LITCHFIELD ENGINEERING
Civil Engineering & Development Services

STORM DRAINAGE REPORT
for the
LBH RESIDENCE

Prepared for:

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Date Issued: March 14, 2019

3/14/2019

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A. Project Overview

Project: LBH Residence
Tax Parcel No. 531510-0125

Site Area: The project area is 0.71 acres.

Site Location:

The site is located in the City of Mercer Island at 7450 North Mercer Way within the SW ¼ of Section 1, Township 24 North, Range 4 East, W.M. See Figure 1-Vicinity Map.

Existing Adjacent Development:

Existing development adjacent to the subject site includes the following:
North – Lake Washington
East – Single Family Residence
South – North Mercer Way
West – Single Family Residence

Pre-developed Site Conditions:

The project site presently consists of a single-family residence and carriage house with a driveway that connects North Mercer Way. Except for the existing residential structures and driveway, the site is vegetated with grass areas, shrubs, and few trees. The site slopes down from the south to the north at an average grade of approximately 11.5%. Soils mapped on-site consists of Kitsap silt loam (see Figure 2 – Soils Map).

Post-developed Site Conditions:

The project is proposing to remodel the existing residence, expand the existing terrace, replace the existing driveway, and add a pool, spa, and new terrace. The residence will continue to take access from North Mercer Way at the same location. Developed runoff from the proposed improvements will be collected and tightlined to Lake Washington.

