	4320	Fail
0.0260	42	1797	4278	Fail
0.0263	41	1737	4236	Fail
0.0266	40	1694	4235	Fail
0.0269	39	1638	4200	Fail
0.0272	36	1590	4416	Fail
0.0275	34	1540	4529	Fail
0.0277	34	1489	4379	Fail
0.0280	31	1431	4616	Fail
0.0283	28	1394	4978	Fail
0.0286	26	1346	5176	Fail
0.0289	25	1305	5220	Fail
0.0292	22	1257	5713	Fail
0.0295	20	1213	6065	Fail
0.0298	18	1169	6494	Fail
0.0301	14	1130	8071	Fail
0.0304	13	1091	8392	Fail
0.0307	11	1048	9527	Fail
0.0310	10	1015	10150	Fail
0.0313	10	989	9890	Fail
0.0315	8	958	11975	Fail
0.0318	6	928	15466	Fail
0.0321	4	911	22775	Fail
0.0324	4	882	22050	Fail
0.0327	4	853	21325	Fail
0.0330	3	828	27600	Fail
0.0333	3	805	26833	Fail
0.0336	3	774	25800	Fail
0.0339	3	760	25333	Fail
0.0342	3	736	24533	Fail
0.0345	3	716	23866	Fail
0.0348	3	695	23166	Fail
0.0351	3	672	22400	Fail
0.0354	3	655	21833	Fail

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

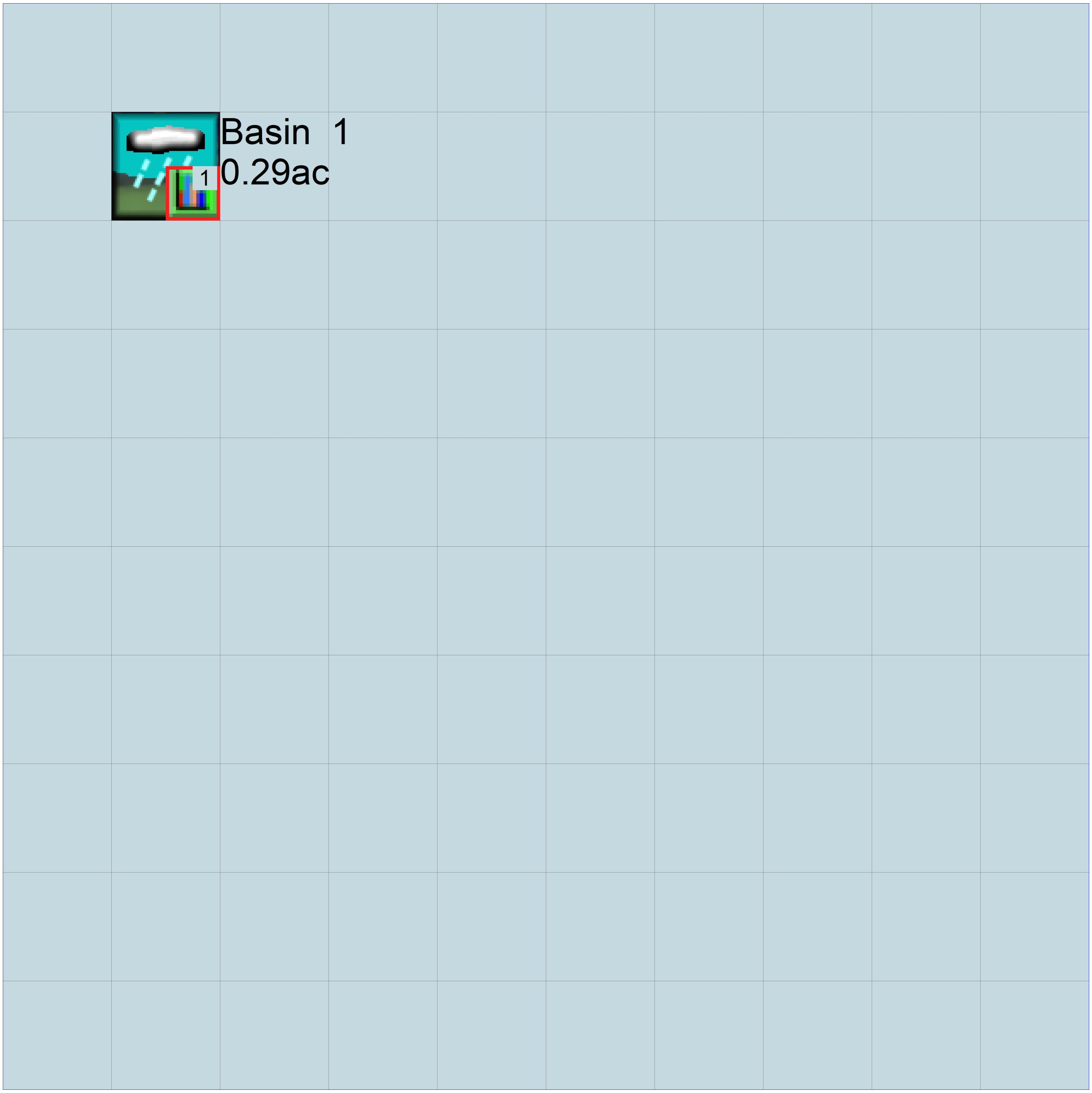
PERLND Changes

No PERLND changes have been made.

