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STORMWATER SITE PLAN REPORT

Perla Residence

42XX Holly Lane
Mercer Island, WA 98040

02/01/2019

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CG Project No.: 18340.20

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The project is a new single-family residence with an associated driveway and walkways on a 15,876 sf (0.364 ac) lot. The existing site consists of a gravel parking area, lawn, small trees, shrubs and other vegetation. The new single-family residence will require the removal of the gravel parking area, some small trees and shrubs and grading of the site. This project will add more than 5,000 sf of new/replaced impervious surfaces and will, therefore, comply with Minimum Requirements #1-9 per the 2014 Stormwater Management Manual for Western Washington (herein referred to as the Ecology Manual). There is an existing sewer line that runs through the south portion of the site to a manhole in the SW corner of the site. Due to significant excavation on-site, the sewer line and manhole will be replaced in order to maintain sufficient cover over the pipe as it runs through the subject property.

Address: 42XX Holly Lane, Mercer Island, WA 98040
Tax Parcel Number: 738900-0020
Watershed: Lake Washington (direct discharge)
Zoning: R-15

Existing Condition

Inside the area of proposed development on-site, topography descends from the SE to the NW with an average slope of about 12%. According to King County iMap, the site is in an erosion hazard area. Adjacent parcels contain single-family residences. The north property line is in Holly Lane and the south, east and west property lines are shared borders with other single-family residences' property lines. The residences to the west and south (downstream) of the subject property have frontage along Lake Washington. There is a 5' "public and private utility and storm easement" that runs along the north edge of the property that is adjacent to a 5' water easement.

Developed Condition

In the developed condition, the project will add over 5,000 sf of new or replaced impervious surfaces. The City of Mercer Island currently requires compliance with the 2014 Ecology Manual. Therefore, it must address all Minimum Requirements (#1-9) per Figure 2.4.2 of Volume I of the Ecology Manual. Flow control is not required for the project because the site directly discharges to Lake Washington. Infiltration and Low Impact Development (LID) are not feasible because the site is mapped as an Erosion Hazard Area by the City. However, due to small, capacity-constrained pipes downstream, a detention pipe system has been designed to collect runoff from hard surfaces on-site to facilitate the discharge of stormwater at slower rates during rainfall events.

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The proposed hard surface areas on-site are as follows (not including Holly Lane):

New/Replaced Hard Surface	
Roof:	3,254 sf (0.075 ac)
Covered Patio Roof:	490 sf (0.011 ac)
Driveway/Parking:	1,320 sf (0.030 ac)
Walkways/Pool:	950 sf (0.022 ac)
Grasscrete Sewer Path:	581 sf (0.013 ac)
Total:	6,595 sf (0.151 ac)

Minimum Requirements:

The project will comply with all Minimum Requirements (#1-9) of the Ecology Manual. These are discussed below.

Minimum Requirement #1 Preparation of Stormwater Site Plans: The project must prepare a Stormwater Site Plan for local government review. The Stormwater Site Plan consists of this report and the construction drawings completed per the 2014 Ecology Manual and City guidelines.

Minimum Requirement #2 Construction Stormwater Pollution Prevention (SWPP): A Stormwater Pollution Prevention Plan (SWPPP) must be prepared as part of the Stormwater Site Plan for this project because all new development and redevelopment projects are responsible for preventing erosion and discharge of sediment and other pollutants into receiving waters. The SWPPP will include a narrative (see Section IV) to explain and justify the pollution prevention facilities for the project, and construction drawings showing minimum erosion and sedimentation control facilities necessary for the proposed site improvements.

Minimum Requirement #3 Source Control of Pollution: No known operational or structural sources of pollutions are associated with this project.

Minimum Requirement #4 Preservation of Natural Drainage Systems and Outfalls: All surface water runoff from the proposed project, including all pervious and impervious surfaces, such as roads, utilities, buildings, lawns, pastures and forests, must be discharged at the natural location so as not to be diverted onto, or away from, the adjacent downstream property. The manner by which the runoff is discharged from the project site must not create a significant adverse impact to downstream properties or drainage systems.

Minimum Requirement #5 On-site Stormwater Management: Not applicable for proposed impervious surfaces. The site is within an Erosion Hazard Area as mapped by the City. Infiltration is not allowed in this area. All disturbed pervious areas shall meet the post-Construction Soil Quality and Depth per BMP T5.13 (see Section V for Permanent Stormwater Control Plan).

Minimum Requirement #6 Runoff Treatment: The project will result in less than 5,000 sf of pollution-generating hard surfaces (PGHS) and, therefore, runoff treatment will not be required.

Minimum Requirement #7 Flow Control: Not applicable. The project is exempt from the Flow Control requirement because it directly discharges runoff to Lake Washington. However, due to small, capacity-constrained pipes downstream, a detention pipe system has been designed to collect runoff from hard

surfaces on-site to facilitate the discharge of stormwater at slower rates during rainfall events (see Section V for more about the Permanent Stormwater Control Plan).

Minimum Requirement #8 Wetlands Protection: Not applicable. This site's runoff does not directly or indirectly discharge into a wetland.

Minimum Requirement #9 Operation and Maintenance: To ensure that stormwater control facilities are adequately maintained and operated properly, an Operations and Maintenance Manual is required to be provided with the Stormwater Site Plan documents (see Section VII).

Figure I-1. Vicinity map (from Google Maps).

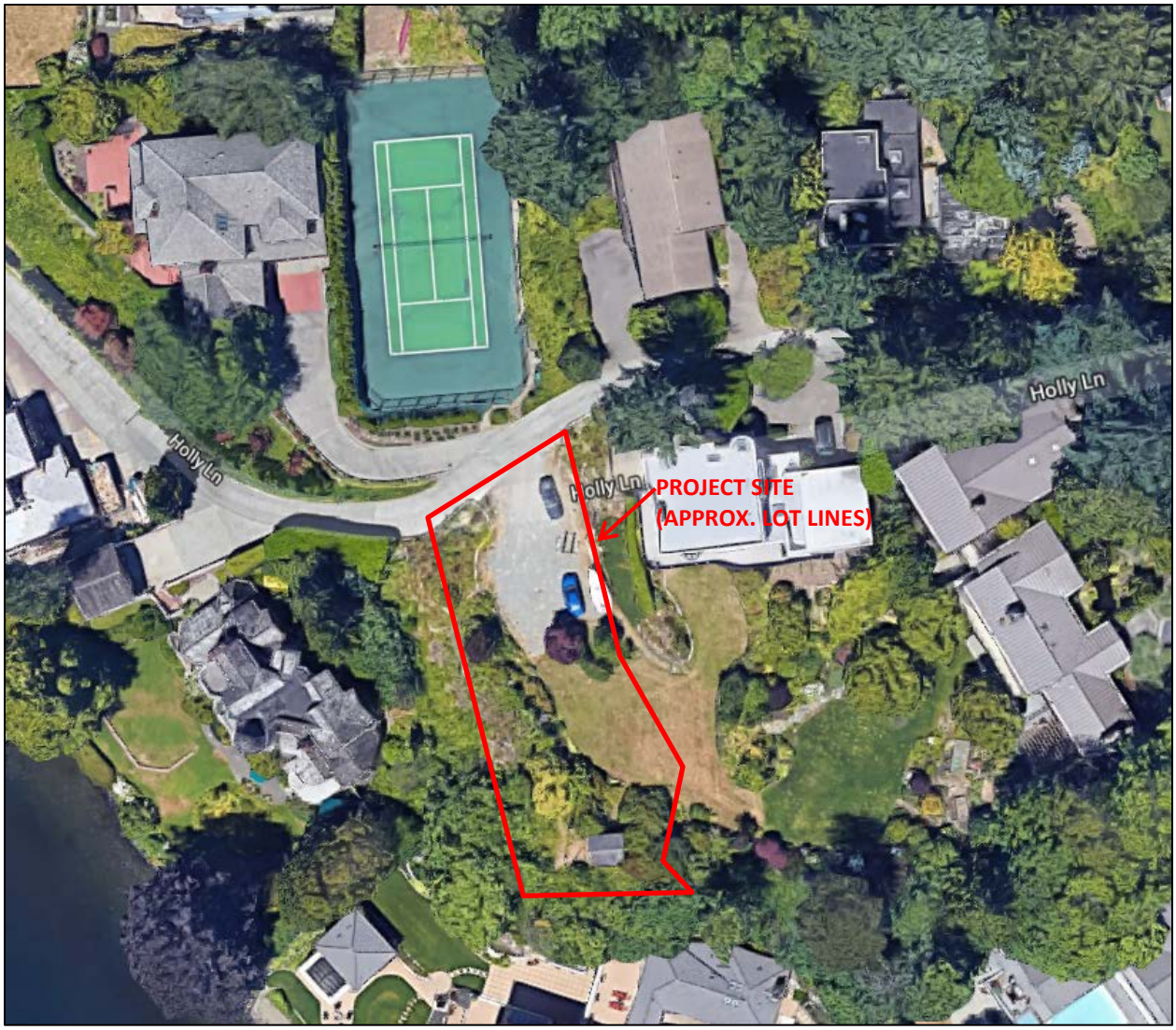

Figure I-2. Aerial image (from Google Maps).

Section II –Existing Conditions Summary

Section II Summary

Narrative

The existing site contains a gravel parking area, a gazebo, and is covered with a few small trees and other vegetation. Site topography descends from the SE to the NW with an average slope of about 12%. According to the low impact development infiltration feasibility on Mercer Island map (see Figure III-3), infiltrating LID facilities are not permitted for this site.

Adjacent areas contain single-family residences. The north property line is in Holly Lane and the south, east and west property lines are shared borders with other single-family residences' property lines. The residences to the west and south (downstream) of the subject property have frontage along Lake Washington. There is a 5' "public and private utility and storm easement" that runs along the north edge of the property that is adjacent to a 5' water easement. There is also a 10' sewer easement that runs through the southern portion of the site. There is an 8" PVC sewer main contained within the easement (see civil plans and survey for more on easements).

Underlying soils were found to be Kitsap Silt Loam, 2 to 8% slopes for most of the site, corresponding to hydrologic soil group "C" per the Natural Resources Conservation Service Soil Survey resource. Groundwater was encountered at depths of 10 feet below existing grade during the geotechnical exploration.

The existing impervious areas on-site are as follows (not including road in ROW):

Existing Impervious	
Roof:	154 sf (0.004 ac)
Gravel Parking:	2,447 sf (0.056 ac)
Total:	2,601 sf (0.060 ac)

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Section III – Off Site Analysis

Section III Summary

Task 1: Study Area Definition and Maps
Task 2: Resource Review
Task 3: Field Inspection
Task 4: Drainage System Description and Problem Descriptions
Task 5: Mitigation of Existing or Potential Problems

Task 1: Study Area Definition and Maps

The study area is defined as the project site and the area one mile downstream (minimum flow path distance) from the proposed discharge location for the purposes of Task 2, and is defined as the project site and a minimum of one-quarter mile downstream from the proposed discharge location for the purposes of Tasks 3, 4, and 5. The figure below was taken from the City of Mercer Island online mapping portal and shows the study area.

