DRAINAGE REPORT

For

LORENZINI SFR LOT 2

4719 86TH AVE SE Mercer Island, WA

DRS Project No. 21071
Mercer Island Permit No. XXXX-XXX

Applicant

Design Built Homes
11400 SE 8th ST, Suite 415
Bellevue, WA 98004

Report Prepared by

DRS

D. R. STRONG Consulting Engineers, LLC
620 7th Ave.
Kirkland WA 98033
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Report Issue Date:

March 25, 2025

DRAINAGE REPORT
4719 89th AVE SE
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SECTION I: PROJECT OVERVIEW

GENERAL DESCRIPTION

The Site is located at 4719 86th Ave SE, Mercer Island Washington, also known as Tax Parcel Number 7598100420. The Parcel was subdivided into two single-family residential lots. The Project is the western half of the Parcel labeled as Lot 2. Access to the Project will be along 89th Ave SE where it connects with the existing roadway facility. Lot 2 will be accessed from a private shared-use driveway located along the northern edge of the property line within a recorded access easement. The Project is required to meet the standards in the 2019 Department of Ecology Stormwater Management Manual for Western Washington. The existing residence will be removed. The final short plat for this project is approved and awaiting recording, therefore, this report will be written with the context of future Lot 2. The new Parcel Number is 759810-0422-01.

PREDEVELOPED SITE CONDITIONS

The total area of Lot 2 is 13,670 s.f. (0.314 ac). The total project area is 15,164 s.f. (0.348 ac). The Site has been cleared as part of Project 2311-076. Vegetation consists of lawn and landscaping with evergreen and deciduous trees. There are no critical areas identified on the Site.

The Site is encompassed in one Threshold Discharge Area (TDA). This TDA consists of on Natural Discharge Areas (NDA) and one Natural Discharge Locations (NDL). The topography of NDA 1 slopes from a high point in the north east corn of the site at approximately 12.2% at the eastern side of the Project to 4.4% at the western side of the Project; runoff travels southwest along the western property line exiting the Site through as sheet flow along the southwest property corner and continues southwest through the existing stormwater conveyance system in SE 47th PL. The system along SE 47th PL conveys runoff and outfalls to Lake Washington.

The USDA Web Soil Survey describes the soil on Site as Arents, Alderwood material, 6 to 15 percent slopes (AmC - 6-15% slopes), Kitsap silt loam, 2 to 8 percent slopes and Kitsap silt loam, 15 to 30 percent slopes.

DEVELOPED SITE CONDITIONS

Lot 2 will be accessed through a private shared-use driveway crossing Lot 1. The Project will continue the existing 20-foot-wide driveway leading to Lot 2 and provide a 19-foot-wide driveway on Lot 2. A total of 1,286 s.f. of new pavement will be provided (879 on site, 407 off site). The existing residence has been removed.

Stormwater detention was designed for the combined projects of Lots 1 and 2. A total of 5,097 CF of volume was required for flow control; accordingly, all developed runoff is being routed to a 109-foot long, 8-foot diameter tank. This accounted for 5,468 s.f. (40% of Site area) of impervious area to be installed with Lot 2.

The Project is located in R-9.6 zoning, which has a minimum lot area of 9,600 s.f. Maximum lot coverage is 40% with 60% required landscaping. Up to 9% of the lot area can be used for other hardscape improvements including walkways, decks, patios, but not driveways.

- Total area of land-disturbing activities = 15,164 s.f.
- Total Lot Coverage Allowed = 5,468 s.f. (40% of Site area)
- Total On-Site Hardscape Area Added = 4,610 s.f.

Applicable Minimum Requirements for the Project are determined by Flow chart (see Appendix A). The Project is defined as new development and therefore does not qualify for Redevelopment thresholds.

The Project will result in more than 2,000 s.f. of new, replaced, and new plus replaced impervious surfaces. The Project will provide 5,017 s.f. of hardscape surfaces; accordingly, all minimum requirements apply to the new and replaced hard surfaces and the land disturbed.

Minimum Requirement #1: Preparation of Stormwater Site Plans

This Stormwater Site Plan has been prepared in accordance with the 2019 Department of Ecology Stormwater Management Manual for Western Washington.

Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP)

The Project will comply with the Construction SWPP thirteen elements. An erosion control plan will be provided with each building permit.

Minimum Requirement #3: Source Control of Pollution

All known, available, and reasonable source control BMPs will be applied to this Project.

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

The natural drainage patterns will be maintained for this Project. Surface runoff will be collected for flow control and discharged to the existing system in SE 47th PL.

Minimum Requirement #5: On-site Stormwater Management

The project will apply On-site Stormwater Management BMPs in accordance with the project thresholds, standards, and lists found in Table 1-3-2 of the 2019 Department of Ecology Stormwater Management Manual for Western Washington. For the process of selecting on-site BMPs see Appendix A.

Since all nine minimum requirements are triggered by this project, On-site Stormwater Management BMPs from List #2 will be applied according to feasibility to each type of surface. The result of the BMP selection process for the Project is outlined below.

Lawn and Landscaped Areas:

- Post-Construction Soil Quality and Depth BMP T5.13 will be applied to all feasible areas in accordance with the 2019 Department of Ecology Stormwater Management Manual for Western Washington. See soil management plan, below.

Roofs:

- Full Dispersion: Not feasible as there is not enough available area that is in the native or forested condition.
- Full Infiltration: Not permitted per Mercer Island infiltration feasibility map.
- Bioretention: Not feasible due to the lack of a safe and available overflow pathway to the municipal storm system.
- Downspout Dispersion Systems: Not feasible due as there is not enough available area that is in the native or forested condition.
- Perforated Stub-out Connections: Not feasible as there is no logical location to connect to the municipal storm system with the use of gravity.