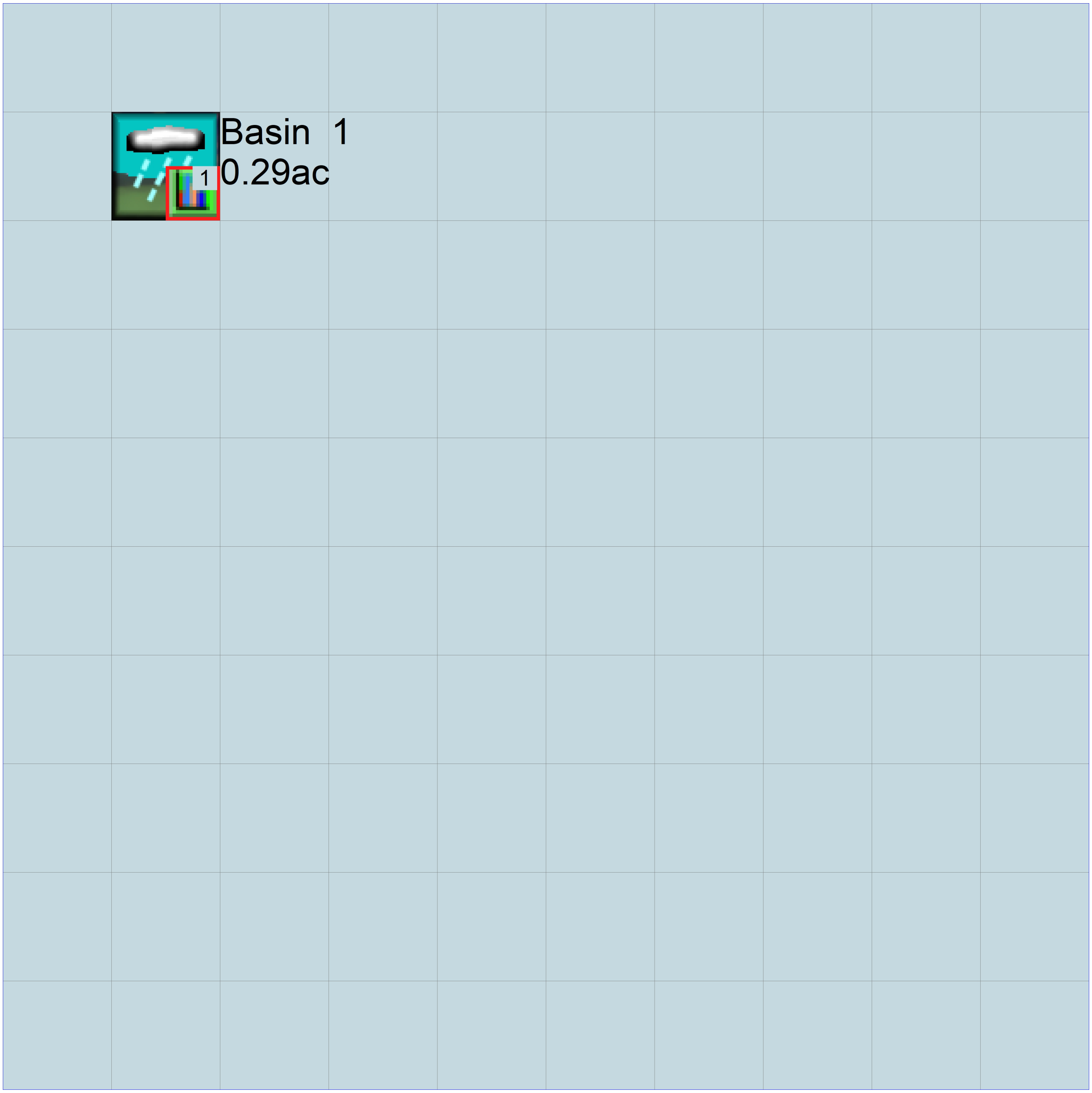
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   4045 W Mercer Way.wdm
MESSU      25   Pre4045 W Mercer Way.MES
           27   Pre4045 W Mercer Way.L61
           28   Pre4045 W Mercer Way.L62
           30   POC4045 W Mercer Way1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      12
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                    MAX                      1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   12     C, Forest, Steep        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   12         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   12         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   12         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   12             0       4.5      0.08       400      0.15       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   12             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   12           0.2       0.3      0.35         6       0.3       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   12             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
  END GEN-INFO
  *** Section IWATER***

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

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

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

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  12                       0.285     COPY   501     12
PERLND  12                       0.285     COPY   501     13

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

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



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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

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

```
WDM       1 EVAP     ENGL    0.76            PERLND   1 999 EXTNL  PETINP
WDM       1 EVAP     ENGL    0.76            IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

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

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

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   4045 W Mercer Way.wdm
MESSU      25   Mit4045 W Mercer Way.MES
           27   Mit4045 W Mercer Way.L61
           28   Mit4045 W Mercer Way.L62
           30   POC4045 W Mercer Way1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      18
      IMPLND       4
      IMPLND       7
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                    MAX                      1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   18      C, Lawn, Steep         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   18         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   18         0    0    4    0    0    0    0    0    0    0    0    0    1    9
```

```
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   18         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   18              0       4.5      0.03       400      0.15       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   18              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   18            0.1      0.15      0.25         6       0.3      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   18              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

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

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    ***
    4         0    0    1    0    0    0
    7         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    0    1    9
    7         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    4         0    0    0    0    0
    7         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4            400      0.01       0.1       0.1
    7            400       0.1       0.1      0.05
```

```
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4             0         0
    7             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4             0         0
    7             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  18                        0.19     COPY   501     12
PERLND  18                        0.19     COPY   501     13
IMPLND   4                       0.075     COPY   501     15
IMPLND   7                        0.02     COPY   501     15

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

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



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

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

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

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

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

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
```

```
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

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

END EXT SOURCES

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

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

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

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


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

APPENDIX C. Conveyance Calc

RATIONAL METHOD
for Conveyance Facility Sizing

Project: 4045 West Mercer Way Mercer Island
Description: Rational Method for pipe direct discharging into Lake Washington

Design Storm: 100 yr

Q=CIA
Where: Q = peak flow (cfs); I = peak rainfall intensity (inches/hour)
C = estimated composite runoff coefficient; A = drainage subbasin area (acres)

Composite Runoff Coefficient

Cc = (C1*A1+C2*A2…)/At
Where: Cc = composite runoff coefficient; A# = area of land cover (acres)
C# = runoff coefficient for Area #; At = total area (acres)