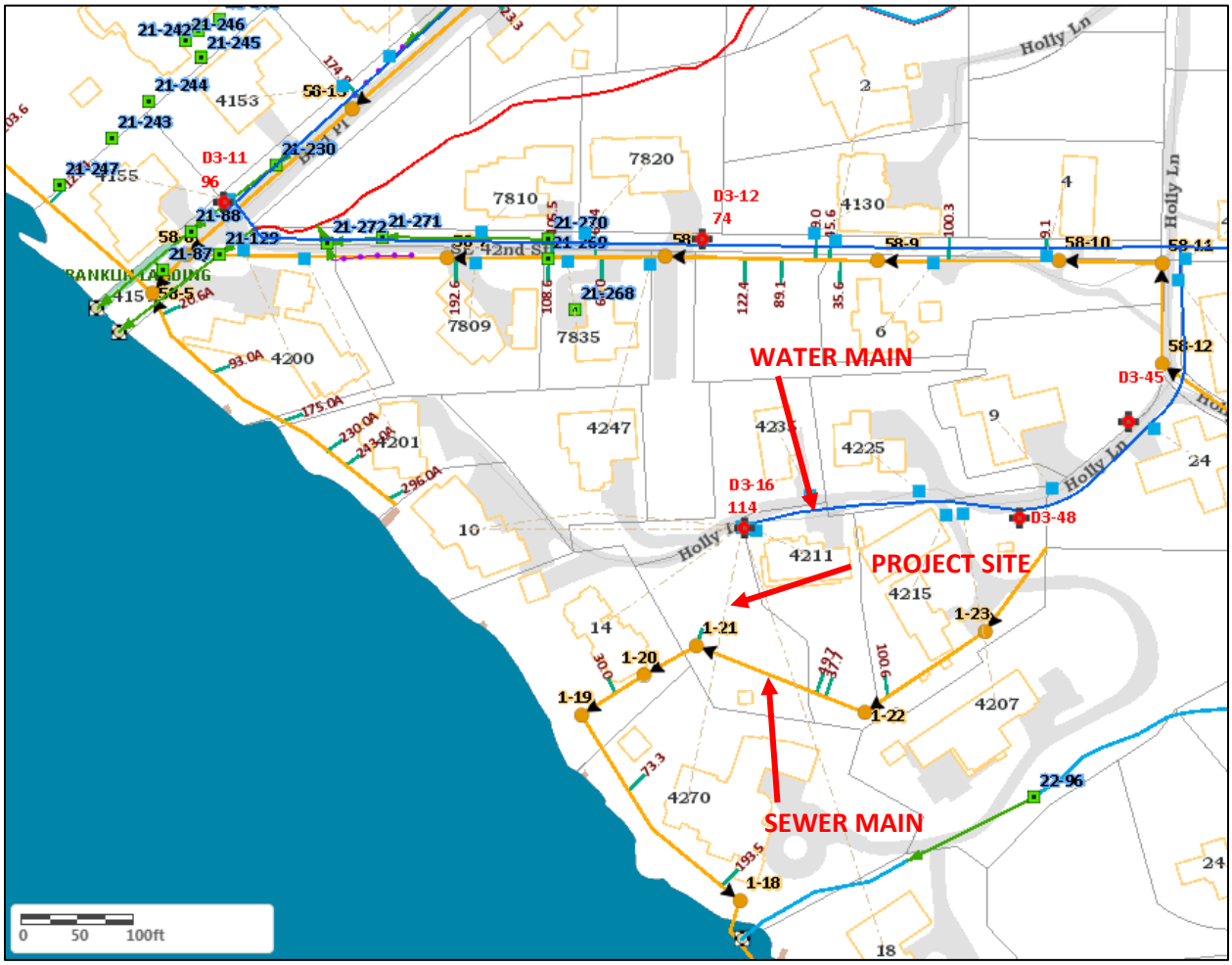

Figure III-1. Study area (from City of Mercer Island GIS Portal).

Task 2: Resource Review

Drainage and water quality problems and complaints were investigated using the King County iMap website. None were found within the range of the required downstream analysis.

Environmentally Sensitive Areas were investigated using the King County iMap and City maps. The site is within an erosion hazard area and is within an area where infiltrating LID facilities are infeasible.

Task 3: Field Inspection

A field inspection was performed on 11/1/18. The weather was cloudy with light rain.

The site has frontage on Holly Ln to the north and contains an existing driveway approach to a gravel parking area on-site. There is a water main in Holly Ln that extends just to the neighboring property to the east and a sewer main which runs through the south portion of the site. Surrounding developments are single-family residences.

From the survey, there is a 5' storm easement parallel to Holly Ln that runs through the north portion of the site. However, there is no hard evidence that there is actually a storm main contained within the easement. The contractor for the project TV'd storm pipes in the vicinity and found that there is a 4" storm line running down Holly Lane that conveys stormwater to a catch basin downstream of the project site near the property at 10 Holly Lane. The 4" pipe will be the target discharge location for this project.

Task 4: Drainage System Description and Problem Descriptions

Since on-site stormwater management BMPs are infeasible for this site (see Section V) and the project is flow-control exempt with a capacity-constrained system downstream, the proposed single-family residence will convey stormwater through roof drains to a detention pipe system located near the NW corner of the site. The detention pipe system will have a flow control structure that will discharge stormwater at a slower rate during rainfall events into a new catch basin near the NW corner of the property lines. From there, runoff will be conveyed into a new catch basin in Holly Lane where the existing 4" pipe will be cut and connected into the new catch basin.

There are no anticipated problems with this drainage concept since the outfall to Lake Washington is not far from the site and the flow control structure will gradually release stormwater into the existing pipe private drainage system in Holly Lane. However, there is a downstream issue which consists of a crushed discharge pipe that will be explained more in-depth in Task 5.

Task 5: Mitigation of Existing or Potential Problems

There are some existing pipe conveyance issues associated with the private drainage system adjacent to this site. Reference the schematic drawing in exhibit XXXXX that shows the private drainage system that the new storm detention system is planning on connecting to for release of on-site stormwater. Also reference the included video of the drainage system.

We have been provided with a video which the general contractor had performed to review the existing system functionality. From the overhead photo this system starts with a small drainage catch basin at

the south portion of the neighbor's driveway across Holly Lane adjacent to the existing tennis court. We reviewed the video provided to us by the general contractor and it starts out in the above-mentioned catch basin. The drainage line from the catch basin to the Type 1 catch basin in Holly lane is approximately 118 feet in length and this line from the video appears to be in good shape and is clear and free of debris.

The camera was then placed in the type one catch basin heading in the direction to Lake Washington. From this catch basin the line is an 8" diameter PVC pipe. The pipe crosses Holly Lane and approximately 17 feet from the catch basin the pipe bends towards lot 10 heading directly to the lake between lot 10 and 14.

Approximately 20 feet to 27 feet we observed gravel and soil debris in the pipe which did not block the flow of the water in the system. This video ends at 111 feet from the Type 1 catch basin which is short of the lake due to a crushed pipe on lot 10's property. Subsequently we had requested that the contractor send the camera up from the lake end of the discharge pipe to the lake. This was subsequently inspected, and they found that the 8" PVC pipe was crushed at approximately 30 feet from the lake discharge pipe.

Conclusions and Recommendations:

1. We recommend that the existing 8" PVC pipe be replaced where the crushed pipe was located on lot 10.
2. After the pipe has been fixed, we recommend that the whole piping system be jetted and cleaned from the Type 1 catch basin to the lake.
3. We will be routing the Perla drainage outlet from the storm detention system to a control manhole and then outlet into a new catch basin and grate installed in the existing 4" diameter drainage pipe at the north end of Holly Lane.

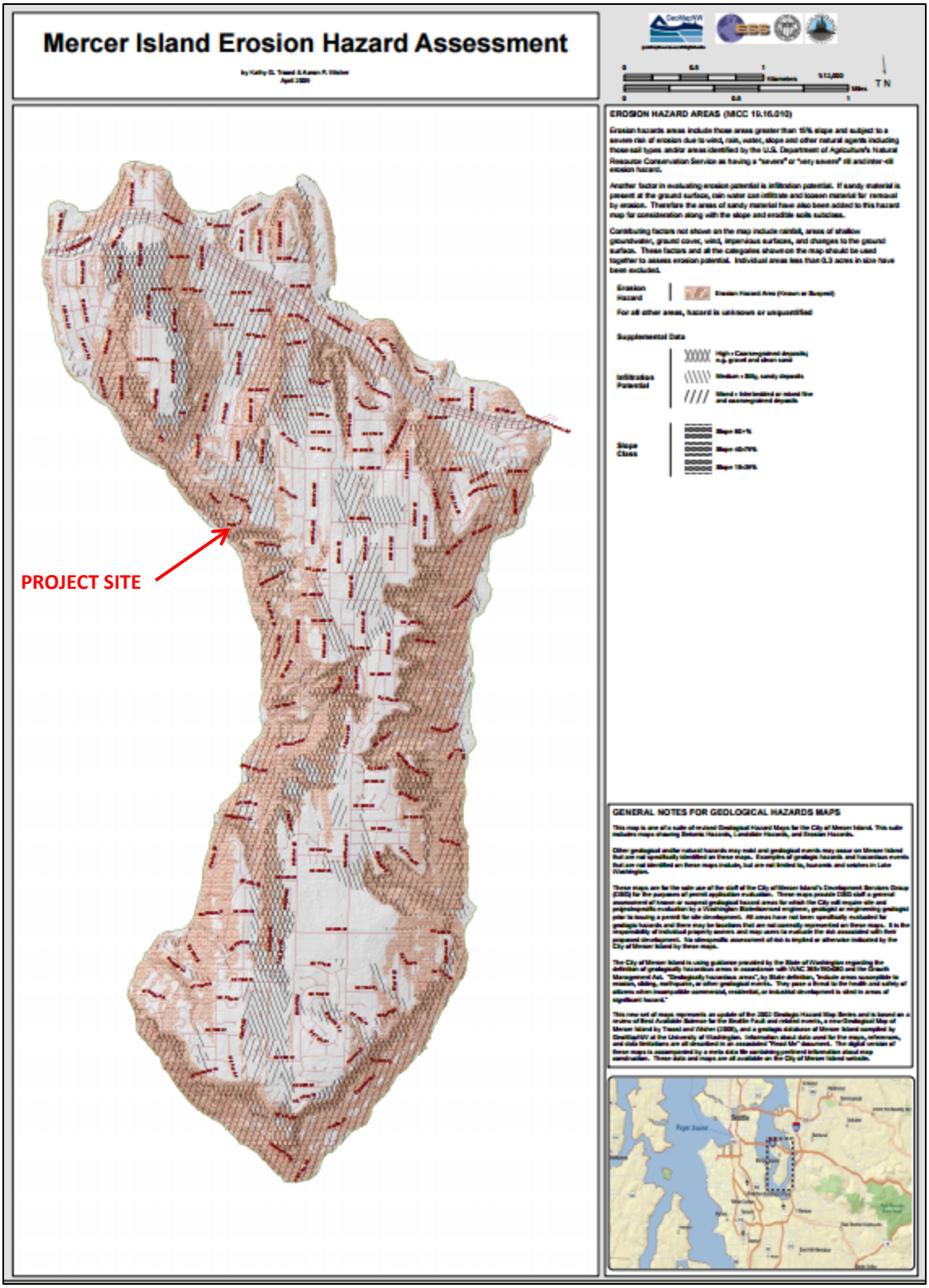

Figure III-2. Mercer Island Erosion Hazard Map.