Other Hard Surfaces (Driveways/Sidewalks) ï

- Full Dispersion: Not feasible as there is not enough available area that is in the native or forested condition.
- Permeable Pavement: Not permitted per Mercer Island infiltration feasibility map.
- Bioretention: Not feasible due to the lack of a safe and available overflow pathway to the municipal storm system.
- Sheet Flow Dispersion: Not feasible due as there is not enough available area that is in the native or forested condition.

Soil Management Plan

Within the limits of Site disturbance, duff and topsoil will be retained in an undisturbed state and stockpiled for later use to stabilize and amend soils throughout the Site. Post-construction soil amendment will meet the requirements of BMP T5.13 Post-Construction Soil Quality and Depth. Detailed calculation for imported soil amendment compost, if necessary, will be provided during engineering review for the Project.

Minimum Requirement #6: Runoff Treatment

Not applicable for this project. The total effective PGIS for the Project is less than 5,000 s.f. (1,286 s.f.) and therefore, per the TDA thresholds as outlined in 1-3.4.6 of the 2019 Department of Ecology Stormwater Management Manual for Western Washington, a treatment facility is not applicable. Runoff treatment has been reviewed and approved with Permit Number 2311-076.

Minimum Requirement #7: Flow Control

A continuous simulation model, WWHM 2012, was used to analyze the pre- and post-developed runoff rates. The soil type is modeled as hydrologic soil group C for the Alderwood SCS classification as shown in Figure 4. In the pre-developed condition, the entire Site is modeled as ñForestò In post-development conditions, the soil types are unchanged from the pre-developed conditions. Pursuant to the 2019 Department of Ecology Stormwater Management Manual for Western Washington, Volume III-

Appendix C, all areas that meet the soil quality and depth requirement are to be entered into the model as pasture rather than lawn/landscaping; accordingly, landscaped areas are modeled as ñPastureò for this Project. The remaining portions of the developed Site tributary to the proposed detention tank are modeled impervious as appropriate. Results of the WWHM2012 analysis are included in Appendix B. The detention facility was designed, approved, and built under Permit Number 2311-076 and was designed to accommodate 5,468 s.f. of impervious area from this lot.

Minimum Requirement #8: Wetlands Protection

Not applicable to this Project. There are no wetlands on the Project Site nor in the vicinity of the downstream discharge area.

Minimum Requirement #9: Operation and Maintenance

To maximize the effectiveness of the On-Site Stormwater Management BMPs the following practices should be implemented as part of an overall Site management program:

- Soil quality and depth should be established toward the end of construction and once established, should be protected from compaction, such as from large machinery, use, and from erosion.
- Soil should be planted and mulched after installation.
- Plant debris or its equivalent should be left on the soil surface to replenish organic matter.
- An Operation and Maintenance excerpt from the Manual is included at the end of this section.

PROPOSED SITE DOWNSTREAM DRAINAGE SYSTEM

Upstream Analysis

In evaluating the upstream area, we reviewed the USGS topographic survey mapping of the area, and field topographic survey, performed by D.R. STRONG. Consulting Engineers, LLC. The majority of upstream runoff appears to be drained away from the Site. Runoff from the parcel to the north drains toward the west and is either collected along SE 47^{th} ST or sheet flows across neighboring parcels to the west until it is collected along 84^{th} AVE SE. A negligible amount of stormwater may enter the Project Site over the northern property line before draining to the west, away from the Site. Runoff from parcels to the south drains southwest and away from the Site. In summary, the amount of upstream stormwater the Site is expected to receive is negligible.

Downstream Analysis

The downstream area is located within the Mercer Island Drainage Basin. The downstream area was evaluated by reviewing available resources, and by conducting a field reconnaissance. The field reconnaissance was performed on June 18, 2021 under sunny conditions and no precipitation.

The Site is encompassed in one Threshold Discharge Area (TDA). This TDA consists of on Natural Discharge Areas (NDA) and one Natural Discharge Locations (NDL). The topography of NDA 1 slopes from a high point in the north east corn of the site at approximately 12.2% at the eastern side of the Project to 4.4% at the western side of the Project; runoff travels southwest along the western property line exiting the Site through as sheet flow along the southwest property corner and continues southwest through the existing stormwater conveyance system in SE 47th PL. The system along SE 47th PL conveys runoff until it outfalls to Lake Washington.

Downstream Path of the NDA 1

Point ñA1ò is the natural discharge location where runoff sheet flows over the southwestern property corner of the Site. (0ö)

From ñA1ò to Point ñA2ó, runoff travels south as surface flow over vegetation. (0ô±200ö) No flow was observed.

Point ñA2ó, runoff enters an existing catch basin located in the loop of SE 47^{TH} PL (±200ö)

From Point ñA2ò to Point ñA3ó, Runoff continues southwest as pipe flow through a 12-inch diameter concrete pipe. (±260) No flow was observed.

Point ñA3ó, runoff from the 12-inch PVC converges with an open water course. (±260ö)

From Point ñA3ò to Point ñA4ó, Runoff continues west as channelized flow through. (±420) No flow was observed.

Point ñA4ó, runoff from the channelized flow enters a 12ò concrete pipe. (±420ö)

From Point ñA4ò to Point ñA5ó, Runoff continues southwest as pipe flow through a stormwater conveyance system. (±515) No flow was observed.

Point ñA5ó, runoff enters a Type 2 manhole just north of Mercer Way. (±515ö)

From Point ñA5ò to Point ñA6ó, Runoff continues southwest as pipe flow through a 12-inch concrete pipe. (±620) No flow was observed.