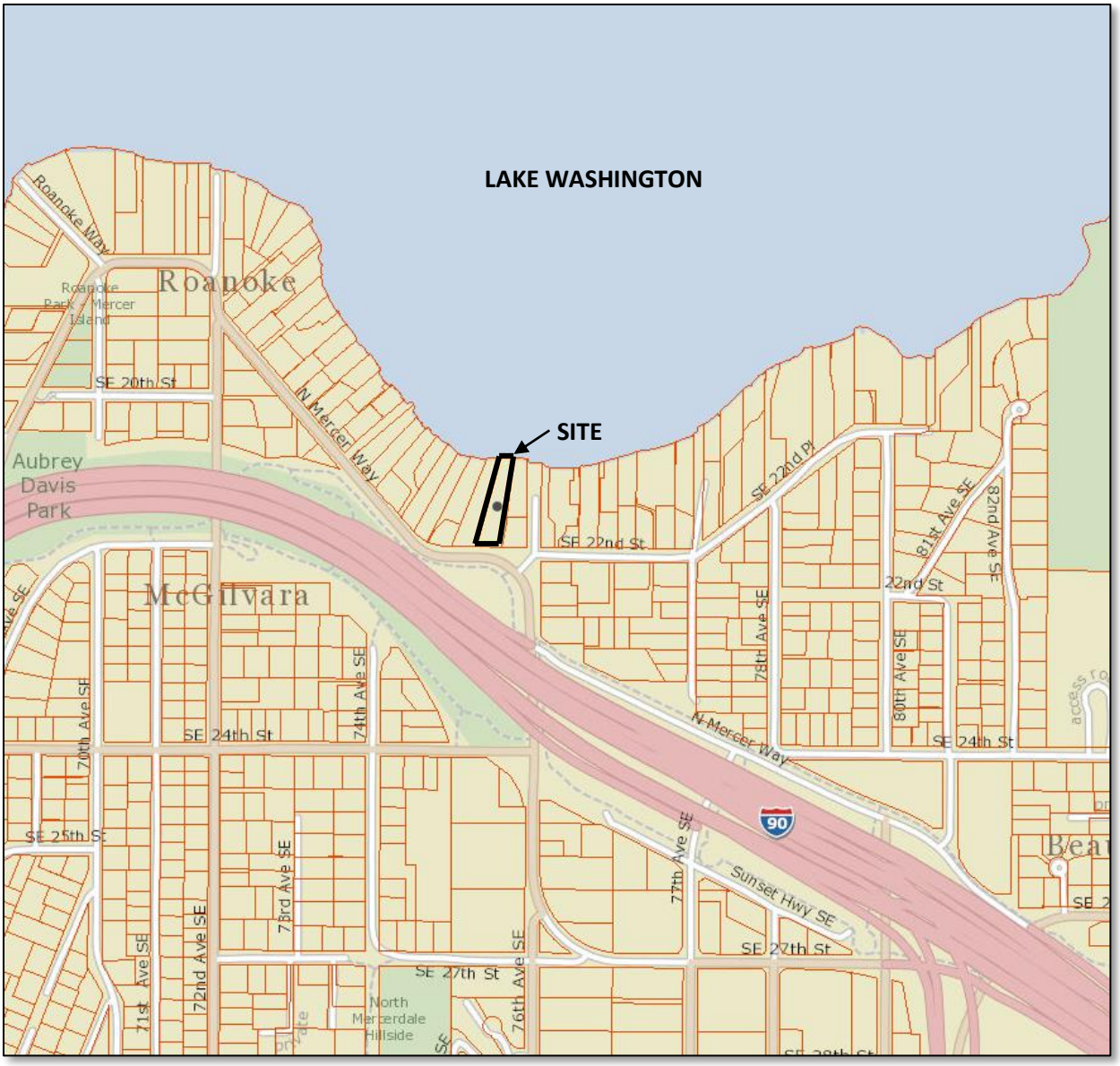


Figure 1 – Vicinity Map