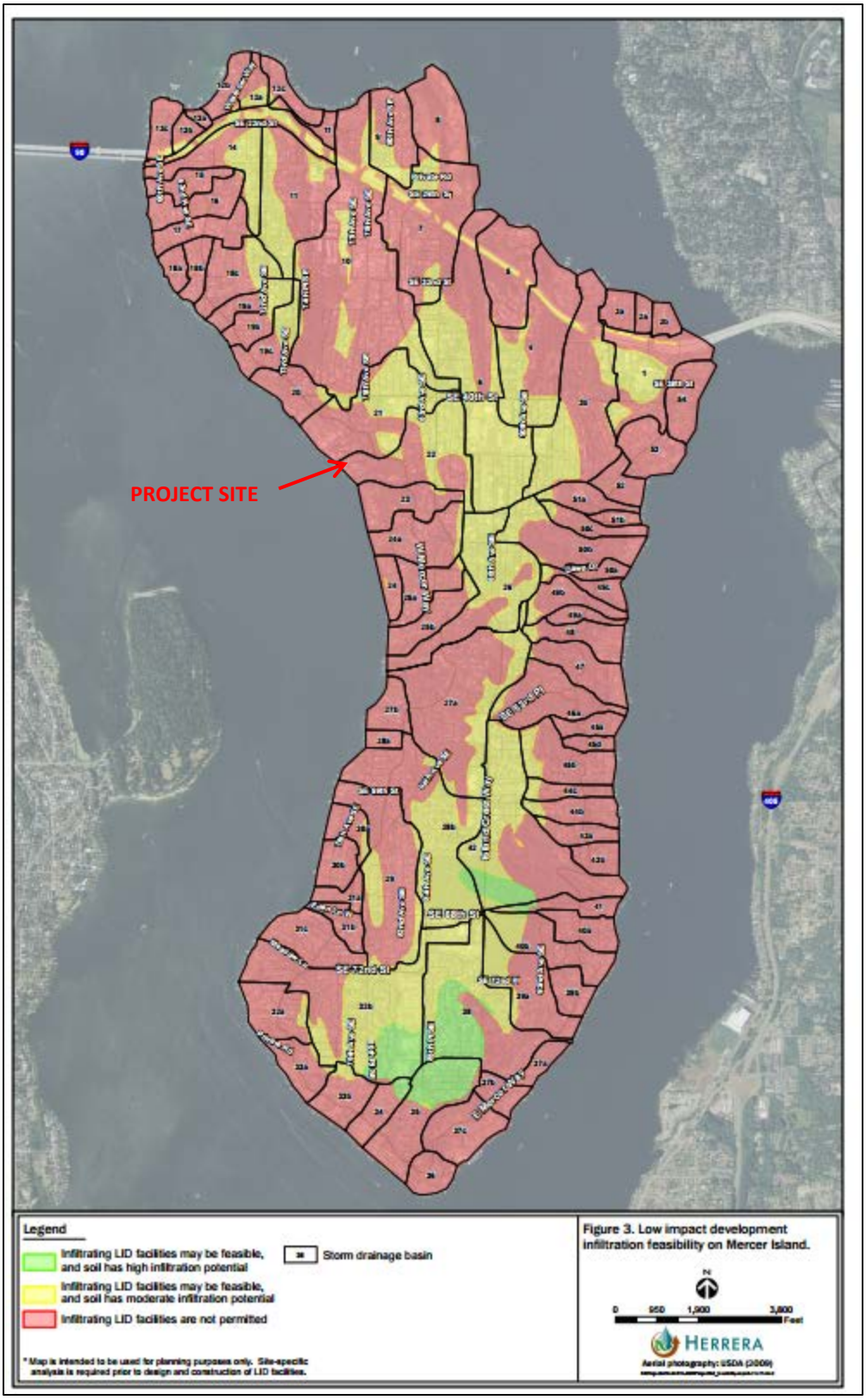

Figure III-3. Mercer Island LID Infiltration Feasibility Map.

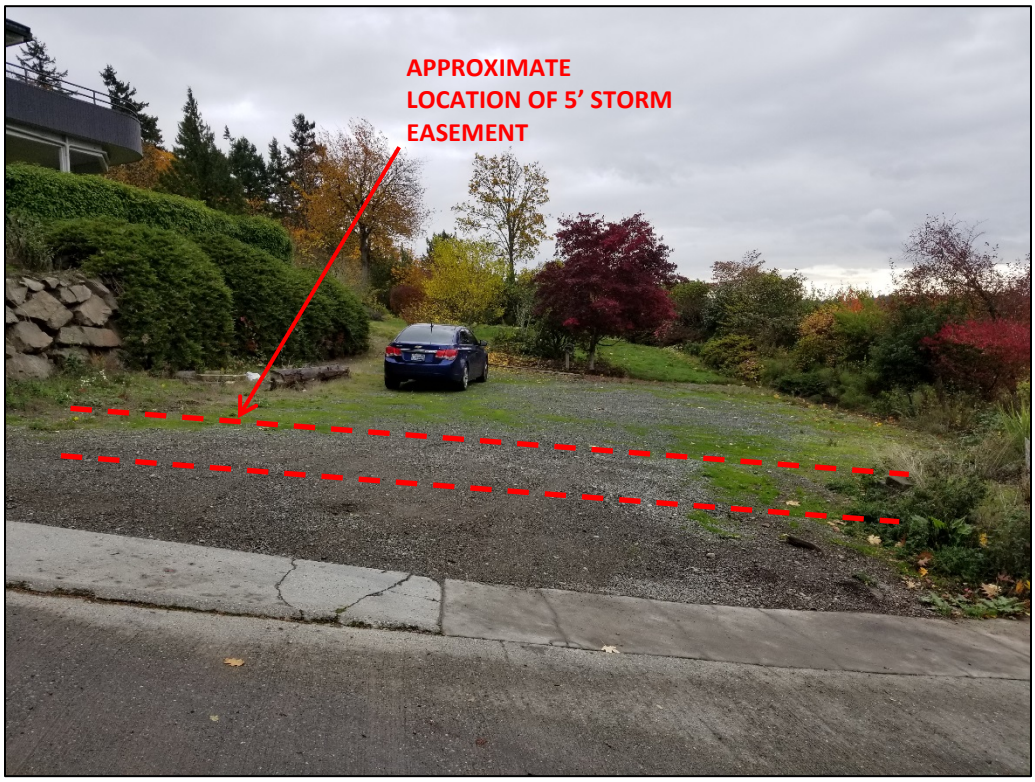

Figure III-4. View of site from Holly Lane facing south.

Figure III-5. Area drain in neighbor's driveway across street.

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Figure III-6. Typical vegetation on-site.

Figure III-7 – Trench drain near bottom of Holly Ln in front of 10 Holly Ln.

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Section IV – Stormwater Pollution Prevention Plan (SWPPP) Narrative

Section IV Summary

Narrative

The purpose of this section of the report is to provide a summary of erosion controls and source controls for the site and serves as a supplement to the erosion control plan.

The project is a new single-family residence on a 15,876 sf (0.364 ac) lot. There is an existing driveway approach and gravel parking area that will be removed and replaced with a house, driveway, and walkways.

Address: 42XX Holly Lane, Mercer Island, WA 98040
Tax Parcel Number: 738900-0020

The existing lot is mostly undeveloped and is covered with small trees and other vegetation. There is an average slope of about 12% from the SE to the NW. The site is mapped as an "Erosion Hazard Area (Known or Suspect)" by the City. Adjacent areas contain single-family residences.

ESC measures were chosen per Volume II of the 2014 Ecology Manual.

The following ESC measures are suggested for each category below:

Element 1: Mark Clearing Limits

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. The BMPs relevant to marking the clearing limits that will be applied for this project include:

High Visibility Plastic or Metal Fence (BMP C103)

Element 2: Establish Construction Access

Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads. The specific BMPs related to establishing construction access that will be used on this project include:

Stabilized Construction Entrance (BMP C105)

Element 3: Control Flow Rates

Flow controls will be used for energy dissipation. The specific BMPs related to controlling flow rates include:

Silt Fence (BMP C233)

Element 4: Install Sediment Controls

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All stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before leaving the construction site or prior to being discharged. Pollution prevention facilities on the erosion control plan must be constructed prior to or in conjunction with all clearing and grading so as to ensure that the transport of sediment to surface waters and adjacent properties is minimized. The specific BMPs to be used for controlling sediment on this project include:

Silt Fence (BMP C233)

Element 5: Stabilize Soils
Exposed and unworked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. Soils must not remain exposed and unworked for more than 7 days during the dry season (May 1 – September 30) and more than 2 days during the wet season (October 1 – April 30). The specific BMPs for soil stabilization that shall be used on this project include:

Temporary and Permanent Seeding (BMP C120)
Mulching (BMP C121)
Plastic Covering (BMP C123)
Sodding (BMP C124)
Topsoiling/Composting (BMP C125)
Dust Control (BMP C140)

Element 6: Protect Slopes
Design and construct cut-and-fill slopes in a manner to minimize erosion. Applicable practices include, but are not limited to, reducing continuous length of slope with terracing and diversions, reducing slope steepness, and roughening slope surfaces (for example, track walking). The specific BMPs to be used for protecting slopes for this project include:

BMPs from Element 5
Surface Roughening (BMP C130)

Element 7: Protect Drain Inlets
Stormwater shall not enter the conveyance system without first being filtered or treated to remove sediment. All existing storm drains and storm drain inlets made operable during construction shall have inlet protection. Inlet protection devices shall be cleaned or removed and replaced when sediment has filled one-third of the available storage (or as specified by the manufacturer). The specific BMPs to be used for protecting drain inlets are:

Storm Drain Inlet Protection (BMP C220)

Element 8: Stabilize Channels and Outlets
Not applicable. There are no known on-site conveyance channels.

Element 9: Control Pollutants
Design, install, implement and maintain effective pollution prevention measures to minimize the discharge of pollutants. The suggested BMPs are:

Concrete Handling (BMP C151)
Sawcutting and Surfacing Pollution Prevention (BMP C152)

Material Delivery, Storage and Containment (BMP C153)

Element 10: Control Dewatering
De-watering is not anticipated during construction.

Element 11: Maintain BMPs
All temporary and permanent erosion and sediment control BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.

Element 12: Manage the Project

- Phase development projects to the maximum degree practicable and take into account seasonal work limits.

- Inspection and monitoring – Inspect, maintain, and repair all BMPs as needed to assure continued performance of their intended function. Conduct site inspections and monitoring in accordance with the Construction Stormwater General Permit or local plan approval authority.

- Maintaining an updated construction SWPPP – Maintain, update, and implement the SWPPP in accordance with the Construction Stormwater General Permit.

Element 13: Protect Low Impact Development BMPs
There are no low impact development BMPs proposed for this site.

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Section V – Permanent Stormwater Control Plan Narrative

Section V Summary

PART A: Summary
PART B: Performance Standards and Goals
PART C: Low Impact Development Features
PART D: Flow Control System
PART E: Water Quality System
PART F: Conveyance System Analysis and Design

PART A: Summary

The existing lot is mostly undeveloped and is covered with a few small trees and other vegetation. There is an average slope of about 12% to the northwest. The project will add a single-family residence and will replace an existing gravel parking area on-site. Low Impact Development infiltration techniques are not feasible because the site is mapped as an "Erosion Hazard Area (Known or Suspect)" per City maps. Dispersion Low Impact Development techniques are not feasible because there is insufficient room on-site to locate dispersion devices far enough away from steep slopes around the site. In the developed condition, runoff from impervious surfaces will be conveyed to a detention pipe system with a flow control structure in order to facilitate stormwater discharge at a slower rate due to downstream capacity-constrained pipes. The flow control structure that will discharge stormwater at a slower rate during rainfall events into a new catch basin near the NW corner of the property lines. From there, runoff will be conveyed into a new catch basin in Holly Lane where an existing 4" pipe will be cut and connected into the new catch basin.