From Point ñA6,ò stormwater outfalls from a 12-inch concrete pipe into an open watercourse (±620)

From Point ñA6ò to Point ñA7ó, Runoff continues south as channel flow. (±705) No flow was observed.

From Point ñA7,ò stormwater enters an 18-inch corrugated metal pipe (±705)

From Point ñA7ò to Point ñA8ó, Runoff continues south as pipe flow through an 18-inch corrugated metal pipe. (±725) No flow was observed.

From Point ñA8,ò stormwater enters a type 1 CB east of 84^{th} Ave SE. (±725)

From Point ñA8ò to Point ñA9ó, Runoff continues west as pipe flow through a 12-inch concrete pipe. (±740) No flow was observed.

From Point ñA9,ò stormwater outfalls from a 12-inch concrete pipe to an open water course (±740)

From Point ñA9ò to Point ñA10ó, Runoff continues west as channelized flow through an open water course. (±1320) No flow was observed.

From Point ñA10,ò stormwater enters an 18-inch corrugated metal pipe where it travels through a series of catch basins, and open water courses until it ultimately outfalls to Lake Washington (±1320)

SECTION II: SITE MAPS

FIGURE 1
VICINITY MAP

4719 86TH AVE SE, MERCER ISLAND, WA

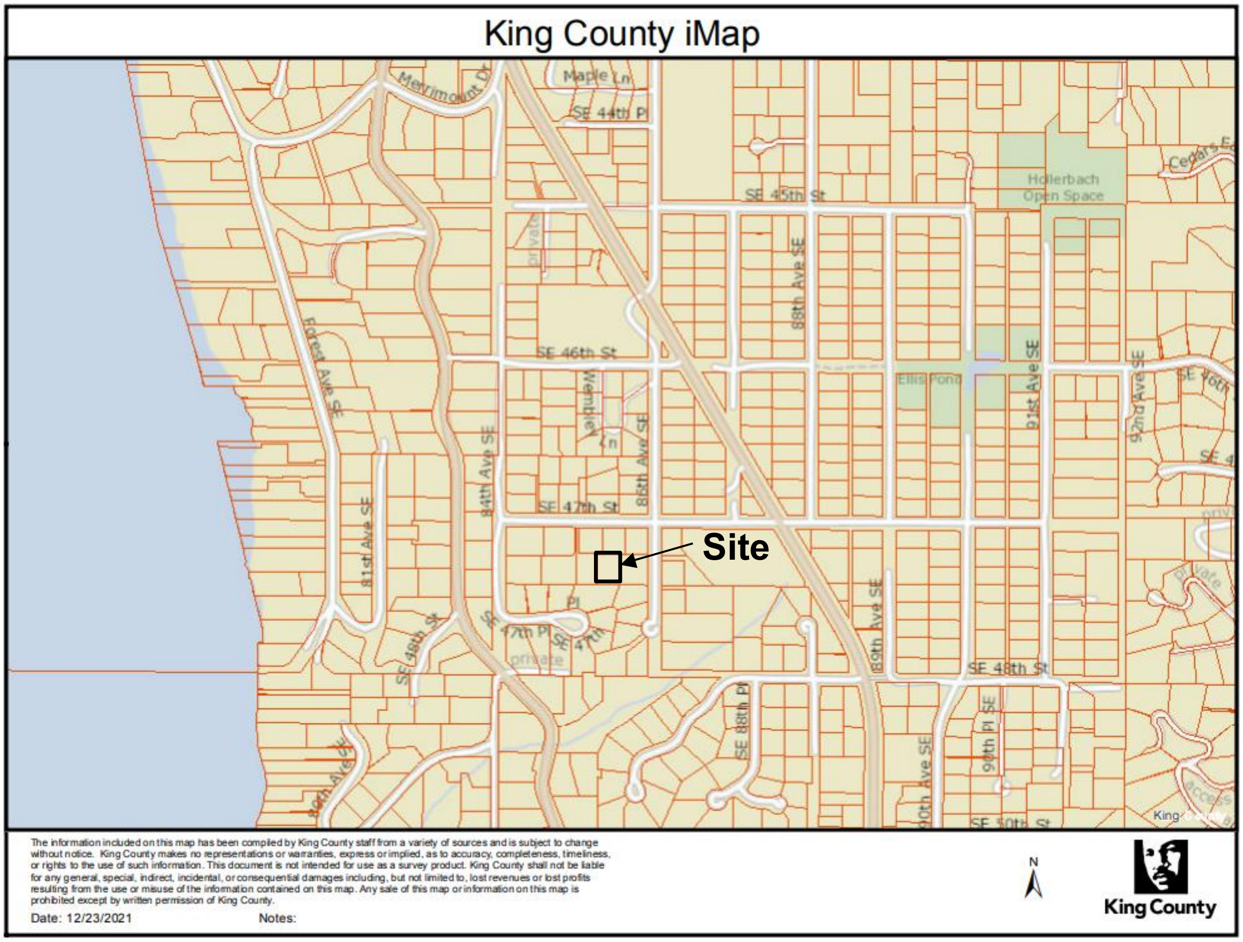
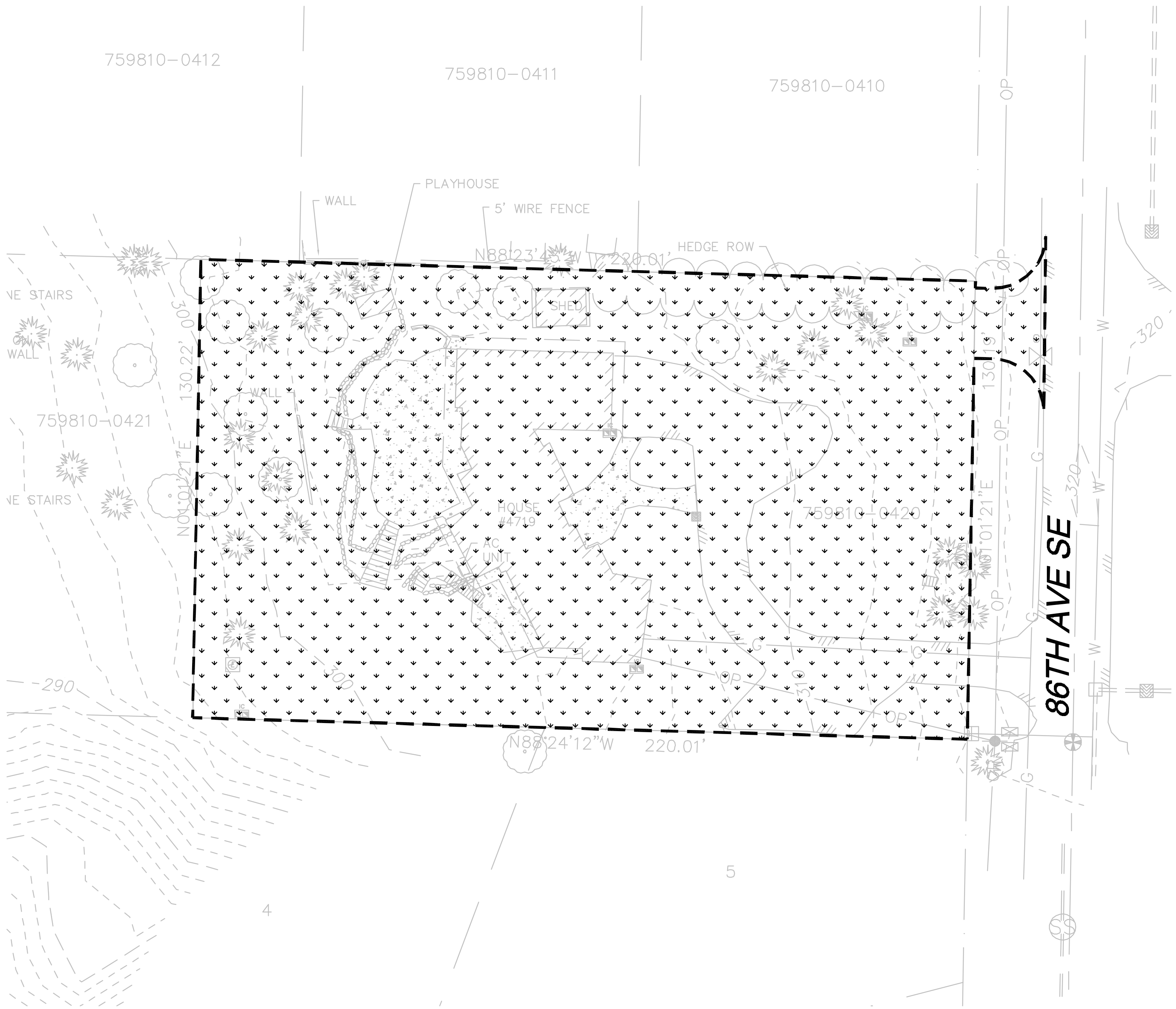