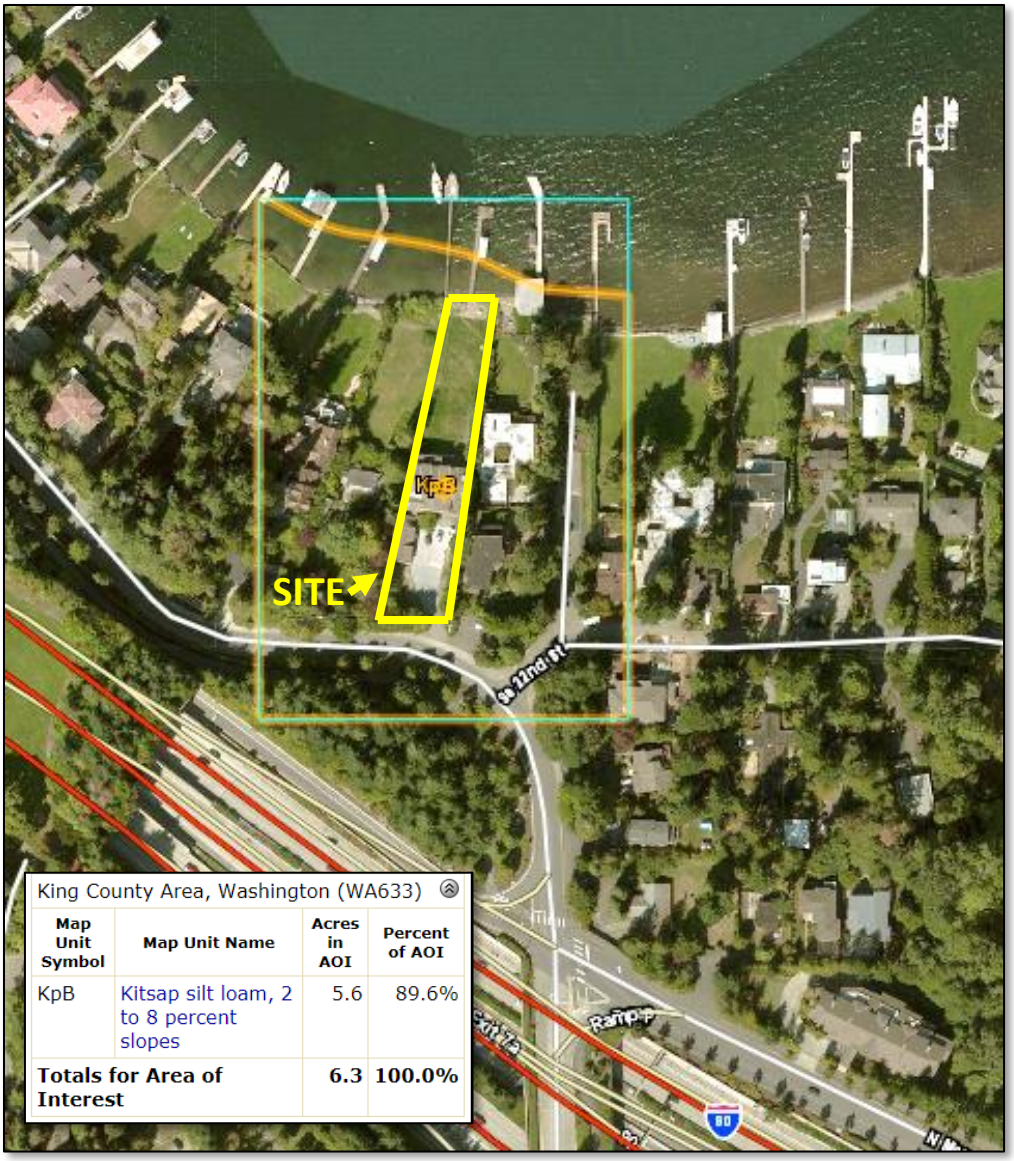
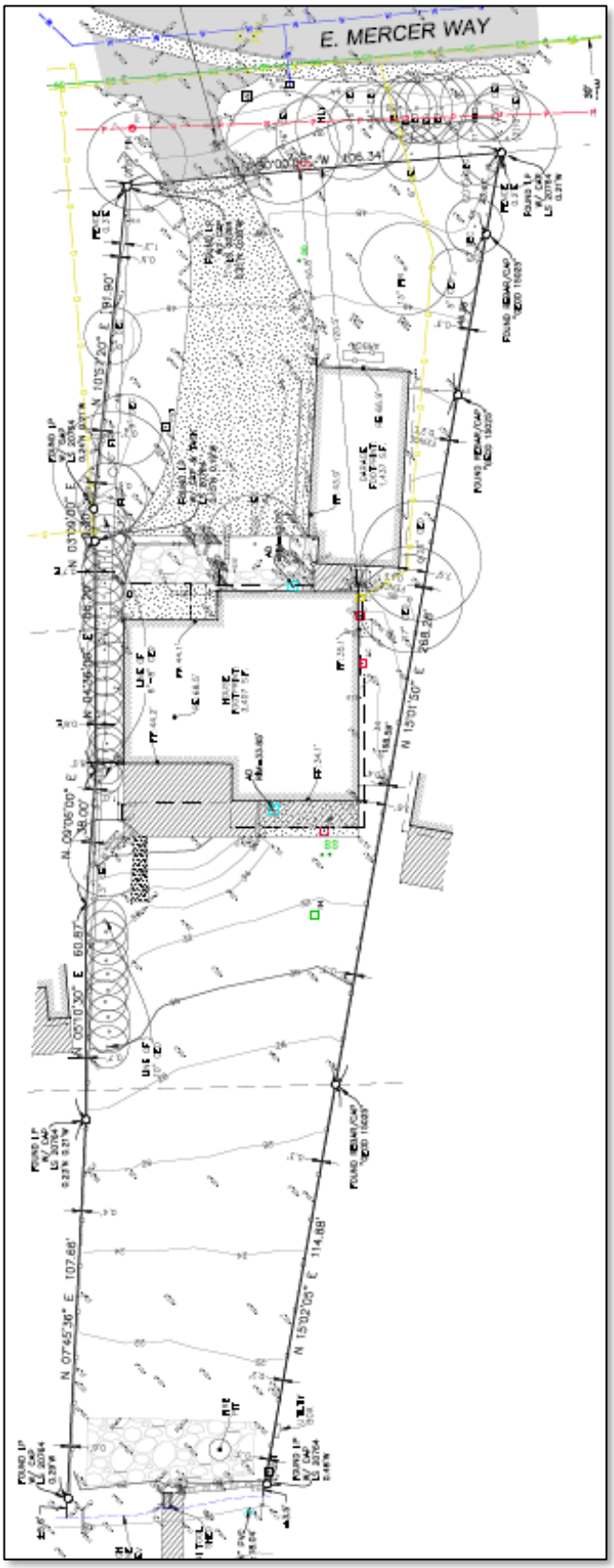