The existing site land coverage is as follows:

Pervious Areas	
Forest, Mod, C:	13,275 sf (0.305 ac)
Total:	13,275 sf (0.305 ac)
Hard Surface Areas	
Gazebo Roof:	*154 sf (0.004 ac)*
Gravel Driveway, Flat:	2,447 sf (0.056 ac)
Total:	2,601 sf (0.060 ac)

The proposed land coverage is as follows:

Pervious Areas	
Lawn, Flat, C:	9,704 sf (0.223 ac)
Total:	9,704 sf (0.223 ac)
Hard Surface Areas	
Roof:	3,254 sf (0.075 ac)
Covered Patio Roof:	490 sf (0.011 ac)
Driveway/Parking (flat):	1,320 sf (0.030 ac)
Walkways/Pool (flat):	950 sf (0.022 ac)
Grasscrete Sewer Path (flat):	581 sf (0.013 ac)
Total:	6,595 sf (0.151 ac)

PART B: Performance Standards and Goals

Low Impact Development: Not applicable for impervious surfaces. The project is in an area where LID infiltrating facilities are not allowed. All disturbed pervious areas shall meet the post-Construction Soil Quality and Depth per BMP T5.13.

Flow Control Standard: Not applicable. The site directly discharges to Lake Washington.

Water Quality Standard: Not applicable. The total of pollution-generating hard surface (PGHS) is less than 5,000 sf.

On-Site Detention Requirements: A detention pipe system has been designed per the City of Mercer Island's "On-Site Detention Design Requirements" Table 1: On-Site Detention Design for projects between 500 sf and 9,500 sf new plus replaced impervious surface area.

PART C: Low Impact Development Features

Per Minimum Requirement #5: On-Site Stormwater Management BMPs, the project must employ BMPs to "infiltrate, disperse, and retain stormwater runoff onsite to the maximum extent feasible without causing flooding or erosion impacts." No LID BMPs are proposed for proposed impervious areas because the site contains steep slopes or is within 50 ft of the tops of steep slopes and is located in an Erosion Hazard Area as determined by City maps. All disturbed pervious surfaces shall meet the post-Construction Soil Quality and Depth per BMP T5.13.

PART D: Flow Control System

Not applicable. Per the "Water Flow Control/Detention Design Requirements" handout by the City, stormwater detention (flow control) is not required if the project discharges runoff directly to Lake Washington. However, due to capacity-constrained downstream pipes, a detention pipe system with a flow control structure has been designed to facilitate the discharge of stormwater at slower rates during rainfall events.

The detention pipe system was designed using Table 1 from the City of Mercer Island's "On-Site Detention Design Requirements" (see Figure V-1 for reference). The project proposes between 6,000 and 7,000 sf of new/replaced hard surfaces. Therefore, 43 linear feet of 60" diameter detention pipe was designed for this project (see civil plans for placement, details and more).

PART E: Water Quality System

Not applicable. The total of pollution-generating hard surface (PGHS) is less than 5,000 sf.

Part F: Conveyance System Analysis and Design

New pipe systems were sized to convey the 25-year peak flow. A 6" PVC pipe will be used for roof runoff conveyance. All new impervious surfaces will be tied into the house's roof drains, which will convey runoff to the detention pipe system. Using the Rational Method, the 25-year peak runoff from the hard surfaces is 0.38 cfs (see Figure V-2). The conveyance capacity for a 6" PVC pipe with a minimum 0.5% slope is 0.40 cfs per the Manning's Equation (see Figure V-3). Therefore, 6" PVC roof drains are expected to be sufficient for the proposed impervious surfaces on-site.

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Table 1

ON-SITE DETENTION DESIGN FOR PROJECTS BETWEEN 500 SF AND 9,500 SF NEW PLUS REPLACED IMPERVIOUS SURFACE AREA

New and Replaced Impervious Surface Area (sf)	Detention Pipe Diameter (in)	Detention Pipe Length (ft)		Lowest Orifice Diameter (in)[3]		Distance from Outlet Invert to Second Orifice (ft)		Second Orifice Diameter (in)	
		B soils	C soils	B soils	C soils	B soils	C soils	B soils	C soils
500 to 1,000 sf	36"	30	22	0.5	0.5	2.2	2.0	0.5	0.8
	48"	18	11	0.5	0.5	3.3	3.2	0.9	0.8
	60"	11	7	0.5	0.5	4.2	3.4	0.5	0.6
1,001 to 2,000 sf	36"	66	43	0.5	0.5	2.2	2.3	0.9	1.4
	48"	34	23	0.5	0.5	3.2	3.3	0.9	1.2
	60"	22	14	0.5	0.5	4.3	3.6	0.9	0.9
2,001 to 3,000 sf	36"	90	66	0.5	0.5	2.2	2.4	0.9	1.9
	48"	48	36	0.5	0.5	3.1	2.8	0.9	1.5
	60"	30	20	0.5	0.5	4.2	3.7	0.9	1.1
3,001 to 4,000 sf	36"	120	78	0.5	0.5	2.4	2.2	1.4	1.6
	48"	62	42	0.5	0.5	2.8	2.9	0.8	1.3
	60"	42	26	0.5	0.5	3.8	3.9	0.9	1.3
4,001 to 5,000 sf	36"	134	91	0.5	0.5	2.8	2.2	1.7	1.5
	48"	73	49	0.5	0.5	3.6	2.9	1.6	1.5
	60"	46	31	0.5	0.5	4.6	3.5	1.6	1.3
5,001 to 6,000 sf	36"	162	109	0.5	0.5	2.7	2.2	1.8	1.6
	48"	90	59	0.5	0.5	3.5	2.9	1.7	1.5
	60"	54	37	0.5	0.5	4.6	3.6	1.6	1.4
6,001 to 7,000 sf	36"	192	128	0.5	0.5	2.7	2.2	1.9	1.8
	48"	102	68	0.5	0.5	3.7	2.9	1.9	1.6
	60"	64	43	0.5	0.5	4.6	3.6	1.8	1.5
7,001 to 8,000 sf	36"	216	146	0.5	0.5	2.8	2.2	2.0	1.9
	48"	119	79	0.5	0.5	3.8	2.9	2.2	1.7
	60"	73	49	0.5	0.5	4.5	3.6	2.0	1.6
8,001 to 8,500 sf[1]	36"	228	155	0.5	0.5	2.8	2.2	2.1	1.9
	48"	124	84	0.5	0.5	3.7	2.9	1.9	1.8
	60"	77	53	0.5	0.5	4.6	3.6	2.0	1.6
8,501 to 9,000 sf	36"	NA[1]	164	0.5	0.5	NA[1]	2.2	NA[1]	1.9
	48"	NA[1]	89	0.5	0.5	NA[1]	2.9	NA[1]	1.9
	60"	NA[1]	55	0.5	0.5	NA[1]	3.6	NA[1]	1.7
9,001 to 9,500 sf[2]	36"	NA[1]	174	0.5	0.5	NA[1]	2.2	NA[1]	2.1
	48"	NA[1]	94	0.5	0.5	NA[1]	2.9	NA[1]	2.0
	60"	NA[1]	58	0.5	0.5	NA[1]	3.7	NA[1]	1.7

Notes:

- Minimum Requirement #7 (Flow Control) is required when the 100-year flow frequency causes a 0.15 cubic feet per second increase (when modeled in WWHM with a 15-minute timestep). Breakpoints shown in this table are based on a flat slope (0-5%). The 100-year flow frequency will need to be evaluated on a site-specific basis for projects on moderate (5-15%) or steep (> 15%) slopes.
- Soil type to be determined by geotechnical analysis or soil map.
- Sizing includes a Volume Correction Factor of 120%.
- Upper bound contributing area used for sizing.

[1] On Type B soils, new plus replaced impervious surface areas exceeding 8,500 sf trigger Minimum Requirement #7 (Flow Control)

[2] On Type C soils, new plus replaced impervious surface areas exceeding 9,500 sf trigger Minimum Requirement #7 (Flow Control)

[3] Minimum orifice diameter = 0.5 inches

in = inch

ft = feet

sf = square feet

Basis of Sizing Assumptions:

Sized per MR#5 in the Stormwater Management Manual for Puget Sound Basin (1992 Ecology Manual)

SBUH, Type 1A, 24-hour hydrograph

2-year, 24-hour storm = 2 in; 10-year, 24-hour storm = 3 in; 100-year, 24-hour storm = 4 in

Predeveloped = second growth forest (CN = 72 for Type B soils, CN = 81 for Type C soils)

Developed = impervious (CN = 98)

0.5 foot of sediment storage in detention pipe

Overland slope = 5%

Last updated 1-26-18

2

Figure V-1. On-site detention design sizing table from City of Mercer Island's On-Site Detention Design Requirements.

Rational Method - Developed Conditions
for: Perla Residence Conveyance Capacity

$Q = C_{avg}iA$

Tc = 6.30 (assumed, since all pipe flow)

	Area (ac)	C
Dense Forest		0.10
Light Forest		0.15
Pasture		0.20
Lawns		0.25
Gravel		0.80
Pavement & Roofs	0.151	0.90
Open Water		1.00
Other		0.00

C_{avg} = 0.90

Total Area (A) = 0.151 acres

i = (Pr)(ir) Pr= total precipitation at the project site for 24-hr duration storm
ir= unit peak rainfall intensity factor
ir= (ar)(Tc)^(-br) ar, br= coefficients from Table 3.2.1.B of KCSWDM

$(ir)_2$=	0.54	i_2=	1.0866	Q_2=	0.15
$(ir)_{10}$=	0.75	i_{10}=	2.25389	Q_{10}=	0.31
$(ir)_{25}$=	0.80	i_{25}=	2.81435	Q_{25}=	**0.38**
$(ir)_{100}$=	0.82	i_{100}=	3.27428	Q_{100}=	0.44

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020	Rational Method Developed Conditions Perla Residence	By TAF Chkd Scale N.T.S. Job No. 18340.20	Date 1/25/2019 Date Sheet No.

Figure V-2. 25-year peak flow Rational Method calculations.

Manning's Equation - Developed Conditions
for: Perla Residence Conveyance

$$Q = \frac{1.49}{n} * A * R^{\frac{2}{3}} * S^{\frac{1}{2}}$$

n_{PVC}= 0.013

Conveyance Capacity					
Pipe Size	**4-inch**	**6-inch**	**8-inch**	**10-inch**	**12-inch**
Slope (ft/ft)					
0.005	0.13	0.40	0.87	1.55	2.52
0.010	0.19	0.56	1.23	2.20	3.57
0.015	0.23	0.69	1.50	2.69	4.37
0.020	0.27	0.79	1.74	3.11	5.05
0.025	0.30	0.89	1.94	3.47	5.65
0.030	0.33	0.97	2.13	3.81	6.18
0.035	0.36	1.05	2.30	4.11	6.68
0.040	0.38	1.12	2.46	4.39	7.14
0.045	0.40	1.19	2.60	4.66	7.57
0.050	0.43	1.26	2.75	4.91	7.98
0.055	0.45	1.32	2.88	5.15	8.37
0.060	0.47	1.38	3.01	5.38	8.75
0.065	0.49	1.43	3.13	5.60	9.10
0.070	0.50	1.49	3.25	5.81	9.45
0.075	0.52	1.54	3.36	6.02	9.78
0.080	0.54	1.59	3.47	6.21	10.10
0.085	0.56	1.64	3.58	6.40	10.41
0.090	0.57	1.68	3.68	6.59	10.71
0.095	0.59	1.73	3.78	6.77	11.01
0.150	0.74	2.18	4.76	8.51	13.83

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020	Manning's Equation		By TAF	Date 1/25/2019
	Developed Conditions		Chkd	Date
			Scale N.T.S.	Sheet No.
	Perla Residence		Job No. 18340.20	

Figure V-3. Conveyance capacity table using Manning's Equation.