C #		Description	Area (sf)	Area (acres)	C	A*C
1	Onsite/New	Impervious Surface	12,250	0.281	0.90	0.253
			Totals:	**0.281**		**0.253**

Cc = 0.90 (total C#*A#)/(total area)

Time of Concentration

Seg. #	Description of Flow Path Segment	Length (ft)	kr	Upper Elev	Lower Elev	Slope (ft/ft)	Travel Time (minutes)
1	Paved Area (sheet flow) and shallow gutter flow	125	20	70	18	0.416	0.16
	Totals:	**125**					**0.2**

Unity Peak Intensity Factor
ir = ar*Tc^-br
where: Tc = time of concentration (minutes)
ar and br = coefficients from Table 3.2.1.B

Tc = 6.30 minutes (from table above or 6.3 minimum or 100 max)
ar = 2.61 (from Table 3.2.1.B)
br = 0.63 (from Table 3.2.1.B)

ir = 0.82

Peak Rainfall Intensity

Ir = Pr*ir
where: Ir = peak rainfall intensity (inches/hour)
Pr = total 24-hour precipitation for design return period (inches/24 hours)
ir = unit peak rainfall intensity factor

Pr = 3.15 precipitation (inches)
ir = 0.82 unit peak intensity factor (from above)

Ir = 2.58 inches/hour

Peak Runoff Rate
Q = C*Ir*A

C = 0.90 Cc (unitless) from above
Ir = 2.58 Ir (inches/hour) from above
A = 0.28 total area (acres) from above

Q = 0.653 cfs

Pipe Capacity Calculations (Manning's Equation)
Full Flow (d/D = 0.90)

Description	ID (inches)	Area (sf)	Wetted Per. (ft)	Hyd. Radius (ft)	Manning's n	Slope (ft/ft)	Velocity (ft/s)	Pipe Capacity (cfs)	Req'd Flow (cfs)	
6" for all impervious areas onsite	6	0.1963495	1.570796327	0.125	0.012	0.02	4.39	0.862	**0.653**	**Capacity OK**

APPENDIX D. Arborist Report

7724 2nd Ave NE
Seattle, WA 98115
206.898.6312

russell+ lambert LANDSCAPE ARCHITECTURE

Tree Report

4045 W Mercer Way

August 27, 2020

Prepared For: Bret Chatalas
4037 W Mercer Way
Mercer Island, WA, 98040
(206) 850-1242
bret@cactusrestaurants.com

Prepared By: Russell + Lambert
Mary Ellen Russell
WA Landscape Architect #1149
ISA Tree Risk Assessment Qualified
(206) 898-6312

Overview

At the request of Bret Chatalas I visited 4045 W Mercer Way, Mercer Island WA on August 25,2020 to inventory and assess existing and recently removed trees around a derelict house located on the site. This tree report is undertaken as part of the permit process to demolish the house. The house is in dangerous condition with sagging structural members, floating doorways, and large panes of broken glass. No redevelopment of the property is planned at this time.

During the site visit I performed level 2 Basic Tree Risk Assessments with a five year time frame for existing trees 6” or greater measured 4.5’ from the ground (DBH) located within the potential impact area for the demolition. The site includes a steep slope above the existing house that is heavily vegetated. Trees at the top of the slope will not be impacted by the demolition and were not assessed.

The owner’s contractor has already cleared vegetation around the house to allow access for demolition, removing (7) existing trees and (2) standing dead trees. This work was done prior to submitting for a tree removal permit. I observed the stumps of previously removed trees. Wood from the removed trees has been already been removed from the site.

DBH measurements were taken using a diameter tape rounded to the nearest inch. Where site conditions limit access diameter was estimated using a standard measuring tape. For multi-stem trees the diameter was averaged by taking the square root of the sum of the squared diameters of each stem. This report summarizes details of my observations and assessments below.

Tree Condition Categories

This report categorizes tree condition as 'Good', 'Fair', or 'Poor'. 'Good' indicates that a tree has no evident significant structural defects or disease concerns and has good form for the species and typical vigor. 'Fair' indicates that the tree may have minor to moderate structural defects that are not expected to contribute to a failure within the next five years, minor disease or pest concerns, an asymmetric or unbalanced crown, or less than normal vigor. 'Poor' indicates that the tree has significant conditions of concern which are likely to cause a failure within the next five years such as major structural defects, disease or significant pest concerns, decline due to old age, evidence of decay at the roots, severely overextended branches, sparse or abnormal foliage, and very low vigor. Trees in 'Poor' condition may or may not be classified as high-risk trees depending on the size and location of the tree and the likelihood of impacting a target in the event of a failure.

Existing Trees

There are (6) existing trees in the potential impact area with a DBH 6" or greater. There are no street trees at the property. There are no trees off-site which have critical root zones extending into the potential impact area.

Previously Removed Dead Trees

Two standing dead trees have been previously removed. Their stumps show extensive decay without live wood. These stumps are located with asterisks on the tree map.

Tree 1

Prunus sp. (Flowering Cherry)	Diameter: 17" avg.	Exceptional Tree: No
Condition: Poor	Risk Rating: Low	Hazardous Tree: No

Tree 1 is located near the lake shore. It has been tagged as '1' with pink construction flagging. It has a multi-stem form with (1) 7" stem, (1) 10" stem, and (1) 12" stem. It has indications of decay including a swollen base with a small cavity and areas of loose, patchy bark. Due to its small size and location away from active uses the risk rating is low. The canopy extends 16' from the base of the tree. The critical root zone extends 8' from the base of the tree.

This tree is planned for retention. Prior to demolition tree protection fencing that meets the requirements of the City of Mercer Island should be placed at the drip line and maintained throughout demolition.