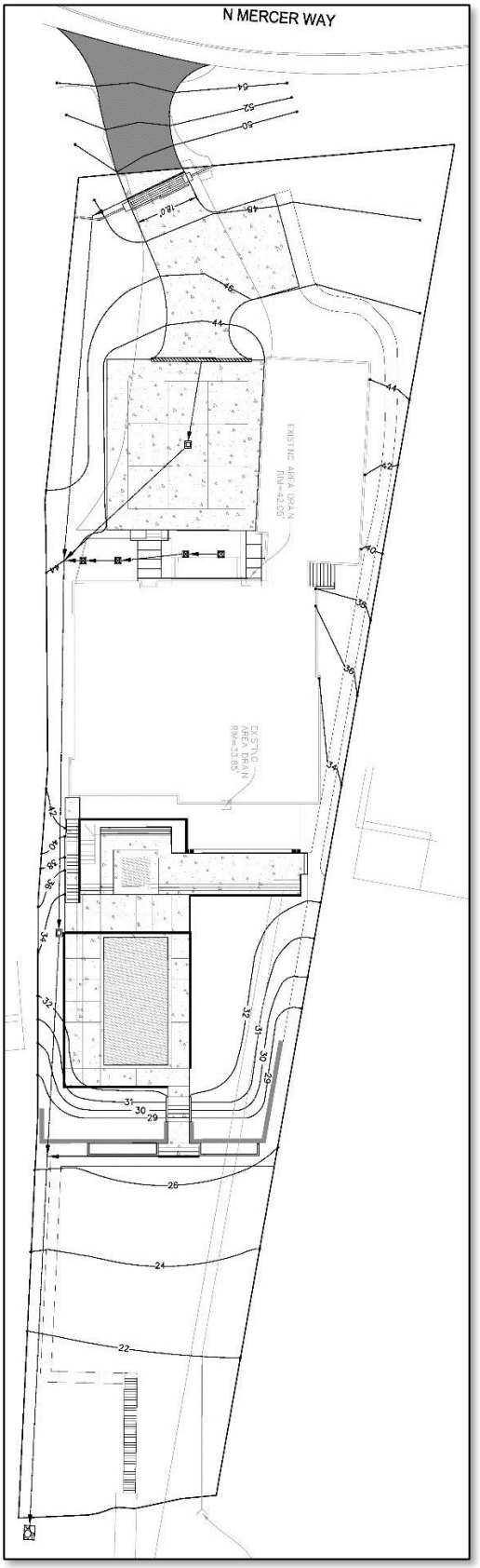
Figure 2 – Soils Map

Figure 3 – Existing Conditions Map



Existing Areas:	SF
Driveway/Parking/Auto Court =	3,493
Patio by Lake =	842
Residence & Carriage =	6,213
Back Patio/Deck/Stairs =	461
Front Patio =	448
Front Side Stairs =	16
AC Pad =	15
Total Existing Hard Surface =	11,488
Total Pervious =	19,453
Total Site =	30,941
Percent Existing =	37%

Figure 4 – Developed Conditions Map



Developed Areas:	SF
Drive/Parking/Auto Court =	3,577
Carriage House =	1,702
Side Stair =	48
Side Entry =	78
Front Entry =	116
Residence =	4,680
Pool/Terraces =	2,945
Lower Walk/Stairs =	154
Back Stairs =	104
Beach Walk =	117
Total Hard Surface =	13,521
Total Pervious =	17,420
Total Site =	30,941

B. Minimum Requirements

Per Figure I-2.4.1 and I-2.4.2 of the Department of Ecology's Surface Water Management Manual for Western Washington (SWMMWW), Minimum Requirements #1-9 apply to all new hard surfaces (See Figure 5A & 5B – Minimum Requirements Flow Charts).

Minimum Requirement No. 1 – Preparation of Stormwater Site Plans

A Stormwater Site Plan has been prepared for review by the City.

Minimum Requirement No. 2 – Construction Stormwater Pollution Prevention (SWPP)

A SWPP (i.e. TESC) plan addressing the 13 elements of Construction Stormwater Pollution Prevention is included below.

Element 1 – Mark Clearing Limits – Clearing limits at the property lines will be delineated with silt fence and orange construction fencing (if necessary).

Element 2 – Establish Construction Access – The existing asphalt driveway will be utilized as the construction entrance.

Element 3 – Control Flow Rates – The site will generate minimal flow above the existing conditions and is therefore exempt from flow control.

Element 4 – Install Sediment Controls – Silt fencing will be constructed in accordance with BMP C233 prior to construction to control sediment transportation.

Element 5 – Stabilize Soils – Stockpiled or unworked soils will be protected during construction by covering with plastic or temporary or permanent seeding. All exposed soils will be landscaped or seeded at the completion of the project.

Element 6 – Protect Slopes – All slopes on site during construction are required to be protected with mulch or other means as specified in the construction sequence.

Element 7 – Protect Drain Inlets – The existing conveyance system inlets will be protected during construction if warranted.

Element 8 – Stabilize Channels and Outlets – There are no proposed surface channels or outfalls.

Element 9 – Control Pollutants – The small size of this project will limit the opportunity for discharge of pollutants. Waste/demolition debris will not be stockpiled, fueling will be done off-site and concrete trucks will be washed out off-site.

Element 10 – Control De-watering – De-watering is not anticipated.

Element 11 – Maintain BMPs – BMPs will be maintained as necessary to assure continued functioning.

Element 12 – Manage the Project – An inspector (sites less than 1 acre) will be present or on call to ensure BMPs are maintained and assess effectiveness of ESC measures. Rainy season requirements will be implemented if necessary.