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Section VI – Special Reports and Studies

Section VI Summary

Narrative

The following reports are provided in this section:

1. Geotechnical Plan Review dated September 21, 2018 by Robert M. Pride, LLC.
2. Geotechnical Recommendations dated July 20, 2016 by Robert M. Pride, LLC.
3. Soil Resource Report dated November 9, 2018 by NRCS Web Soil Survey.

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www.cgengineering.com

September 21, 2018

Mr. Joe Bergevin
J D Bergevin Homes
P. O. Box 648
Woodinville, WA 98072

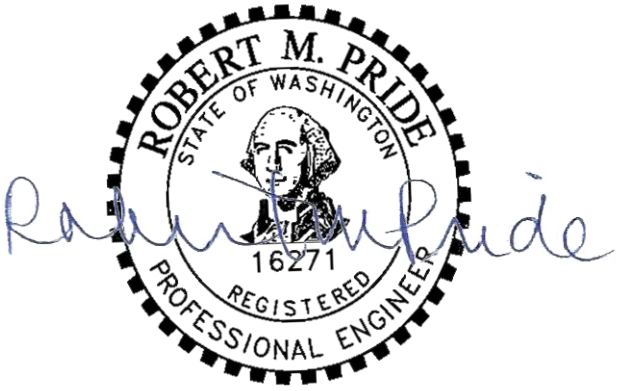
Re: **Geotechnical Plan Review**
Proposed Residence Addition
4211 Holly Lane
Mercer Island, Washington

Dear Mr. Bergevin,

This report confirms that I have reviewed the final site plan SD 1.0 showing the proposed additions on the north and east sides of the house located on Holly Lane. There will be a car parking area on the north side that will be supported by a new retaining wall and structural fill. Existing dense glacial till soils will provide excellent support for the existing residence foundations including the proposed retaining wall footings.

On the basis of my final plan review they are acceptable from a geotechnical point of view. Appropriate field inspections will be made during construction, and field memos will be prepared for submittal to the city of Mercer Island. P:lease call me if there are any questions.

Respectfully,



Robert M. Pride, P. E.
Principal Geotechnical Engineer

dist: (1) Addressee
rmp: WileyResid3

July 20, 2016

Mr. Joe Bergevin
J D Bergevin Homes
P. O. Box 648
Woodinville, WA 98072

Re: **Geotechnical Recommendations**
Proposed Residence
4211 Holly Lane
Mercer Island, Washington

Dear Mr. Bergevin,

This report summarizes the results of our site investigation and geologic assessment of the subsoil conditions on this proposed residential property located on the southeasterly side of Holly Lane in Mercer Island. It is understood that a new residences will be built on this site that is currently unoccupied.

The purpose of this report is to describe the subsoil conditions onsite, and to provide recommendations for design and construction of this project. References include geologic mapping for this area of Mercer Island and previous geotechnical studies performed in this area.

Site Conditions

This property has a gentle slope from east to west with a gradient ranging from 4H:1V to 5H:1V, but there is a steep slope extending down from the west side to an existing property at the bottom of this steep slope area.

Glacial dialict deposits (Qpogd) are mapped under this area and they are suitable for support for the proposed residence foundations. Two test borings were drilled on this property to document subsoil and groundwater conditions. Below the shallow topsoils were medium dense silty and gravelly sands that will provide excellent support for the new structure. Below a depth of ten feet were dense silty sands with gravel that extended down to the bottom of the borings at 31 feet. Groundwater was encountered in these borings at a depth of ten feet below existing grades. Summary logs of these test borings are attached, and their locations are shown on Drawing No. 1.

Geotechnical Recommendations

Based on our geotechnical site investigation and our assessment of the subsoil conditions the proposed new structure foundations will extend down to the medium dense to dense glacial soils that will be encountered at the proposed building pad grade. An allowable soil bearing value of 3000 psf may be used in the design of these new foundations, with a passive earth pressure of 300 pcf and a friction value of 0.45.

Retaining walls for the upper side of the residence should be designed for an active pressure of 30 pcf and a passive pressure of 300 pcf. All perimeter foundations should have perforated subdrain pipes installed to collect minor surface water infiltration down to the footing levels. Impervious surfaces including the roof and driveway areas will need storm water discharge to a catch basin prior to offsite discharge into the city storm drain system.

Temporary excavations may be made at a 1H:1V slope for the upper two feet, and then at 1H:2V below to the proposed building pad grade. No temporary shoring will be required as long as the building pad is at least five feet from the easterly property line.

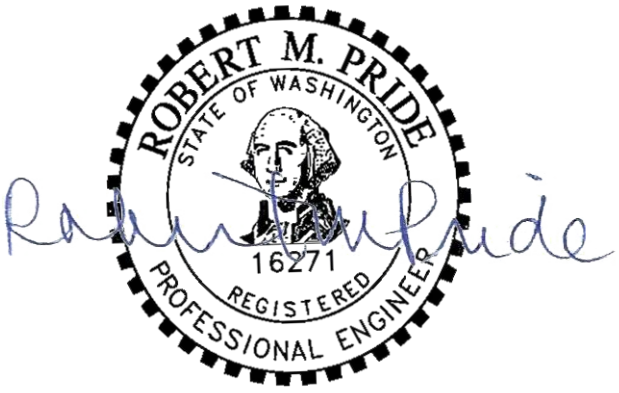
On the basis of my site evaluation and engineering assessment there is no potential for instability to the existing steep slope that is stable and not subject to landslide movement. It is recommended that the new structure be setback a minimum of 20 feet from the top of the existing steep slope, and that construction equipment be restricted within ten feet of this slope. Silt fencing for erosion control and equipment setback distance should be placed at the ten foot setback from the top of the slope.

Summary

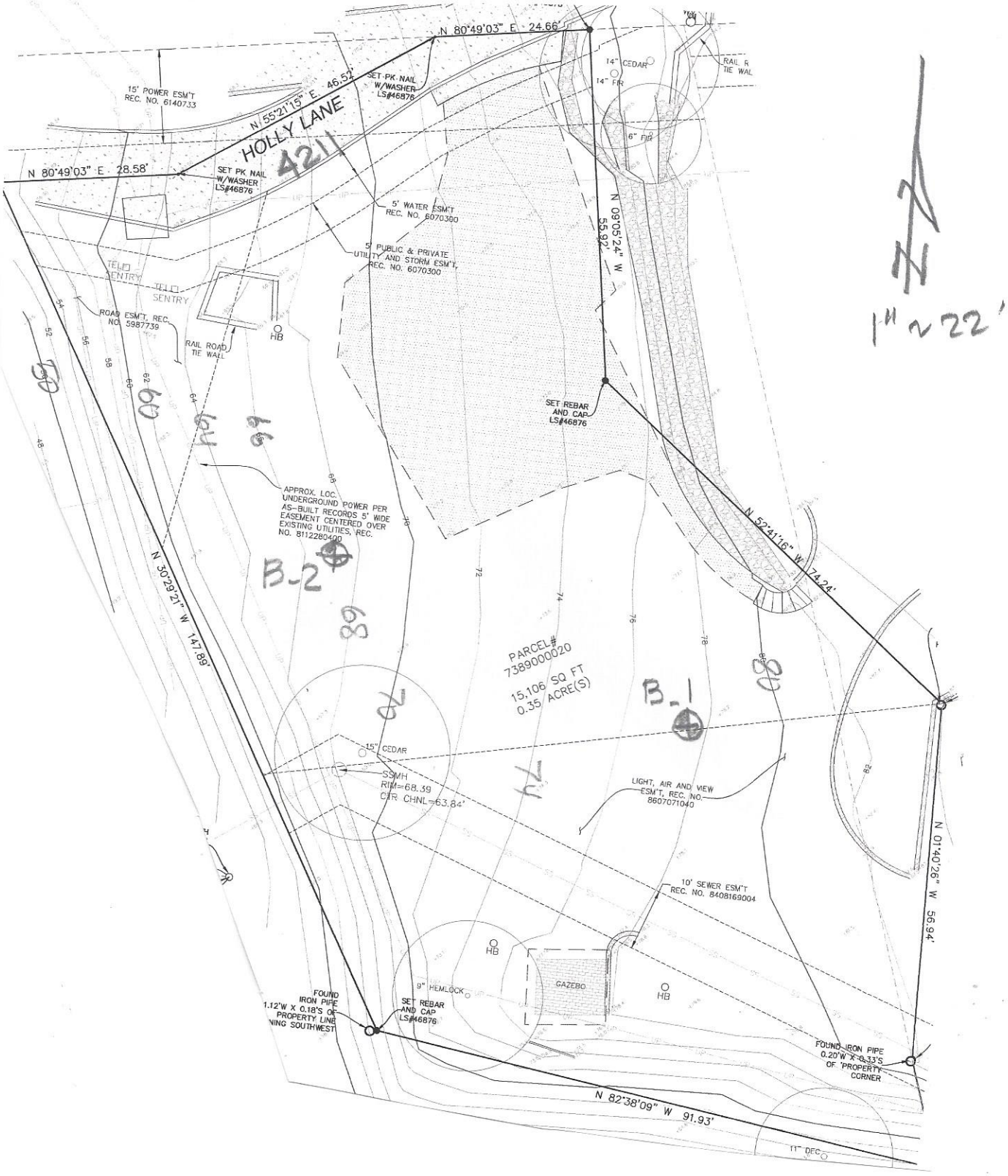
We will review those portions of the plans and specifications that pertain to the new foundations to determine that they are consistent with the recommendations of this report. Construction monitoring and consultation services should also be provided to confirm that the new foundations are satisfactory.

Our findings and recommendations of this report were prepared in accordance with generally accepted principles of geotechnical engineering as practiced in the Puget Sound area at the time this report was submitted. We make no warranty, either express or implied. If there are any questions please call.