Tree 2

Acer macrophyllum (Bigleaf Maple)	Diameter: 17”	Exceptional Tree: No
Condition: Poor	Risk Rating: Low	Hazardous Tree: No

Tree 2 is located on the steep slope above the existing house. It has been tagged as ‘2’ with pink construction flagging. Its crown has previously broken off leaving a sparse, narrow canopy of suckering growth. The likelihood of failure within five years is probable. Since the timeframe for demolishing the house is short, and after the house is removed there will not be any targets within striking range, the risk rating is low. The canopy extends 12’ from the base of the tree. The critical root zone is 6’ from the base of the tree.

This tree is planned for retention. Prior to demolition tree protection fencing that meets the requirements of the City of Mercer Island should be placed minimum 6’ from the base of the tree on the downhill side. Tree protection fencing should be maintained throughout demolition.

Tree 3

Acer macrophyllum (Bigleaf Maple)	Diameter: 13”	Exceptional Tree: No
Condition: Poor	Risk Rating: Low	Hazardous Tree: No

Tree 3 is located on the steep slope above the existing house. It has been tagged as ‘3’ with pink construction flagging. It has a low live crown ratio with few branches and sparse canopy and it leans down-slope. The likelihood of failure within five years is probable. Since the timeframe for demolishing the house is short, and after the house is removed there will not be any targets within striking range, the risk rating is low. The canopy extends 11’ from the base of the tree. The critical root zone is 5.5’ from the base of the tree.

This tree is planned for retention. Prior to demolition tree protection fencing that meets the requirements of the City of Mercer Island should be placed minimum 5.5’ from the base of the tree on the downhill side. Tree protection fencing should be maintained throughout demolition.

Tree 4

Acer macrophyllum (Bigleaf Maple)	Diameter: 12”	Exceptional Tree: No
Condition: Poor	Risk Rating: Low	Hazardous Tree: No

Tree 4 is located on the steep slope above the existing house. It has been tagged as ‘4’ with pink construction flagging. Its crown has previously broken off leaving a narrow canopy of suckering growth. Tree 4 is heavily infested with English Ivy which weighs down the tree and makes failure more likely. The likelihood of failure within five years is probable. Since the timeframe for demolishing the house short, and after the house is removed there will not be any targets within striking range, the risk rating is low. The canopy extends 12’ from the base of the tree. The critical root zone is 6’ from the base of the tree.

This tree is planned for retention. Prior to demolition tree protection fencing that meets the requirements of the City of Mercer Island should be placed minimum 6’ from the base of the tree on the downhill side. Tree protection fencing should be maintained throughout demolition.

Tree 5

Acer macrophyllum (Bigleaf Maple) Diameter: 25” avg. Exceptional Tree: No
Condition: Poor Risk Rating: Low Hazardous Tree: No

Tree 5 is located on the steep slope above the existing house. It has a multi-stem form with (1) 11” stem, (1) 12” stem, and (1) 20” stem. It has been tagged as ‘5’ with pink construction flagging. The 20” stem has significant evidence of decay on the east side of the trunk. Branches on all three stems have previously broken off leaving a narrow canopy with a low live crown ratio. The likelihood of failure within five years is probable. Since the timeframe for demolishing the house is short, and after the house is removed there will not be any targets within striking range, the risk rating is low. The canopy extends 14’ from the base of the tree. The critical root zone is 7’ from the base of the tree.

This tree is planned for retention. Prior to demolition tree protection fencing that meets the requirements of the City of Mercer Island should be placed minimum 7’ from the base of the tree on the downhill side. Tree protection fencing should be maintained throughout demolition.

Tree 6

Acer macrophyllum (Bigleaf Maple) Diameter: 18” Exceptional Tree: No
Condition: Poor Risk Rating: Low Hazardous Tree: No

Tree 6 is located on the steep slope above the existing house. It has been tagged as ‘6’ with pink construction flagging. It has substantial decay on the uphill side of the trunk, encompassing half of the trunk diameter. The top has previously broken off leaving a narrow suckering canopy. The likelihood of failure within five years is probable. Since the timeframe for demolishing the house is just a few weeks, and after the house is removed there will not be any targets within striking range, the risk rating is low. The canopy extends 12’ from the base of the tree. The critical root zone is 6’ from the base of the tree.

This tree is planned for retention. Prior to demolition tree protection fencing that meets the requirements of the City of Mercer Island should be placed minimum 6’ from the base of the tree on the downhill side. Tree protection fencing should be maintained throughout demolition.

Note regarding safety during demolition

Trees 1-6 are all in poor condition with structural weaknesses and a history of failures. During demolition workers should take safety precautions to avoid disturbing the trees and wear protective gear. No workers should be on-site during high winds when tree failure is most likely.

Stump A

Acer macrophyllum (Bigleaf Maple) Diameter: less than 10”
Exceptional Tree: No

Stump A is 10” wide at its widest point. Since trees are wider at the base than at 4.5’ from the ground, this tree would have been less than 10” DBH before it was removed.

Stump B

Acer macrophyllum (Bigleaf Maple) Diameter: 23” max.
Exceptional Tree: No

Stump B had (3) stems that measure 7”, 8”, and 20” at the base. This tree was larger than 10” DBH, with a maximum possible DBH of 23”, (and likely several inches smaller). The largest stem emerges from the ground at a 45 degree angle toward the existing house. Aerial photography shows that this tree leaned far over the house. The uniformly poor condition of the other Bigleaf Maples on the site suggests that this tree was likely to have had decay and/or broken branches.

Stump C

Acer macrophyllum (Bigleaf Maple) Diameter: 29” max. Exceptional Tree: No

Stump C had (6) stems that measure 8”, 10”, (2) 11”, 14”, and 16” at the base. This tree was larger than 10” DBH, with a maximum possible DBH of 29”, (and likely several inches smaller). This tree has extensive evidence of decay on the downhill side of the base including fungal fruiting bodies. This tree was in poor condition with a probable likelihood of failure within the next five years.

Stump D

Prunus sp. (Flowering Cherry) Diameter: 21” max.
Exceptional Tree: No

Stump D is 21” at the widest point of the base. This tree was likely greater than 10” DBH. Aerial photography showing the tree in bloom was used to confirm the species identification. There is no remaining evidence of its condition.