FIGURE 2
PREDEVELOPED FIGURE

Predeveloped and Developed Figures shown for entire Short Plat due to single system for both proposed lots.



AREA BREAKDOWN

TOTAL SITE/PROJECT AREA:	29,138 S.F. (0.669 ACRES)

LEGEND

– – – –	SITE/PROJECT BOUNDARY	
(dotted hatch)	C, FOREST, MODERATE	29,138 S.F. (0.669 ACRES)

NORTH

GRAPHIC SCALE

0 20 40 80

1 INCH = 40 FT.

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PREDEVELOPED FIGURE

SHORT PLAT
LORENZINI SP
MERCER ISLAND, WA

DRAFTED BY: JSE
DESIGNED BY: JSE
PROJECT ENGINEER: MAJ
DATE: 25.03.17
PROJECT NO.: 21071

FIGURE: 02

FIGURE 3
DEVELOPED FIGURE

Predeveloped and Developed Figures shown for entire Short Plat due to single system for both proposed lots.

AREA BREAKDOWN

TOTAL SITE/PROJECT AREA:	29,138 S.F. (0.669 ACRES)

LEGEND

SITE/PROJECT BOUNDARY

(hatched)	LOT AREA (PROPOSED):	28,644 S.F. (0.658 ACRES)
	PERVIOUS:	17,187 S.F. (0.395 ACRES)
	IMPERVIOUS:	11,457 S.F. (0.263 ACRES)
(cross-hatched)	ROW:	494 S.F. (0.011 ACRES)
	PERVIOUS:	0 S.F. (0.000 ACRES)
	IMPERVIOUS:	494 S.F. (0.011 ACRES)

NORTH

GRAPHIC SCALE

0 20 40 80

1 INCH = 40 FT.

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DEVELOPED FIGURE

SHORT PLAT
LORENZINI SP
MERCER ISLAND, WA

DRAFTED BY: JSE
DESIGNED BY: JSE
PROJECT ENGINEER: MAJ
DATE: 25.03.17
PROJECT NO.: 21071

FIGURE: 03

FIGURE 4
SOILS MAP

King County Area, Washington

AmC—Arents, Alderwood material, 6 to 15 percent slopes

Map Unit Setting

National map unit symbol: 1hmsq
Elevation: 50 to 660 feet
Mean annual precipitation: 35 to 60 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Arents, alderwood material, and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arents, Alderwood Material