Respectfully,



Robert M. Pride, P. E.
Principal Geotechnical Engineer
dist: (1) Addressee
encl: Drawing No. 1
rmp: WileyResid1



SITE PLAN

Proposed Wiley Residence
4211 Holly Lane
Mercer Island, Washington

Drawing No. **1**

Robert M. Pride, LLC

Consulting Geotechnical Engineer

South Fork Geosciences, PLLC
PO Box 1275, North Bend, WA 98045
andrew@sfgeo.com

LOG OF BORING B-2

Robert M. Pride, LLC
Wiley Property
4211 Holly Ln, Mercer Island, WA
SFG Project #16080

Date Started	: 7-18-2016	Drilling Co.	: Geologic Drill
Date Completed	: 7-18-2016	Driller Name	: Aren Hansen
Hole Diameter	: 6" OD, 2 1/2" ID	Start Time	: 1110
Drilling Method	: H.S.A. Mini Track	End Time	: 1245
Sampling Method	: Split Spoon	Logged By	: Andrew Glandon, LEG

Depth in Feet	Sample	USCS	Formation	Water Level	DESCRIPTION	Blow Count	Blow Count Graph (0 20 40 60 80)	REMARKS
0		ML	Landslide Deposits		Cuttings - moist, light brown SILT with fine to medium sand and gravel			Full recovery unless noted otherwise
5	1	SW			wet, gray to light brown silty fine to coarse SAND with gravel	19		
10	2	SW		▼	moist to wet, light brown silty fine to coarse SAND with gravel	42		Groundwater at apx 9.5-10ft bgs
15	3	SW	Glacial Diamict (Qpogd)		saturated, light brown fine to coarse SAND	61		
		ML			moist, gray SILT with fine sand, trace gravel, some orange-brown oxidation			
20	4	ML			moist, gray SILT with fine sand	31		
25	5	SW-SM	Pre-Olympia Coarse		moist to wet, gray fine to coarse SAND with gravel and silt	87		SPT = 18-37-50 for 5.5"
30	6	SW			moist, black-gray fine to coarse SAND with fine gravel	50		SPT = 32-50 for 4"
35					Total Depth = 30.8333 feet bgs (30' 10") Boring Backfilled with 2 bags of bentonite chips			

South Fork Geosciences, PLLC
PO Box 1275, North Bend, WA 98045
andrew@sfgeo.com

LOG OF BORING B-1

Robert M. Pride, LLC
Wiley Property
4211 Holly Ln, Mercer Island, WA
SFG Project #16080

Date Started	: 7-18-2016	Drilling Co.	: Geologic Drill
Date Completed	: 7-18-2016	Driller Name	: Aren Hansen
Hole Diameter	: 6" OD, 2 1/2" ID	Start Time	: 0915
Drilling Method	: H.S.A. Mini Track	End Time	: 1050
Sampling Method	: Split Spoon	Logged By	: Andrew Glandon, LEG

Depth in Feet	Sample	USCS	GRAPHIC	Formation	Water Level	DESCRIPTION	Blow Count	Blow Count Graph (0 20 40 60 80)	REMARKS
0		ML		Landslide Depsosits		Cuttings - moist, light brown SILT with fine to medium sand and gravel			Full recovery unless noted otherwise
5	1	SW				moist, light brown fine to coarse SAND, some orange brown oxidation	24		
10	2	SW			▼	saturated, light brown to light brown-gray fine to coarse SAND with gravel	27		Groundwater at apx 9.5-10ft bgs
		SP		Glacial Diamict (Qpogd)					
15	3	SP				saturated, gray fine to medium SAND, trace silt	36		Drilling mud added at 15ft to reduce heave
20	4	SP				saturated, gray silty fine SAND	79		SPT = 13-29-50 for 6"
		SP-SM				saturated, gray fine to medium SAND with silt			
25	5	SM				saturated, dark gray silty fine to medium SAND, trace gravel	50		SPT = 50 for 6"
30	6	ML				moist, dark gray SILT with fine to medium sand, trace gravel	86		SPT = 25-36-50 for 4.5"
35						Total Depth = 31.375 ft bgs (31' 4.5") Boring Backfilled with 2 bags of bentonite chips			

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for King County Area, Washington

Perla Residence

November 9, 2018

Map Scale: 1:278 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 4 8 16 24

Feet
0 10 20 40 60

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 14, Sep 10, 2018

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

Date(s) aerial images were photographed: Aug 31, 2013—Oct 6, 2013

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
KpB	Kitsap silt loam, 2 to 8 percent slopes	0.2	89.1%
KpD	Kitsap silt loam, 15 to 30 percent slopes	0.0	10.9%
Totals for Area of Interest		**0.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

King County Area, Washington

KpB—Kitsap silt loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 1hmt9
Elevation: 0 to 590 feet
Mean annual precipitation: 37 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 160 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Kitsap and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kitsap

Setting

Landform: Terraces
Parent material: Lacustrine deposits with a minor amount of volcanic ash

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 24 inches: silt loam
H3 - 24 to 60 inches: stratified silt to silty clay loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Forage suitability group: Soils with Few Limitations (G002XN502WA)
Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 10 percent
Hydric soil rating: No

Bellingham

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Seattle

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Tukwila

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

KpD—Kitsap silt loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 1hmtc
Elevation: 0 to 590 feet
Mean annual precipitation: 37 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Kitsap and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kitsap

Setting

Landform: Terraces
Parent material: Lacustrine deposits with a minor amount of volcanic ash

Typical profile

H1 - 0 to 5 inches: silt loam
H2 - 5 to 40 inches: silt loam
H3 - 40 to 60 inches: stratified silt to silty clay loam

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C

Forage suitability group: Sloping to Steep Soils (G002XN702WA)
Hydric soil rating: No

Minor Components

Bellingham
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Seattle
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Tukwila
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Section VII – Declaration of Covenant and Operation and Maintenance Manual

Section VIII Summary

Narrative

A Declaration of Covenant is provided for the on-site detention system proposed.

The Operation and Maintenance Manual is a standalone document that will be given to the owner(s) following the construction of the project.

The maintenance manual contained herein is for the Perla Residence building project. The contractor will be responsible for the maintenance and operation of all stormwater structures and BMPs requiring maintenance during construction and, after construction, responsibility will pass to the home owner(s). The project contractor will be responsible for passing along the information in this maintenance manual to the owner(s). Upon request by the City, it shall be made available for their inspection. It is generally expected that few to none of these defects will be present upon the yearly inspection of each facility.

250 4th Avenue South, Suite 200
Edmonds, WA 98020
ph. 425.778.8500 | f. 425.778.5536
www.cgengineering.com

AFTER RECORDING, MAIL TO:

City of Mercer Island
Attn: Patrick Yamashita, City Engineer
9611 SE 36th Street
Mercer Island, WA 98040

DECLARATION OF COVENANT FOR INSPECTION AND MAINTENANCE OF PRIVATE STORMWATER FACILITIES

Grantor(s): Michael & Cara Perla

Grantee: City of Mercer Island, a Washington municipal corporation

Property Legal Description (abbreviated): Lots 2 & 3 of the SW 1/4 of the NE 1/4, Section 13, Township 24N, Range 4E, W.M.

Full Legal Description: See Exhibit A.

Assessor's Property Tax Parcel Account Number(s): 738900-0020

WHEREAS, the undersigned Grantors ("Owner(s)") will install stormwater facilities ("Facilities") to comply with Mercer Island Municipal Code 15.09.050 known as "Standards for new development and redevelopment". Facilities include:

- ☐ Rain garden/bioretention
- ☐ Infiltration
- ☐ Permeable pavement
- ☒ Flow control detention pipe/vault
- ☐ Treatment vault
- ☐ Other _____

WHEREAS, the undersigned Owner(s) in consideration of the approved City of Mercer Island ("City") (check one of the following):

- ☐ building permit,
- ☐ stormwater permit,
- ☒ site development permit,
- ☐ subdivision, or
- ☐ short subdivision
- ☐ other _____

under permit no. _____ agrees to the following covenant for inspection and maintenance of private stormwater facilities pursuant to Mercer Island Municipal Code 15.09.070 "maintenance and inspection requirements" relating to the real property legally described in Exhibit A incorporated herein ("Property") and located at 42XX Holly Lane Mercer Island, Washington:

1. Owner(s) shall retain, uphold, and protect the Facilities as shown or described on Exhibit B.
2. The Owner(s) shall, at their own cost, operate, inspect, maintain, and keep in good repair, the Facilities and may not change or alter them without written approval from the City Engineer or through future development permit from the City. All costs of maintenance, inspection, and repair shall be the sole responsibility of the Owner(s).
3. Inspection and maintenance shall be performed in compliance with the most recent version of the Stormwater Management Manual for Western Washington prepared by the Washington State Dept. of Ecology or other standard determined by the City Engineer.
4. The Owner(s) warrants that he/she/they are the owners of the property described on Exhibit A and have the authority to impose this covenant on the property and bind all future owners, successors, and assigns of the Owner(s).
5. The Owner(s) shall inspect the Facilities annually for physical defect by December 31. Records of Facility inspections and maintenance actions shall be retained for a period of at least five years. These records are to be provided to the City upon request.
6. The City is hereby granted by the Owner(s) the right, but not the obligation, to enter upon the property described on Exhibit A at all reasonable times for the purpose of inspecting the private Facilities. If, as the result of any such inspection the City determines that the Facilities are in disrepair, requires maintenance or repair, or is otherwise not functioning as provided as provided in Exhibit B, the Public Works Director shall have the right, but not the obligation, to order the Owner(s) to maintain or repair the same.
7. Where lack of maintenance is causing or contributing to a violation of water quality criteria, property damage or threatens the welfare or safety of the public, actions shall be taken to correct the problem as soon as reasonably feasible.
8. If the City determines that the Facilities require inspection, maintenance or repair, the City shall provide notice to the Owner(s) of the deadline within which such inspection, maintenance or repair must be completed. Said notice may further advise that, should the violator fail to perform, work within the established deadline, the work may be done by the City or a contractor designated by the Public Works Director and the expense thereof shall be charged to the Owner(s). The City's officers, agents, employees, and contractors shall have the right, which is hereby granted by the Owner(s), to enter upon the property described on Exhibit A in order to perform such work. The Owner(s) shall bear the cost of all work performed.
9. The Owner(s) shall indemnify, defend and hold harmless the City, its officers, officials, employees and agents from any and all claims, demands, suits, penalties, losses, damages, judgments, attorneys fees and/or costs of any kind whatsoever, arising out of or in any way resulting from the approval of the Facilities, and installation and presence of the Facilities, and the acts or omissions of the Owner(s), their officers, employees, contractors, and agents relating to the construction, operation and maintenance of the Facilities on the property, except for the City's intentional and willful tortious acts, and waive and release the City from any and all claims for damages and injunctive relief which the Owner(s) may themselves have now or in the future, by reason of the construction, maintenance and operation of said Facilities.
10. This Covenant is intended to promote the efficient and effective management of surface water drainage on the Property, and it shall inure to the benefit of the City and its successors and assigns. This Covenant shall run with the land and be binding upon the Owner(s), successors and assigns.
11. This Covenant may be terminated by execution of a written agreement by the Owner(s) and the City that is recorded by King County.

IN WITNESS WHEREOF, this Declaration of Covenant for Inspection and Maintenance of Private Stormwater Facilities is executed this ____ day of _____, 20___.

_____
(name of corporation, partnership, etc. if applicable)

_____
OWNER *(signature)*

Name: _____
(please print)

_____
OWNER *(signature)*

Name: _____
(please print)

(If married, both spouses must sign, and both signatures must be notarized.)

STATE OF WASHINGTON)
) ss [INDIVIDUAL ACKNOWLEDGMENT]
COUNTY OF KING)

I certify that I know or have satisfactory evidence that _____
_____
(is/are) the person(s) who appeared before me and said person(s) acknowledged that (he/she/they) signed this instrument and acknowledged it to be (his/her/their) free and voluntary act for the uses and purposes therein mentioned in the instrument.

Dated this _____ day of _____, 20___.

_____
Notary Name: _____
NOTARY PUBLIC in and for the State of Washington. My appointment expires: _____

STATE OF WASHINGTON)
) ss [INDIVIDUAL ACKNOWLEDGMENT]
COUNTY OF KING)

I certify that I know or have satisfactory evidence that _____
_____

(is/are) the person(s) who appeared before me and said person(s) acknowledged that (he/she/they) signed this instrument and acknowledged it to be (his/her/their) free and voluntary act for the uses and purposes therein mentioned in the instrument.