Stump E

Acer macrophyllum (Bigleaf Maple)

Diameter: 16" max.
Exceptional Tree: No

Stump E had (3) stems that measure 10" and (2) 9" at the base. This tree was larger than 10" DBH, with a maximum possible DBH of 29", (and likely several inches smaller). The stump is circled by the remains of thick English Ivy vines. The uniformly poor condition of the other Bigleaf Maples on the site suggests that this tree was likely to have had decay and/or broken branches.

Stump F

Acer macrophyllum (Bigleaf Maple)

Diameter: 16" max.
Exceptional Tree: No

Stump F is located near a large swollen root extending from stump B and may be a sucker from the same root system. It measures 16" at the widest point of the base and emerges from the soil at a 45 degree angle down slope. The uniformly poor condition of the other Bigleaf Maples on the site suggests that this tree was likely to have had decay and/or broken branches.

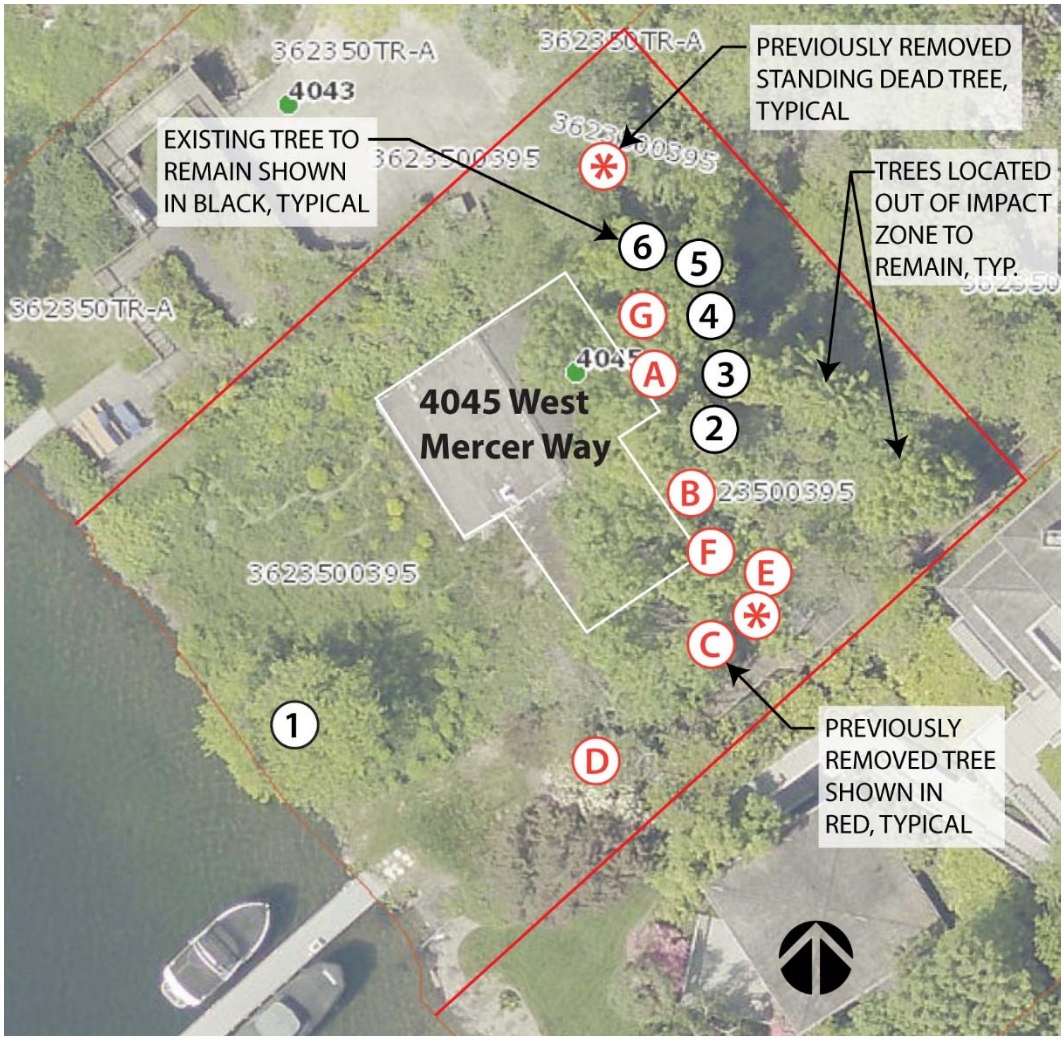
Stump G

Acer macrophyllum (Bigleaf Maple)

Diameter: Less than 10"
Exceptional Tree: No

Stump G measures 9" at its widest point. This tree was a young Bigleaf Maple with a DBH less than 10".

Tree Map



Tree Retention

All of the remaining trees are proposed for retention. (7) existing trees located around the base of the existing house have already been removed. None of the remaining trees or previously removed trees are/were Exceptional.

This site is located within 200' of the Lake Washington shoreline and there are steep slopes on site. MIMC 19.10.050 states that tree removal "that is not associated with a development proposal located within wetlands, watercourses, landslide hazard areas and buffers associated with these critical area types shall be permitted subject to the following standards:

1. One or more of the following criteria apply to the tree(s) proposed for removal:
    a. The tree is documented to be a hazard tree by a TRAQ-qualified arborist;

b. The tree is documented by a qualified arborist to be diseased, in decline, or not viable for retention; or

c. The removal of the tree will enhance ecosystem functions and values and/or promote slope stability."

The largest of the removed trees, Stump C, was diseased with numerous fungal fruiting bodies at the base. The other (6) removed trees were cleared in order to allow equipment access to demolish the existing derelict house. In addition to being potentially dangerous, the house has no significant habitat value. Removing the house and invasive species on site and replanting the cleared area around the house with a diverse mix of native species will improve habitat value and enhance ecosystem functions on site.