Setting

Landform: Till plains
Parent material: Basal till

Typical profile

H1 - 0 to 26 inches: gravelly sandy loam
H2 - 26 to 60 inches: very gravelly sandy loam

Properties and qualities

Slope: 6 to 15 percent
Depth to restrictive feature: 20 to 40 inches to densic material
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 16 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B/D
Hydric soil rating: No

Data Source Information

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 17, Aug 23, 2021

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
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 supply, 0 to 60 inches: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Soils with Few Limitations (G002XN502WA)
Other vegetative classification: 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
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Seattle

Percent of map unit: 1 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Tukwila

Percent of map unit: 1 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: King County Area, Washington
Survey Area Data: Version 17, Aug 23, 2021

King County Area, Washington

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
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 supply, 0 to 60 inches: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Sloping to Steep Soils (G002XN702WA)
Other vegetative classification: Sloping to Steep Soils (G002XN702WA)
Hydric soil rating: No

Minor Components

Bellingham

Percent of map unit: 1 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Seattle

Percent of map unit: 1 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

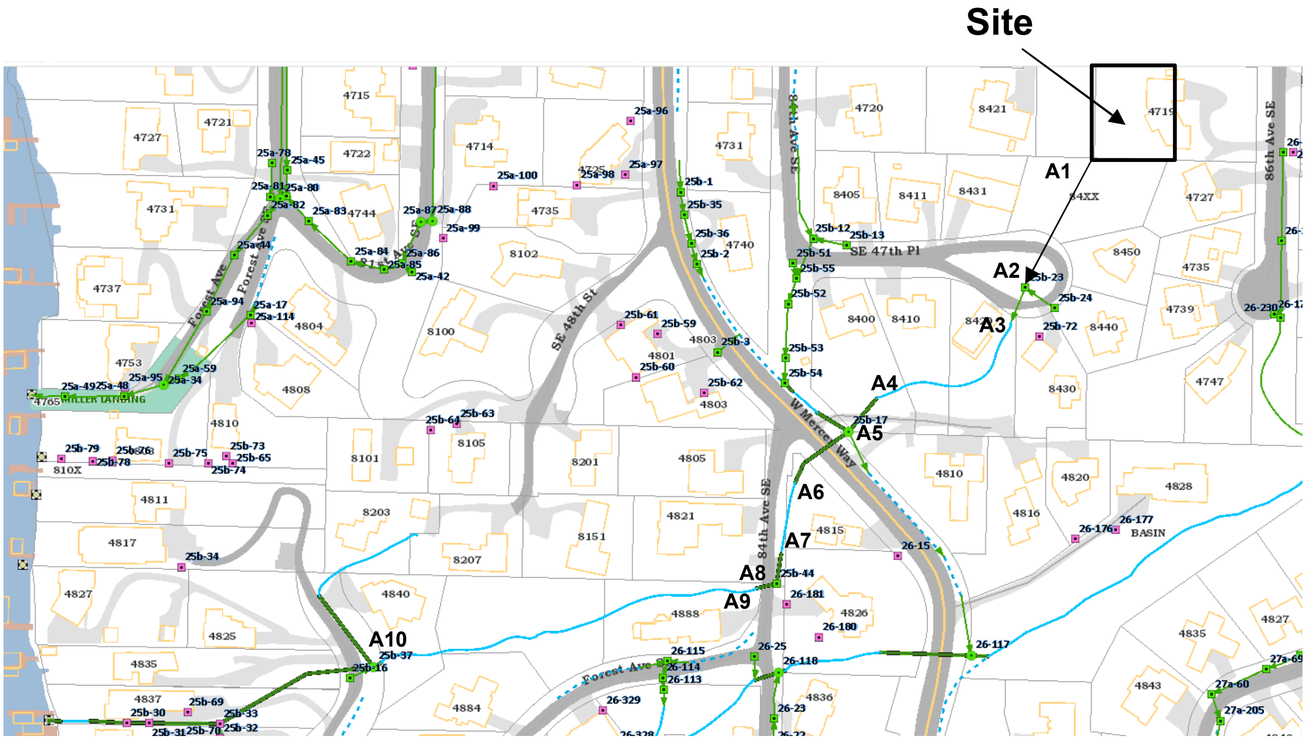
Tukwila

Percent of map unit: 1 percent
Landform: Depressions
Other vegetative classification: Wet Soils (G002XN102WA)
Hydric soil rating: Yes