Dated this _____ day of _____, 20___.

_____
Notary Name: _____
NOTARY PUBLIC in and for the State of Washington. My appointment expires: _____

STATE OF WASHINGTON)
) ss [REPRESENTATIVE ACKNOWLEDGMENT]
COUNTY OF KING)

I certify that I know or have satisfactory evidence that _____
_____
(is/are) the person(s) who appeared before me and said person(s) acknowledged that (he/she/they) signed this instrument, on oath stated that (he/she/they) (was/were) authorized to execute the instrument and acknowledged it as the _____ _____ of _____ to be the free and voluntary act of such party for the uses and purposes therein mentioned in the instrument.

Dated this _____ day of _____, 20___.

_____
Notary Name: _____
NOTARY PUBLIC in and for the State of Washington. My appointment expires: _____

EXHIBIT A

Legal Description of the Property

(PER CHICAGO TITLE INSURANCE COMPANY'S "GUARANTEE" NO.0122668-ETU)

PARCEL B OF MERCER ISLAND LOT LINE REVISION NO. SUB-16-013, AS RECORDED UNDER RECORDING NO. 20170510900005, RECORDS OF KING COUNTY AUDITOR;

SITUATE IN THE CITY OF MERCER ISLAND, COUNTY OF KING, STATE OF WASHINGTON.

EXHIBIT B

Description and Graphic Depiction of Drainage Facilities

- Runoff from impervious surfaces on-site will be tied into the proposed house's roof drains which will be connected directly into the proposed detention pipe.

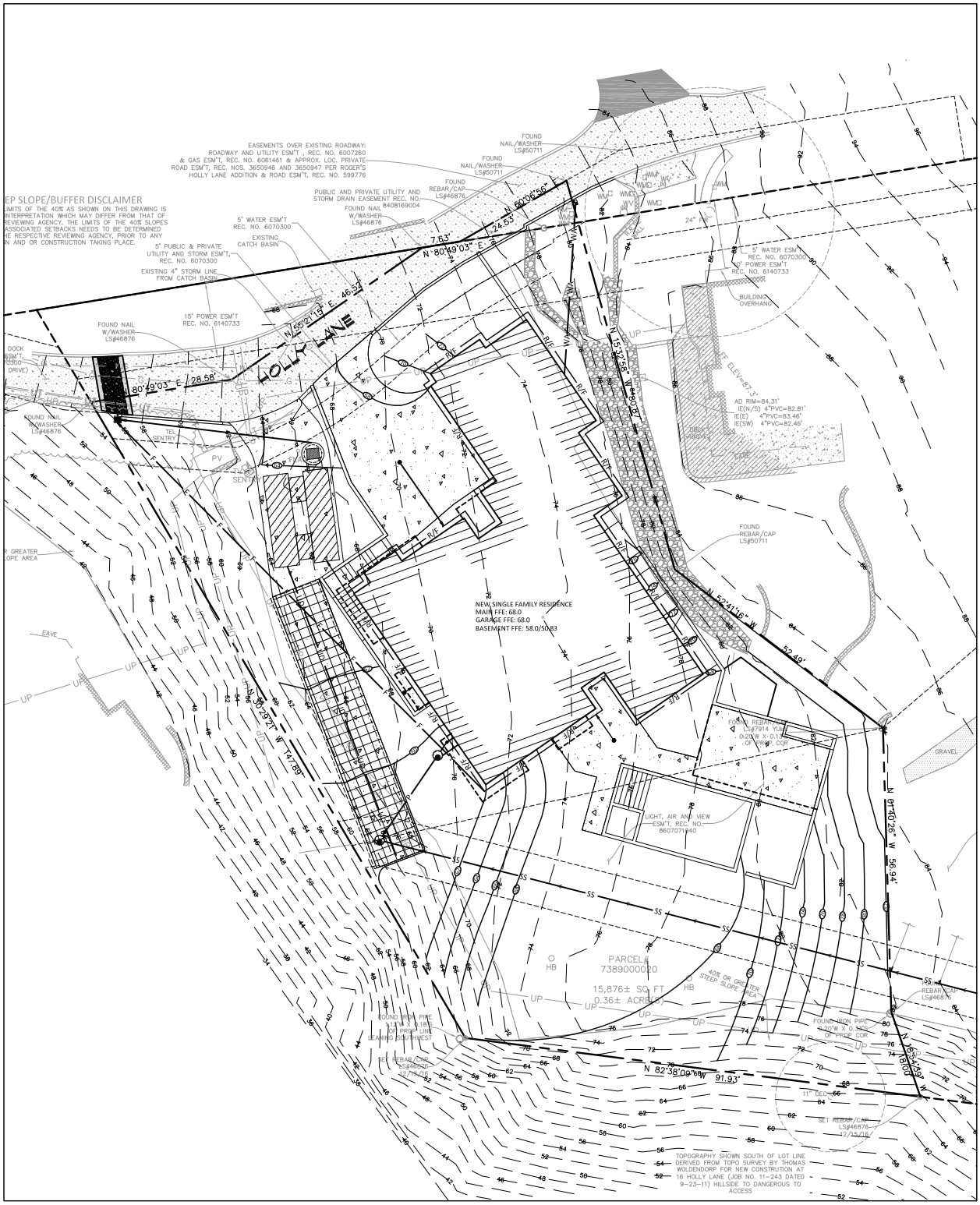
- A grasscrete sewer path will have an underdrain that will connect directly to the proposed detention pipe.

- Other runoff will sheet flow into the flow control structure through an open vaned grate lid in the lower maintenance driveway.

- The proposed house's footing drains will discharge into a proposed catch basin within the property downstream of the flow control structure where it will then be conveyed into a proposed catch basin in Holly Lane over an existing 4" storm pipe.

EXHIBIT B (cont'd)

Description and Graphic Depiction of Drainage Facilities



Perla Residence
42XX Holly Lane
Mercer Island, WA 98040

OPERATION AND MAINTENANCE MANUAL

February 2019

ENGINEERING
250 4th Avenue South, Suite 200
Edmonds, WA 98020
ph. 425.778.8500 | f. 425.778.5536
www.cgengineering.com

Description:
The proposed storm system consists of area drains that capture on site runoff and route it through conveyance pipes its outlet at Lake Washington. Included in this Operation and Maintenance Manual is an 11" x 17" grading and drainage plan sheet showing the location of these facilities. Please note that this map is generated during the design phase and may not reflect all changes made in permitting and construction. CG Engineering may be contacted for an updated copy of this map once the as-built drawings are completed for the site.

Included in this manual are facility-specific sheets indicating the various maintenance components of each facility:

Catch Basins (similar to area drains): Concrete structures with steel grates that collect stormwater runoff from the site and act as junctions for storm conveyance pipes. See "No. 5" for maintenance.

Control Structures: Control structures are catch basins or manholes with a restrictor device for controlling outflow from a facility to meet the desired performance. See "No. 4" for maintenance.

Closed Detention Systems (Detention Pipes/Tanks): Underground storage facilities typically constructed with large diameter corrugated metal or plastic pipe. See "No. 3" for maintenance.

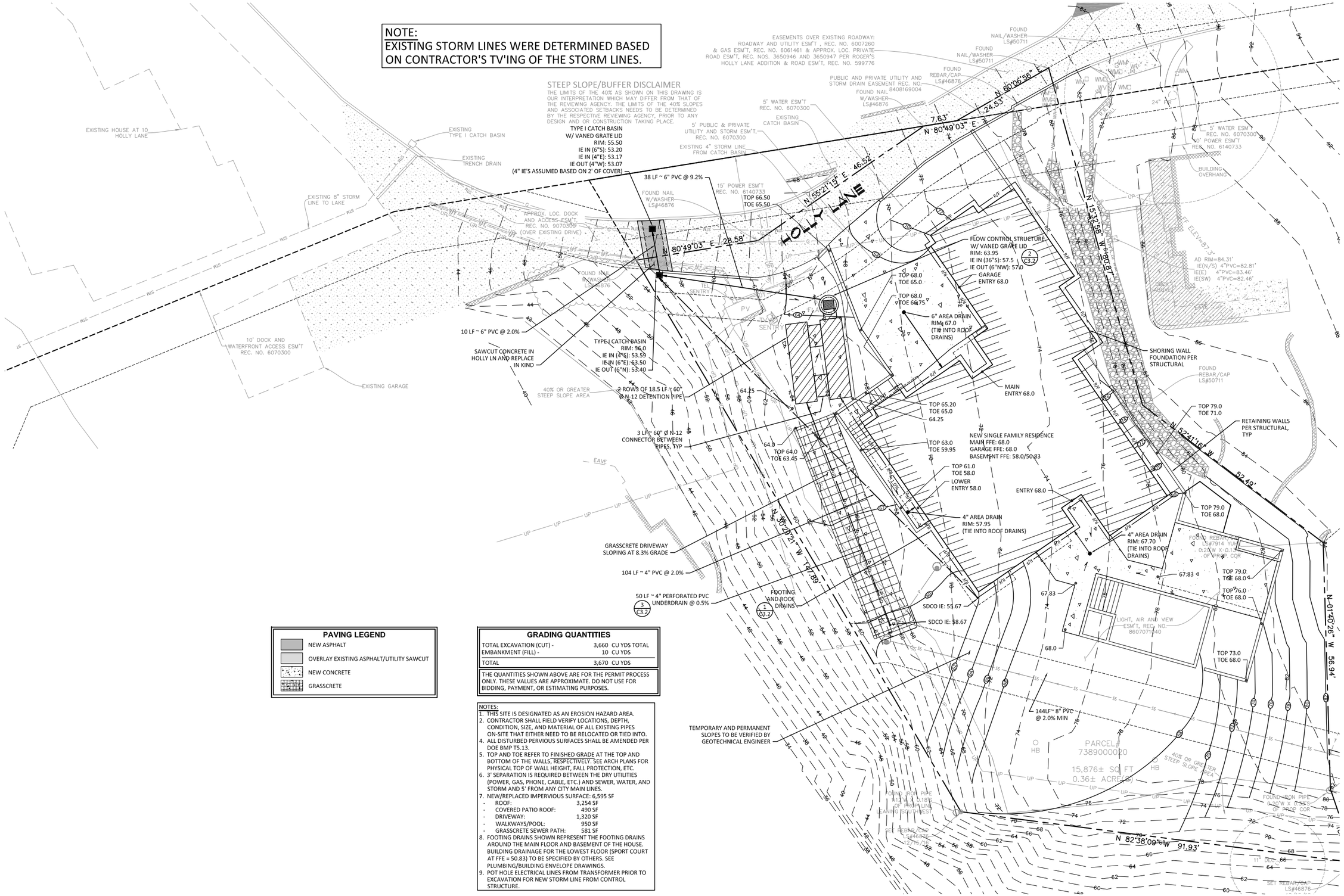
Permeable Pavement: Pervious concrete, porous asphalt, permeable pavers or other forms of pervious or porous paving material intended to allow passage of water through the pavement section. See "Open-celled paving grid with grass" in "No. 22" for maintenance (used for grasscrete).