Impact of tree removal on remaining trees

A geotechnical report completed by PanGeo Engineers states that that "the site trees are not critical to the global stability of the site slopes, provided that any disturbed ground resulting from tree removal be restored based on our recommendations for permanent erosion control." Replanting the disturbed area per the restoration plan recommendations below matches the engineer's recommendation for long-term erosion control. T

Restoration Plan

The removed trees consisted of (6) native Bigleaf Maples and (1) non-native Flowering Cherry. According to the 2015 City of Mercer Island Open Space Vegetation Plan exotic plants, such as the removed Flowering Cherry, "have been shown in many cases to decrease wildlife habitat value…and other ecosystem benefits." The plan calls for urban forests with a "mixture of native coniferous and deciduous canopy trees" combined with "diverse native understory" to improve habitat. With the exception of two exotic Flowering Cherries, the remaining trees on site are/were all Bigleaf Maples. Replacing the removed Bigleaf Maples with a mixture of native coniferous and deciduous trees with a diverse native understory will enhance ecosystem functions.

Per the table in 19.10.070(A) the removal of (2) trees less than 10" DBH, (4) trees between 10" DBH and 24" DBH, and (1) tree that may have been greater than 24" DBH but less than 36" DBH requires a total of 13 replacement trees.

The cleared area around the house should be replanted with the following trees:

No.	Scientific Name	Common Name	Size	Spacing	Comments
4	Thuja plicata	Western Redcedar	6' min.	15' O.C.	min. 6' from foundation
5	Pseudotsuga menziesii	Douglas Fir	6' min.	15' O.C.	min. 6' from foundation
4	Malus fusca	Pacific Crabapple	1.5" cal.	12' O.C.	min. 6' from foundation

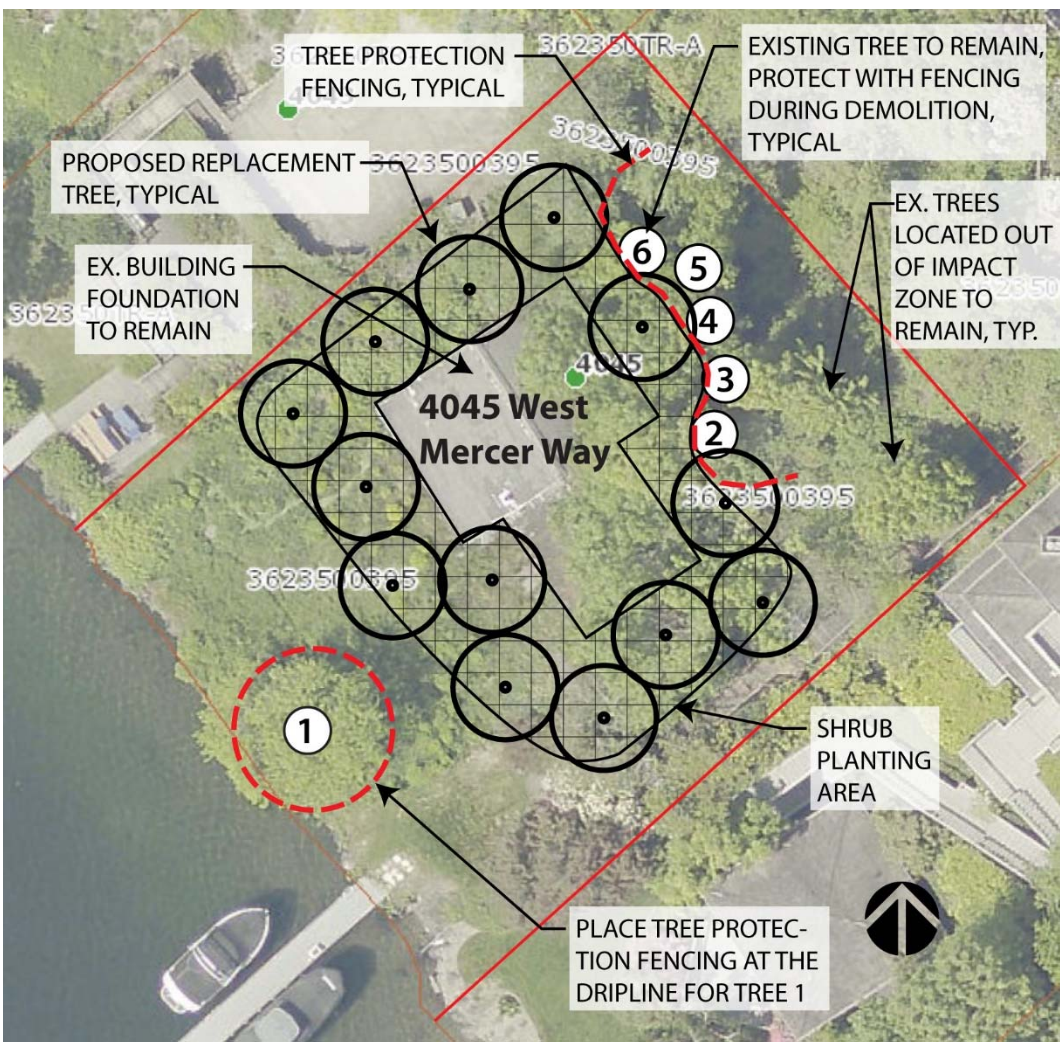
Himalayan Blackberry, English Ivy, and Field Bindweed (aka Morning Glory) were observed at the site. These plants are all invasive in the maritime Northwest and classified as Noxious Weeds or Weeds of

Concern by King County. They should be removed throughout the impact area and the roots should be grubbed out to the greatest extent possible.

After all invasive plants are removed from the impact area the understory should be replanted with the following shrubs:

No.	Scientific Name	Common Name	Size	Spacing	Comments
15	Cornus sericea	Redosier Dogwood	#2 cont.	6’ O.C.	min. 4’ from trees
15	Gaultheria shallon	Salal	#2 cont.	4’ O.C.	min. 4’ from trees
15	Ribes sanguineum	Red Flowering Currant	#2 cont.	6’ O.C.	min. 4’ from trees
15	Symphoricarpos albus	Snowberry	#2 cont.	6’ O.C.	min. 4’ from trees

Planting should be completed between October 1 and April 1. All planted areas should be mulched with a minimum 2” depth of arborist wood chip mulch. The property owner should maintain restoration plantings and replace any that die within the first five years. Maintenance should include watering in the summer as needed to prevent signs of water stress.