Data Source Information

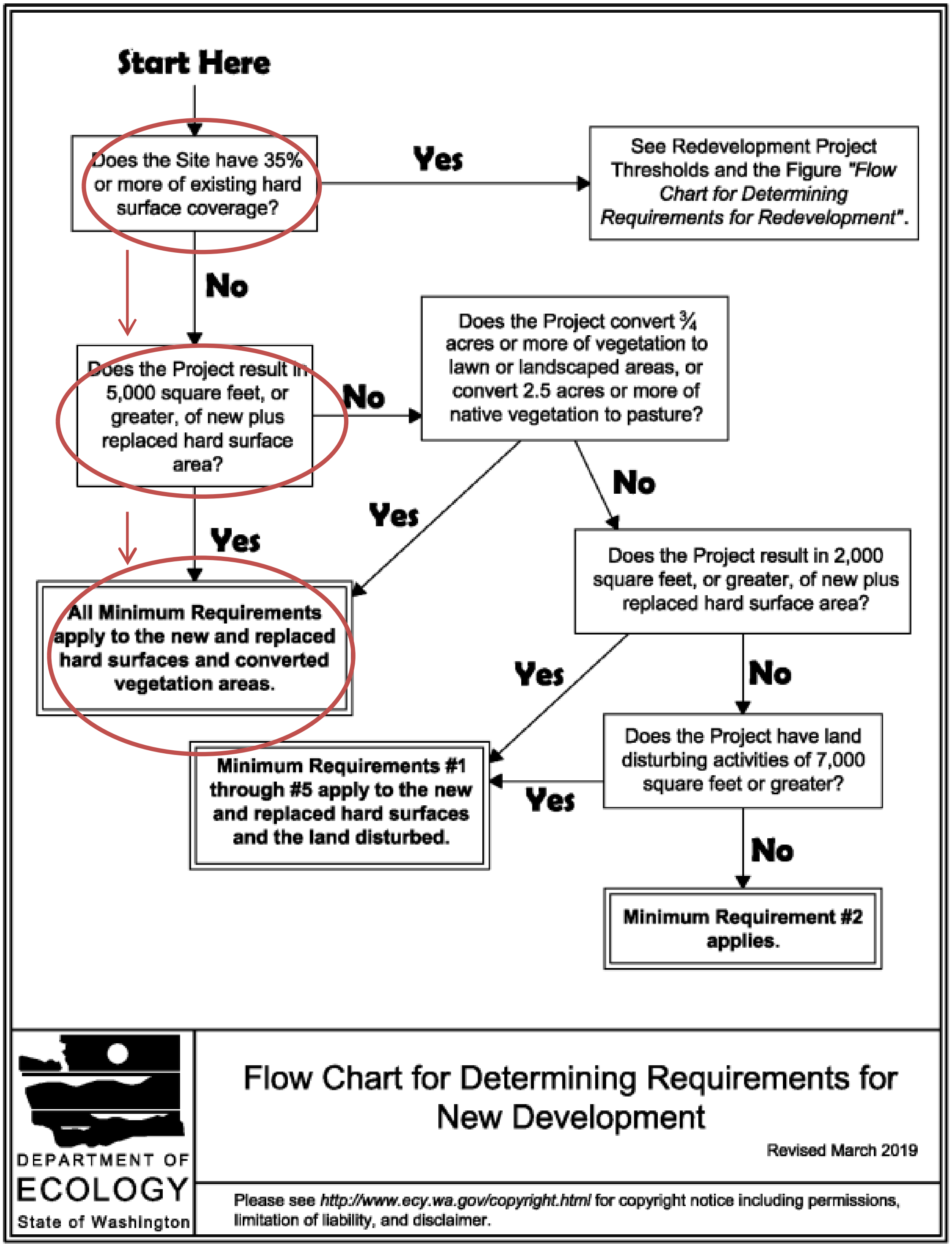
Soil Survey Area: King County Area, Washington
Survey Area Data: Version 17, Aug 23, 2021