Element 13 – Protect Low Impact Development BMPs – There are no LID BMPs proposed.

Minimum Requirement No. 3 – Source Control of Pollution

Proposed construction source control measures are limited given the scope and scale of the project. Temporary/permanent seeding and maintaining existing vegetation to the maximum extent feasibility.

Minimum Requirement No. 4 – Preservation of Natural Drainage Systems and Outfalls

The natural drainage pattern and discharges from the site will be maintained. There will be no significant or adverse impacts to the downstream system.

Minimum Requirement No. 5 – On-site Stormwater Management

According to Table I-2.5.1 of the SWMMWW, since the project is redevelopment on less than 5 acres List #2: On-site Stormwater Management BMPs, must be implemented to the extent feasible for each surface.

Minimum Requirement No. 6 – Water Quality

The new pollution-generating impervious surface (PGIS) is less than the 5,000 SF threshold; therefore, water quality is not required.

Minimum Requirement No. 7 – Flow Control

The project site discharges to Lake Washington via an existing 4" PVC outfall. Lake Washington is listed in Appendix I-E of the SWMMWW as a Flow Control-Exempt Surface Water. Per Section 2.5.7 of the SWMMWW Flow Control is not required for projects that discharge directly to, or indirectly to a flow control-exempt surface water and meet the following restrictions;

- Direct discharge to exempt receiving water does not result in the diversion of drainage from any perennial stream classified as Types 1, 2, 3, or 4 in the State of Washington Interim Water Typing System, or Types "S", "F", or "Np" in the Permanent Water Typing System, or from any category I, II, or III wetland; and
- Flow Splitting devices or drainage BMP's are applied to route natural runoff volumes from the project site to any downstream Type 5 stream or category IV wetland; and
- The project site must be drained by a conveyance system that is comprised entirely of manmade conveyance elements and extends to the ordinary high water mark of the exempt receiving water; and
- The conveyance system between the project site and the exempt receiving water shall have a hydraulic capacity sufficient to convey discharges from future build-out conditions (under current zoning) of the site, and the existing condition from non-project areas from which runoff is or will be collected; and
- Any erodible elements of the manmade conveyance system must be adequately stabilized to prevent erosion under the conditions noted above.

The new/replaced impervious areas from the site will be collected and conveyed via 6" PVC pipes and discharged to Lake Washington. There is an existing 4" PVC outfall to Lake Washington that conveys the existing roof drainage. Both outfalls extend to the ordinary high water line of Lake Washington. The capacity of the conveyance system was analyzed to ensure

that during the 100-year storm event, the system would function adequately. The capacity of 6" PVC pipe is much greater than the actual peak discharge rate for the future build-out conditions of the site. Refer to Section E for the conveyance calculations. There are no streams or wetlands located between the site and the receiving water. The site discharges to Lake Washington and all five of the restrictions have been met, therefore flow control is not required for the project.

Minimum Requirement No. 8 – Wetlands Protection

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

Minimum Requirement No. 9 – Operations and Maintenance

A draft Operations and Maintenance Manual is included in Appendix A.