Pruning

Prune trees only to remove damaged branches or as needed to provide minimal clearance for demolition equipment. Do not top, thin, or wind-sail trees. Under no circumstances should more than 25% of the canopy of trees to be retained be pruned. All pruning should be done under the direction of an ISA certified arborist.

Limit of Liability

The terms and evaluation forms used in this report are as laid out in the International Society of Arboriculture *Tree Risk Assessment Manual*, Second Edition. The tree evaluation is a Level 2 Basic Assessment as defined by the International Society of Arboriculture. As conditions change, it is the responsibility of the property owners to schedule additional site visits by the necessary professionals to monitor the long-term health and risk of the tree.

There are many conditions affecting a tree's health and stability which may be present and cannot be ascertained such as root rot, previous or unexposed construction damage, internal cracks, stem rot and more. Changes in circumstances and conditions can also cause a rapid deterioration of a tree's health and stability. Adverse weather conditions can dramatically affect the health and safety of a tree in a very short amount of time. While I have used every reasonable means to visually examine the tree, this evaluation represents my opinion of the tree health at the time of the evaluation only. I make no warranties about tree condition. These findings are estimates only, and do not guarantee future safety, nor are they predictions of future events, nor do they insure that a tree will not fail.

This tree evaluation is to be used to inform and guide the property owner in the management of their trees. This in no way implies that I am responsible for performing recommended actions or using other methods or tools to further determine the extent of internal tree problems without written authorization from the property owner. Furthermore, my recommendations do not in any way insure that a tree will not fail. Extreme weather conditions or hidden rot can cause good condition trees to fail.

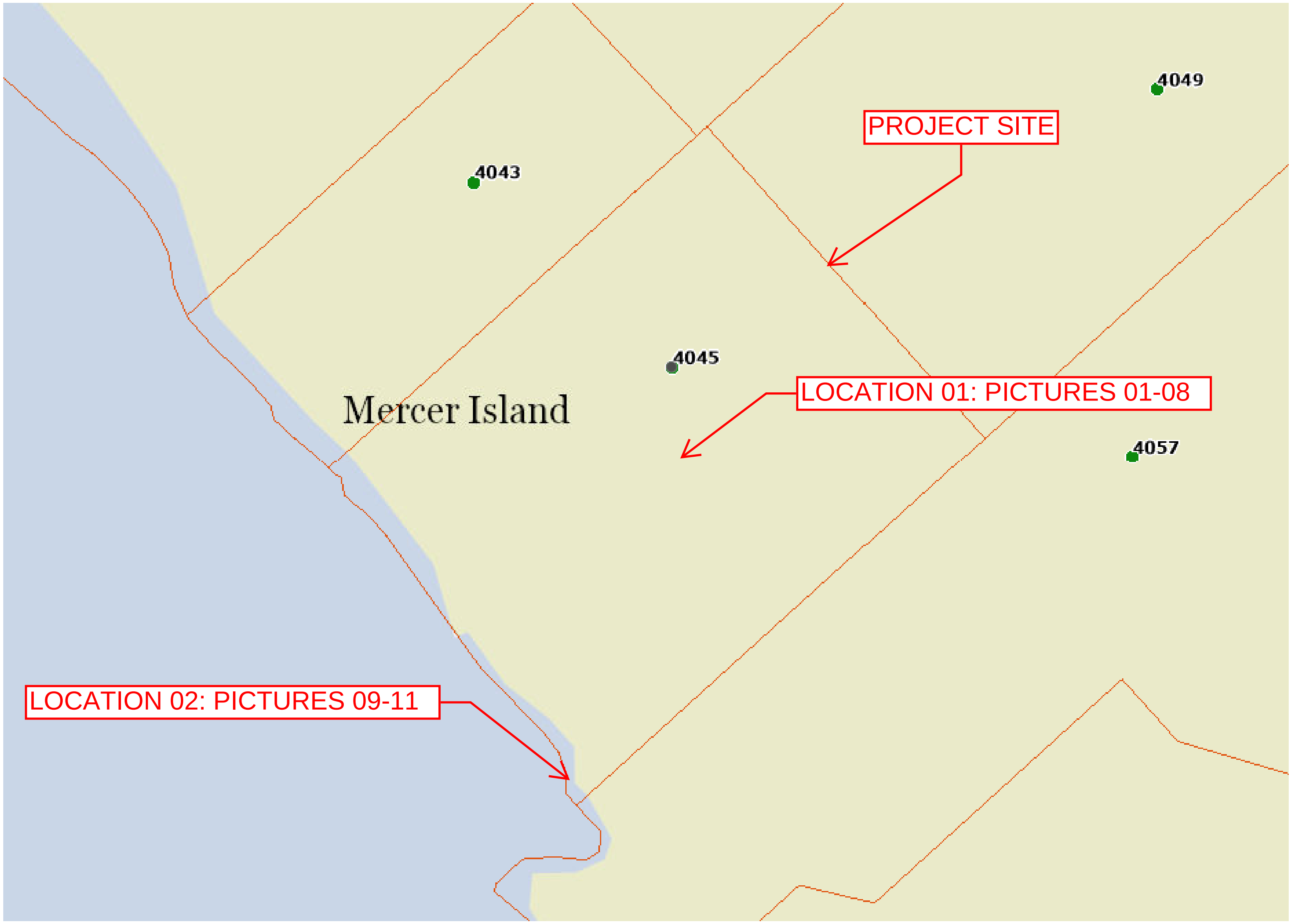
If you have any further questions, please do not hesitate to call.