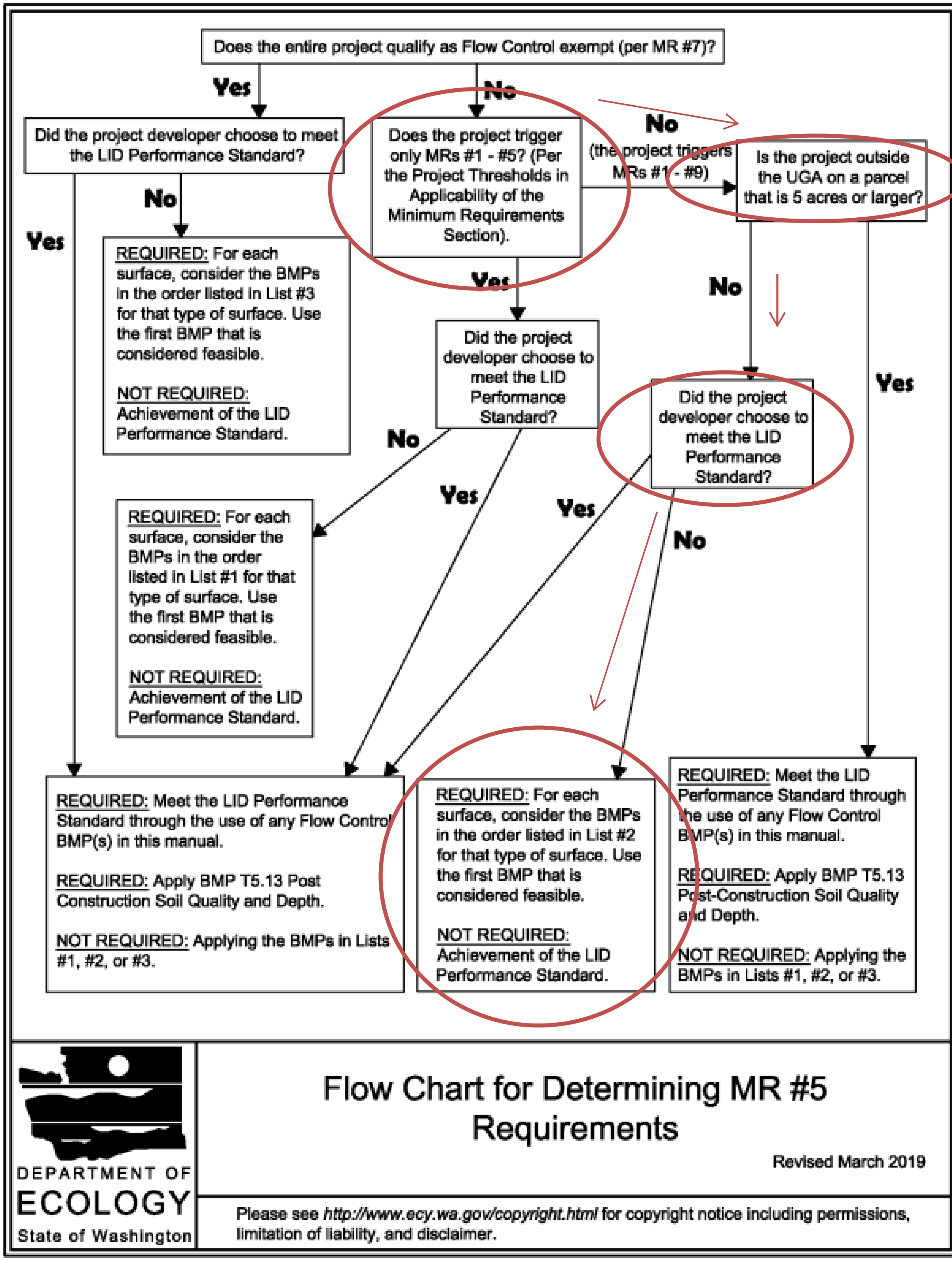
FIGURE 5
DOWNSTREAM MAP



APPENDICES

APPENDIX A
FLOW CHART




Does the entire project qualify as Flow Control exempt (per MR #7)?
Yes
No
Did the project developer choose to meet the LID Performance Standard?
Does the project trigger only MRs #1 - #5? (Per the Project Thresholds in Applicability of the Minimum Requirements Section).
No
(the project triggers MRs #1 - #9)
Is the project outside the UGA on a parcel that is 5 acres or larger?
Yes
No
REQUIRED: For each surface, consider the BMPs in the order listed in List #3 for that type of surface. Use the first BMP that is considered feasible.
NOT REQUIRED: Achievement of the LID Performance Standard.
Yes
No
Did the project developer choose to meet the LID Performance Standard?
Did the project developer choose to meet the LID Performance Standard?
Yes
No
REQUIRED: For each surface, consider the BMPs in the order listed in List #1 for that type of surface. Use the first BMP that is considered feasible.
NOT REQUIRED: Achievement of the LID Performance Standard.
Yes
Yes
No
REQUIRED: Meet the LID Performance Standard through the use of any Flow Control BMP(s) in this manual.
REQUIRED: Apply BMP T5.13 Post Construction Soil Quality and Depth.
NOT REQUIRED: Applying the BMPs in Lists #1, #2, or #3.
REQUIRED: For each surface, consider the BMPs in the order listed in List #2 for that type of surface. Use the first BMP that is considered feasible.
NOT REQUIRED: Achievement of the LID Performance Standard.
REQUIRED: Meet the LID Performance Standard through the use of any Flow Control BMP(s) in this manual.
REQUIRED: Apply BMP T5.13 Post-Construction Soil Quality and Depth.
NOT REQUIRED: Applying the BMPs in Lists #1, #2, or #3.
DEPARTMENT OF ECOLOGY State of Washington
Flow Chart for Determining MR #5 Requirements
Revised March 2019
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APPENDIX B

WWHM Report

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: pipe

Site Name:	Lorenzini
Site Address:	
City:	
Report Date:	4/8/2024
Gage:	Seatac
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Mod	0.638
Pervious Total	0.638
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.638

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	0.364
Pervious Total	0.364
Impervious Land Use	acre
ROOF TOPS FLAT	0.178
ROADS FLAT	0.09
SIDEWALKS FLAT	0.006
Impervious Total	0.274
Basin Total	0.638

Routing Elements
Predeveloped Routing

Mitigated Routing

Tank 1

Dimensions
Depth: 8 ft.
Tank Type: Circular
Diameter: 8 ft.
Length: 109 ft.
Discharge Structure
Riser Height: 7 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.410 in. Elevation:0 ft.
Orifice 2 Diameter: 0.670 in. Elevation:4.7 ft.
Orifice 3 Diameter: 0.430 in. Elevation:6 ft.
Element Flows To:
Outlet 1 Outlet 2