Facilities shall be inspected yearly at a minimum for defects listed in the following facility sheets. Most maintenance tasks are generally reactionary to a defect being found, rather than a matter of constant upkeep. It is generally expected that few to none of these defects will be present upon the yearly inspection of each facility. The facility sheets list the potential conditions warranting maintenance and the expected result following any maintenance. Several engineer's notes for specific tasks are provided within the facility sheets. **Unless otherwise noted on the facility sheets the maintenance tasks should be performed on an "as needed" basis: (a) when the described defect is visible to whomever performs the yearly inspection, or (b) should any defect become apparent between inspections.**

250 4th Avenue South, Suite 200
Edmonds, WA 98020
ph. 425.778.8500 | f. 425.778.5536
www.cgengineering.com

SW 1/4 OF THE NE 1/4, SECTION 13, TOWNSHIP 24 NORTH, RANGE 4 EAST, W.M.

NOTE:
EXISTING STORM LINES WERE DETERMINED BASED ON CONTRACTOR'S TV'ING OF THE STORM LINES.



PAVING LEGEND

- NEW ASPHALT
- OVERLAY EXISTING ASPHALT/UTILITY SAWCUT
- NEW CONCRETE
- GRASSCRETE

GRADING QUANTITIES

TOTAL EXCAVATION (CUT) -	3,660 CU YDS TOTAL
EMBANKMENT (FILL) -	10 CU YDS
TOTAL	3,670 CU YDS

THE QUANTITIES SHOWN ABOVE ARE FOR THE PERMIT PROCESS ONLY. THESE VALUES ARE APPROXIMATE. DO NOT USE FOR BIDDING, PAYMENT, OR ESTIMATING PURPOSES.

NOTES:
1. THIS SITE IS DESIGNATED AS AN EROSION HAZARD AREA.
2. CONTRACTOR SHALL FIELD VERIFY LOCATIONS, DEPTH, CONDITION, SIZE, AND MATERIAL OF ALL EXISTING PIPES ON-SITE THAT EITHER NEED TO BE RELOCATED OR TIED INTO.
4. ALL DISTURBED PERVIOUS SURFACES SHALL BE AMENDED PER DOE BMP T5.13.
5. TOP AND TOE REFER TO FINISHED GRADE AT THE TOP AND BOTTOM OF THE WALLS, RESPECTIVELY. SEE ARCH PLANS FOR PHYSICAL TOP OF WALL HEIGHT, FALL PROTECTION, ETC.
6. 3' SEPARATION IS REQUIRED BETWEEN THE DRY UTILITIES (POWER, GAS, PHONE, CABLE, ETC.) AND SEWER, WATER, AND STORM AND 5' FROM ANY CITY MAIN LINES.
7. NEW/REPLACED IMPERVIOUS SURFACE: 6,595 SF
   - ROOF: 3,254 SF
   - COVERED PATIO ROOF: 490 SF
   - DRIVEWAY: 1,320 SF
   - WALKWAYS/POOL: 950 SF
   - GRASSCRETE SEWER PATH: 581 SF
8. FOOTING DRAINS SHOWN REPRESENT THE FOOTING DRAINS AROUND THE MAIN FLOOR AND BASEMENT OF THE HOUSE. BUILDING DRAINAGE FOR THE LOWEST FLOOR (SPORT COURT AT FFE = 50.83) TO BE SPECIFIED BY OTHERS. SEE PLUMBING/BUILDING ENVELOPE DRAWINGS.
9. POT HOLE ELECTRICAL LINES FROM TRANSFORMER PRIOR TO EXCAVATION FOR NEW STORM LINE FROM CONTROL STRUCTURE.

1 GRADING AND DRAINAGE PLAN
SCALE: 1" = 10'

CG ENGINEERING
250 4TH AVE. S., SUITE 200
EDMONDS, WASHINGTON 98020
PHONE (425) 778-8500
FAX (425) 778-5536

FOR PERMIT REVIEW
NOT FOR CONSTRUCTION
02/01/19

MARK	DATE	DESCRIPTION
	12/18/18	PERMIT SUBMITTAL
	01/23/19	PROP. SEWER MAIN RE-CONSTRUCTION
	02/01/19	PERMIT SUBMITTAL

DESIGN:	TAF
DRAWN:	ATD
CHECK:	JPU
JOB NO:	18340.20
DATE:	12/18/18

PERLA RESIDENCE
42XX HOLLY LANE
MERCER ISLAND, WA 98040

GRADING AND DRAINAGE PLAN AND DETAILS

FILE NAME:

SHEET:
C3.1

SAMPLE ACTIVITY LOG

DATE	FACILITY	MAINTENANCE PERFORMED	RESULTS / NOTES

250 4th Avenue South, Suite 200
Edmonds, WA 98020
ph. 425.778.8500 | f. 425.778.5536
www.cgengineering.com

No. 3 – Closed Detention Systems (Tanks/Vaults)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	Vault replaced or repaired to design specifications and is structurally sound. No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See “Catch Basins” (No. 5)	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).

No. 4 – Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall.	Structure securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight and show signs of rust.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes--other than designed holes--in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
		Gate is rusted over 50% of its surface area.	Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See “Closed Detention Systems” (No. 3).	See “Closed Detention Systems” (No. 3).	See “Closed Detention Systems” (No. 3).
Catch Basin	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).

No. 5 – 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%.	No Trash or debris located immediately in front of catch basin or on grate opening.
		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.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	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 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	Frame is sitting 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.	Basin replaced or repaired to design standards.
		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.	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.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
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 Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with 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.

No. 6 – 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.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe

No. 22 - Maintenance Standards and Procedures for Permeable Pavement.

Note that the inspection and routine maintenance frequencies listed below are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for "stormwater treatment and flow control BMPs/facilities."

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course				
Permeable Pavements, all	A, S		Runoff from adjacent pervious areas deposits soil, mulch or sediment on paving	• Clean deposited soil or other materials from permeable pavement or other adjacent surfacing • Check if surface elevation of planted area is too high, or slopes towards pavement, and can be regraded (prior to regrading, protect permeable pavement by covering with temporary plastic and secure covering in place) • Mulch and/or plant all exposed soils that may erode to pavement surface
Porous asphalt or pervious concrete		A or B	None (routine maintenance)	Clean surface debris from pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: o Walk-behind vacuum (sidewalks) o High efficiency regenerative air or vacuum sweeper (roadways, parking lots) o ShopVac or brush brooms (small areas) • Hand held pressure washer or power washer with rotating brushes Follow equipment manufacturer guidelines for when equipment is most effective for cleaning permeable pavement. Dry weather is more effective for some equipment.
	A[b]		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. To clean clogged pavement surfaces, use one or combination of the following methods: • Combined pressure wash and vacuum system calibrated to not dislodge wearing course aggregate. • Hand held pressure washer or power washer with rotating brushes • Pure vacuum sweepers Note: If the annual/biannual routine maintenance standard to clean the pavement surface is conducted using equipment from the list above, corrective maintenance may not be needed.
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Pressure wash, vacuum sweep, or use a combination of the two for cleaning moss from pavement surface. May require stiff broom or power brush in areas of heavy moss.
	A		Major cracks or trip hazards and concrete spalling and raveling	• Fill potholes or small cracks with patching mixes • Large cracks and settlement may require cutting and replacing the pavement section. Replace in-kind where feasible. Replacing porous asphalt with conventional asphalt is acceptable if it is a small percentage of the total facility area and does not impact the overall facility function. • Take appropriate precautions during pavement repair and replacement efforts to prevent clogging of adjacent porous materials

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

No. 22 (continued) - Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course (cont'd)				
Interlocking concrete paver blocks and aggregate pavers		A or B	None (routine maintenance)	Clean pavement surface using one or a combination of the following methods: • Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Vacuum/sweep permeable paving installation using: o Walk-behind vacuum (sidewalks) o High efficiency regenerative air or vacuum sweeper (roadways, parking lots) o ShopVac or brush brooms (small areas) • Note: Vacuum settings may have to be adjusted to prevent excess uptake of aggregate from paver openings or joints. Vacuum surface openings in dry weather to remove dry, encrusted sediment.
	A [b]		Surface is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Review the overall performance of the facility (note that small clogged areas may not reduce overall performance of facility) • Test the surface infiltration rate using ASTM C1701 as a corrective maintenance indicator. Perform one test per installation, up to 2,500 square feet. Perform an additional test for each additional 2,500 square feet up to 15,000 square feet total. Above 15,000 square feet, add one test for every 10,000 square feet. • If the results indicate an infiltration rate of 10 inches per hour or less, then perform corrective maintenance to restore permeability. • Clogging is usually an issue in the upper 2 to 3 centimeters of aggregate. Remove the upper layer of encrusted sediment, and fines, and/or vegetation from openings and joints between the pavers by mechanical means and/or suction equipment (e.g., pure vacuum sweeper). • Replace aggregate in paver cells, joints, or openings per manufacturer's recommendations
	A		Sediment present at the surface of the pavement	• Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding, then see above. • Determine source of sediment loading and evaluate whether or not the source can be reduced/eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).
	Summer		Moss growth inhibits infiltration or poses slip safety hazard	• Sidewalks: Use a stiff broom to remove moss in the summer when it is dry • Parking lots and roadways: Vacuum sweep or stiff broom/power brush for cleaning moss from pavement surface
	A		Paver block missing or damaged	Remove individual damaged paver blocks by hand and replace or repair per manufacturer's recommendations
	A		Loss of aggregate material between paver blocks	Refill per manufacturer's recommendations for interlocking paver sections
	A		Settlement of surface	May require resetting
Open-celled paving grid with gravel		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A [b]		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Use vacuum truck to remove and replace top course aggregate • Replace aggregate in paving grid per manufacturer's recommendations
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace gravel • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	May require resetting
	A		Loss of aggregate material in paving grid	Replenish aggregate material by spreading gravel with a rake (gravel level should be maintained at the same level as the plastic rings or no more than 1/4 inch above the top of rings). See manufacturer's recommendations.
		A	Weeds present	• Manually remove weeds • Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" to address this issue)

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.

No. 22 (continued) - Maintenance Standards and Procedures for Permeable Pavement.

Component	Recommended Frequency [a]		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Surface/Wearing Course (cont'd)				
Open-celled paving grid with grass		A or B	None (routine maintenance)	• Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves) • Follow equipment manufacturer guidelines for cleaning surface.
	A [b]		Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate)]	• Rehabilitate per manufacturer's recommendations.
	A		Paving grid missing or damaged	• Remove pins, pry up grid segments, and replace grass • Replace grid segments where three or more adjacent rings are broken or damaged • Follow manufacturer guidelines for repairing surface.
	A		Settlement of surface	• May require resetting
	A		Poor grass coverage in paving grid	• Restore growing medium, reseed or plant, aerate, and/or amend vegetated area as needed • Traffic loading may be inhibiting grass growth; reconsider traffic loading if feasible
		As needed	None (routine maintenance)	• Use a mulch mower to mow grass
		A	None (routine maintenance)	• Sprinkle a thin layer of compost on top of grass surface (1/2" top dressing) and sweep it in • Do not use fertilizer
		A	Weeds present	• Manually remove weeds • Mow, torch, or inoculate and replace with preferred vegetation
Inlets/Outlets/Pipes				
Inlet/outlet pipe	A		Pipe is damaged	Repair/replace
	A		Pipe is clogged	Remove roots or debris
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain (may cause prolonged drawdown period)	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Raised subsurface overflow pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	Plant roots, sediment or debris reducing capacity of underdrain	• Jet clean or rotary cut debris/roots from underdrain(s) • If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly
Outlet structure	A, S		Sediment, vegetation, or debris reducing capacity of outlet structure	• Clear the blockage • Identify the source of the blockage and take actions to prevent future blockages

[a] Frequency: A= Annually; B= Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

[b] Inspection should occur during storm event.