Sincerely,

Mary Ellen Russell, PLA
Principal, Russell + Lambert Landscape Architecture
ISA Qualified Tree Risk Assessor

APPENDIX E. Downstream Analysis

JOB ADDRESS Downstream Analysis



General Note - Red Arrow on all sheets represents flow path

Photo 01 - Location 01
Picture from project site. Looking at Lake Washington.

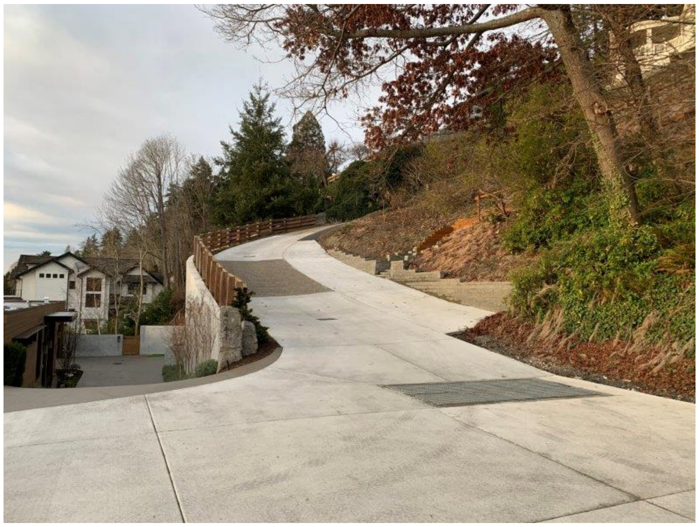


Photo 02 - Location 01
Picture from project site. Looking Northwest at driveway easement/tract to access property.

Photo 03 - Location 01
Picture from project site. Looking East at foundation of old house.

Photo 04 - Location 01
Picture from project site. Looking East at existing block wall.

Photo 05 - Location 01
Picture from project site. Looking East at foundation of old house.

Photo 06 - Location 01
Picture from project site. Looking North at foundation of old house.

Photo 07 - Location 01
Picture from project site. Looking Northwest at tree along lake shore.

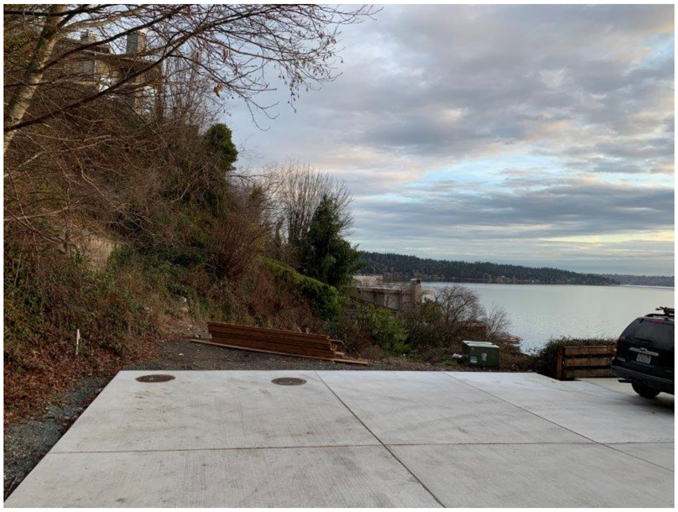


Photo 08 - Location 01
Picture from project site. Looking Southeast at existing driveway.

Photo 09 - Location 02
Looking North from the direct discharge pipe. Storm water will make its way from site, to this pipe, and directly discharge into Lake Washington.

Photo 10 - Location 02
Water from site will make its way to the existing direct discharge pipe and make its way into Lake Washington.

Photo 11 - Location 02
Water from site will make its way to the existing direct discharge pipe and make its way into Lake Washington.

APPENDIX F. Operations and Maintenance

4045 West Mercer Way SFR
Operation and Maintenance Manual

Person or Organization Responsible for Maintenance of the On-Site Storm System:

Scott Chancellor (or future property owners)

The Location Where the Operation and Maintenance Manual is to be Kept:

4045 West Mercer Way
Mercer Island, WA 98040

*Note: The manual and maintenance activity log must be made available to the City of Mercer Island for inspection purposes.

Description of On-Site Storm System

The on-site storm system for the 4045 West Mercer Way SFR consists of 4” & 6” and conveyance pipe, cleanouts, area drains, a trench drain, and Type I & 2 catch basins.

Roof stormwater runoff will be captured in a gutter and downspout system and conveyed to on-site infrastructure which will drain to Lake Washington via an existing outfall.

The Type I & 2 catch basins serve as source control of pollution for the project site. In order to control pollutants, proper maintenance and cleaning of debris, sediments, and oil from stormwater collection and conveyance systems is required per the operation and maintenance recommendations found in Volume 5 of the Stormwater Manual in addition to the BMPs in Volume IV. See the attached sheets for operation and maintenance requirements pertaining to the project.

Contact Information for Stormwater Facility Manufacturers and Installers:

Contractor (Installer of On-Site Stormwater Facilities)
TBD

Civil Engineer (Designer of On-Site Stormwater Facilities)
Ben Iddins, P.E.
Davido Consulting Group, Inc
9706 4th Ave NE, Suite 300
Seattle, WA 98115
Phone – 206.523.0024 Ext. 115
ben@dcgengr.com

Attachments

- Attachment A: Maintenance Standards and Procedures for Catch Basins
- Attachment B: Maintenance Standards and Procedures for Catch Basin Inserts

Table V-4.5.2(5) Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks. Frame is sit-

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	ting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into	Mechanism opens with

Table V-4.5.2(5) Maintenance Standards - Catch Basins (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	Working	frame have less than 1/2 inch of thread.	proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Table V-4.5.2(6) Maintenance Standards - Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4

Table V-4.5.2(17) Maintenance Standards - Coalescing Plate Oil/Water Separators (continued)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	inlet/outlet pipe.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

Table V-4.5.2(18) Maintenance Standards - Catch Basin Inserts

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Media Insert Use Beyond Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.