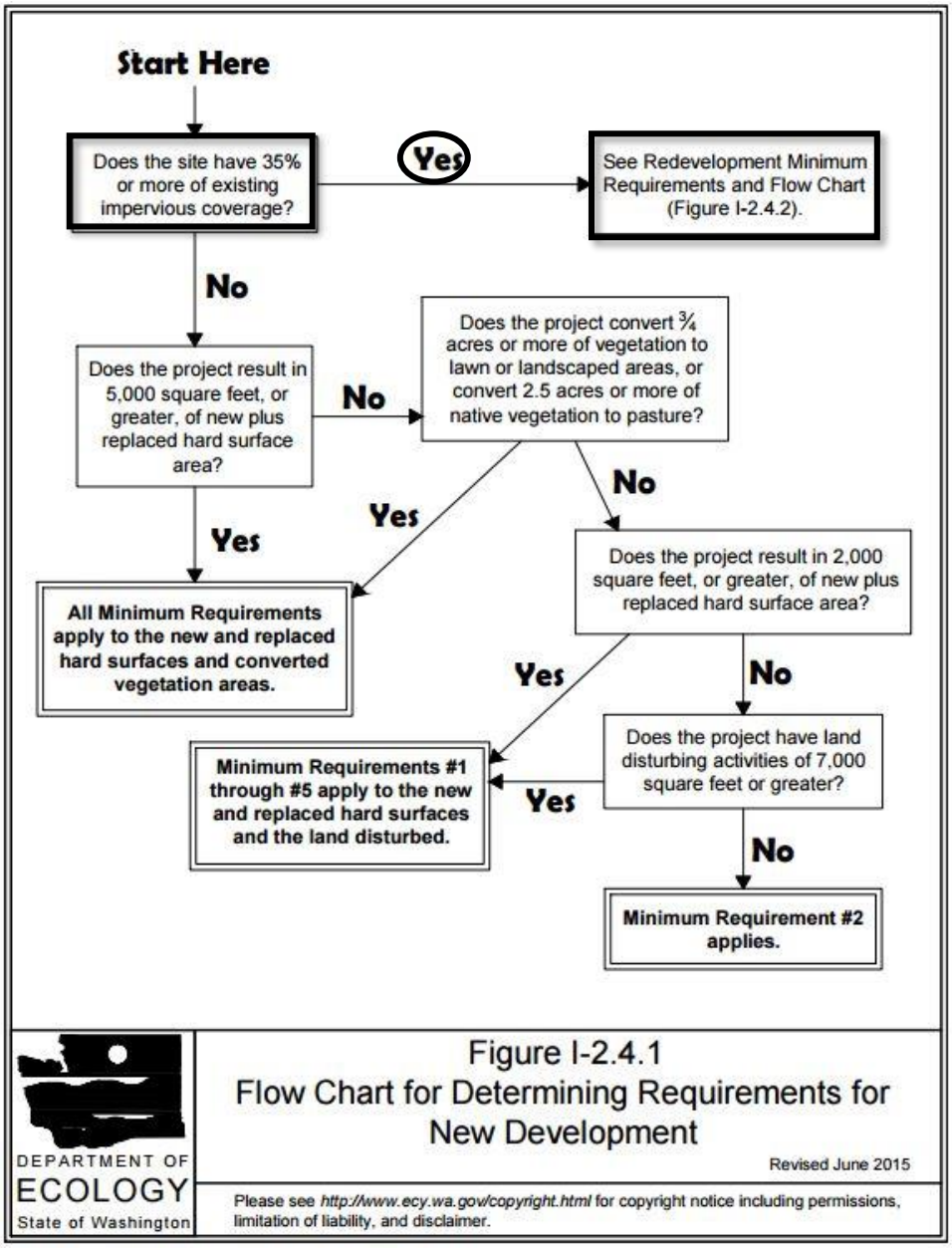


Figure 5A – Minimum Requirements Flow Chart

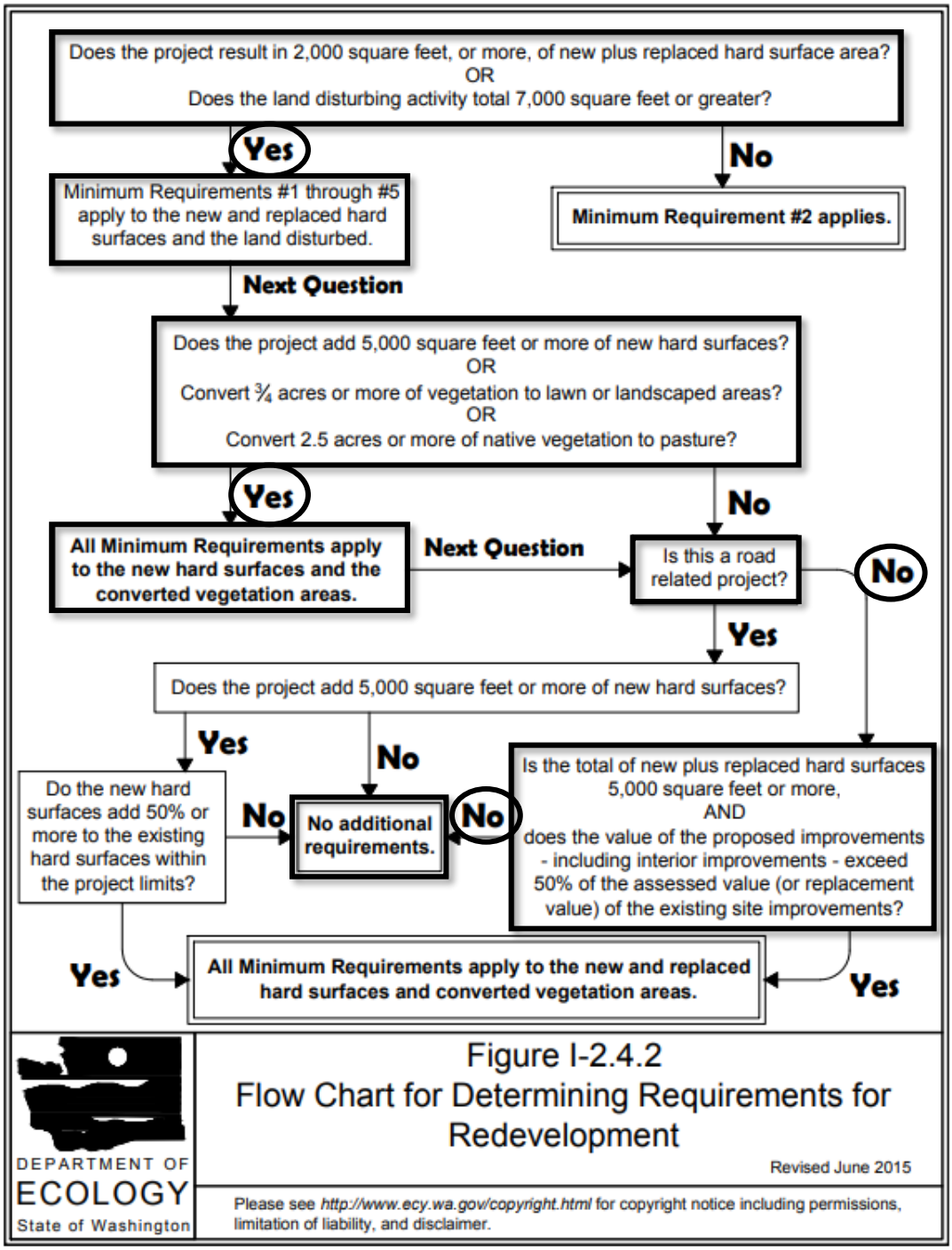


Figure 5B – Minimum Requirements Flow Chart

C. Downstream Analysis

The site is located within the Mercer Island and Water – Lake Washington Drainage Basin. There are no significant areas tributary to the site. A field review of downstream conditions was performed on January 15, 2019. The weather was cloudy and the temperature was approximately 40 degrees. A visual reconnaissance was performed utilizing the site survey and online mapping.

Runoff from the site sheet flows overland to the north for approximately 100 feet before discharging to Lake Washington. There is also a 4" PVC tightline that collects the existing roof runoff and discharges to Lake Washington.

Downstream Concerns & Effects of Proposed Project: Drainage from the developed site will be collected and discharged to Lake Washington. The existing 4" PVC tightline from the roof had been exposed prior to our site reconnaissance. A portion of the existing pipe was damage, therefore that section of pipe will be replaced and has been called out as such on the engineering plan. No other drainage related problems were observed during the site reconnaissance. However, during the site reconnaissance the lawn downstream of the residence was observed to be very damp.

D. On-site Stormwater Management Facilities

Figure 6 - Minimum Requirement #5 Flow Chart, was utilized to determine the requirements to meet On-site Stormwater Management. Please refer to Figure 6 on the following page. Per the flow chart the following BMPS are required to be implemented to the maximum extent feasible;

1. **Post Construction Soil Quality and Depth (BMP T5.13)** – This BMP is feasible and will be implemented per BMP T5.13 for all disturbed and converted vegetated areas.
2. Downspout Full Infiltration (BMP T5.10A), Downspout Dispersion Systems (BMP T5.10B), or Perforate Stub-out Connections (BMP T5.10C) – The site is mapped as "Infiltrating LID facilities are not permitted", therefore full infiltration and perforated stub out connection are not feasible. Downspout dispersion devices are not necessary as there are no target roof areas.
3. Concentrated Flow Dispersion (BMP T5.11) or Sheet Flow Dispersion (BMP T5.12) – Flow dispersion BMPs are not feasible. During the site reconnaissance the area available for dispersing was observed to be very damp and littered with goose droppings. In order to maintain a useable lawn, reduce potential for erosion, and to reduce pollution entering the lake, dispersion systems are not feasible.

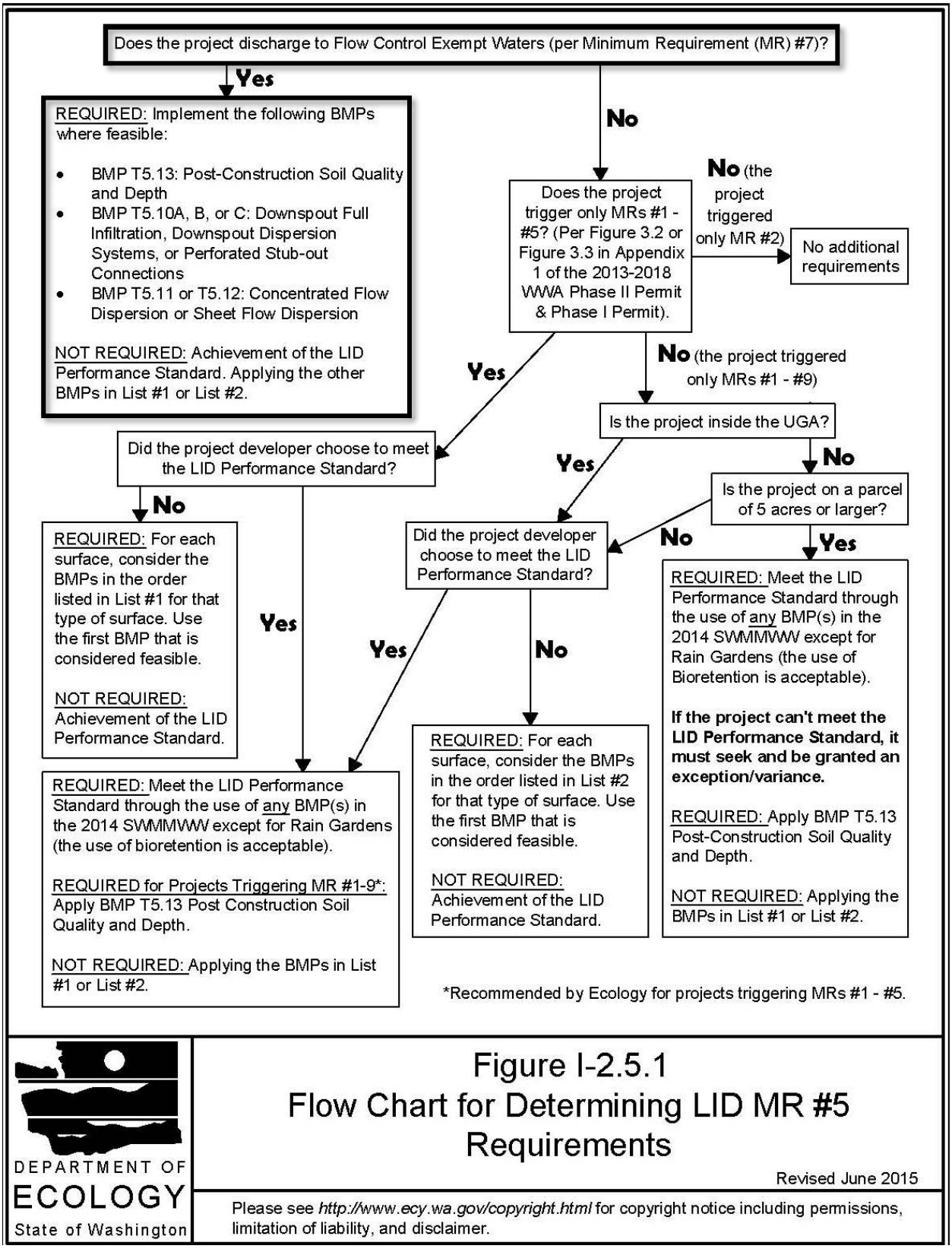


Figure 6 – Minimum Requirement #5 Flow Chart

E. Conveyance System Analysis and Design

The proposed conveyance system will tightline flows through the project site to the natural discharge point. The conveyance calculations were performed using Manning's Equation. The conveyance system was checked to ensure that during the 100-year storm event, the system would function adequately. The 100-year peak flow from the developed site using WWHM with 15-minute time steps was compared to the maximum capacity of the pipe. Using the Manning's Equation, the maximum capacity of a 4" and 6" pipe was calculated:

Pipe Diameter (inches)	Pipe Slope	Capacity (CFS)
4	4.00%	0.47
6	1.10%	0.70

As shown in the table the capacity of a 4" and 6" PVC is greater than the actual peak discharge rate of 0.388 CFS.

WWHM Analysis:

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Mod	0.4
Pervious Total	0.4
Impervious Land Use	acre
ROADS FLAT	0.31
Impervious Total	0.31
Basin Total	0.71

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.4
Total Impervious Area: 0.31

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.150692
5 year	0.205737
10 year	0.245438
25 year	0.299416
50 year	0.342467
100 year	0.388013

APPENDIX A
Maintenance & Operations Manual

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). 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	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
	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 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.