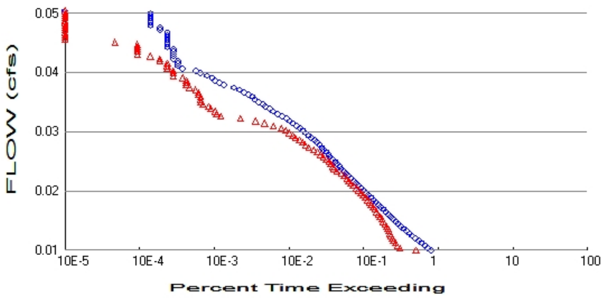
Tank Hydraulic Table

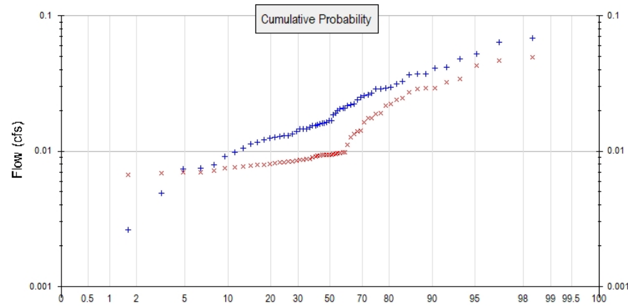
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.000000	0.000000	0.000	0.000
0.0889	0.004197	0.000249	0.001	0.000
0.1778	0.005902	0.000703	0.001	0.000
0.2667	0.007187	0.001286	0.002	0.000
0.3556	0.008251	0.001974	0.002	0.000
0.4444	0.009171	0.002749	0.003	0.000
0.5333	0.009987	0.003601	0.003	0.000
0.6222	0.010723	0.004522	0.003	0.000
0.7111	0.011394	0.005505	0.003	0.000
0.8000	0.012011	0.006546	0.004	0.000
0.8889	0.012582	0.007639	0.004	0.000
0.9778	0.013114	0.008782	0.004	0.000
1.0667	0.013610	0.009970	0.004	0.000
1.1556	0.014075	0.011200	0.004	0.000
1.2444	0.014511	0.012471	0.005	0.000
1.3333	0.014921	0.013779	0.005	0.000
1.4222	0.015307	0.015123	0.005	0.000
1.5111	0.015671	0.016500	0.005	0.000
1.6000	0.016015	0.017908	0.005	0.000
1.6889	0.016339	0.019346	0.005	0.000
1.7778	0.016645	0.020812	0.006	0.000
1.8667	0.016934	0.022305	0.006	0.000
1.9556	0.017206	0.023822	0.006	0.000
2.0444	0.017463	0.025363	0.006	0.000
2.1333	0.017705	0.026926	0.006	0.000
2.2222	0.017933	0.028510	0.006	0.000
2.3111	0.018146	0.030114	0.006	0.000
2.4000	0.018347	0.031736	0.007	0.000
2.4889	0.018535	0.033375	0.007	0.000
2.5778	0.018710	0.035031	0.007	0.000
2.6667	0.018873	0.036701	0.007	0.000
2.7556	0.019025	0.038386	0.007	0.000
2.8444	0.019165	0.040083	0.007	0.000
2.9333	0.019293	0.041792	0.007	0.000
3.0222	0.019411	0.043513	0.007	0.000
3.1111	0.019518	0.045243	0.008	0.000

3.2000	0.019614	0.046982	0.008	0.000
3.2889	0.019699	0.048730	0.008	0.000
3.3778	0.019775	0.050484	0.008	0.000
3.4667	0.019840	0.052245	0.008	0.000
3.5556	0.019894	0.054011	0.008	0.000
3.6444	0.019939	0.055781	0.008	0.000
3.7333	0.019974	0.057555	0.008	0.000
3.8222	0.019999	0.059332	0.008	0.000
3.9111	0.020013	0.061110	0.009	0.000
4.0000	0.020018	0.062890	0.009	0.000
4.0889	0.020013	0.064669	0.009	0.000
4.1778	0.019999	0.066447	0.009	0.000
4.2667	0.019974	0.068224	0.009	0.000
4.3556	0.019939	0.069998	0.009	0.000
4.4444	0.019894	0.071768	0.009	0.000
4.5333	0.019840	0.073534	0.009	0.000
4.6222	0.019775	0.075295	0.009	0.000
4.7111	0.019699	0.077049	0.011	0.000
4.8000	0.019614	0.078797	0.013	0.000
4.8889	0.019518	0.080536	0.015	0.000
4.9778	0.019411	0.082266	0.016	0.000
5.0667	0.019293	0.083987	0.017	0.000
5.1556	0.019165	0.085696	0.018	0.000
5.2444	0.019025	0.087393	0.019	0.000
5.3333	0.018873	0.089078	0.020	0.000
5.4222	0.018710	0.090748	0.021	0.000
5.5111	0.018535	0.092404	0.021	0.000
5.6000	0.018347	0.094043	0.022	0.000
5.6889	0.018146	0.095665	0.023	0.000
5.7778	0.017933	0.097269	0.023	0.000
5.8667	0.017705	0.098853	0.024	0.000
5.9556	0.017463	0.100416	0.024	0.000
6.0444	0.017206	0.101957	0.026	0.000
6.1333	0.016934	0.103474	0.027	0.000
6.2222	0.016645	0.104967	0.028	0.000
6.3111	0.016339	0.106433	0.029	0.000
6.4000	0.016015	0.107871	0.030	0.000
6.4889	0.015671	0.109279	0.031	0.000
6.5778	0.015307	0.110656	0.032	0.000
6.6667	0.014921	0.112000	0.033	0.000
6.7556	0.014511	0.113308	0.033	0.000
6.8444	0.014075	0.114579	0.034	0.000
6.9333	0.013610	0.115809	0.035	0.000
7.0222	0.013114	0.116997	0.088	0.000
7.1111	0.012582	0.118140	0.624	0.000
7.2000	0.012011	0.119233	1.441	0.000
7.2889	0.011394	0.120274	2.412	0.000
7.3778	0.010723	0.121257	3.424	0.000
7.4667	0.009987	0.122178	4.364	0.000
7.5556	0.009171	0.123030	5.136	0.000
7.6444	0.008251	0.123805	5.689	0.000
7.7333	0.007187	0.124493	6.054	0.000
7.8222	0.005902	0.125076	6.467	0.000
7.9111	0.004197	0.125530	6.806	0.000
8.0000	0.000000	0.125779	7.128	0.000
8.0889	0.000000	0.000000	7.437	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area:	0.638
Total Impervious Area:	0

Mitigated Landuse Totals for POC #1

Total Pervious Area:	0.364
Total Impervious Area:	0.274

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.018997
5 year	0.031128
10 year	0.038928
25 year	0.048206
50 year	0.054633
100 year	0.060636

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.011552
5 year	0.019037
10 year	0.025542
25 year	0.035857
50 year	0.045291
100 year	0.056432

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1949	0.022	0.008
1950	0.026	0.014
1951	0.042	0.049
1952	0.013	0.007
1953	0.011	0.008
1954	0.016	0.009
1955	0.026	0.009
1956	0.021	0.019
1957	0.017	0.009
1958	0.019	0.009

1959	0.016	0.008
1960	0.029	0.027
1961	0.016	0.009
1962	0.010	0.007
1963	0.013	0.009
1964	0.019	0.009
1965	0.013	0.013
1966	0.012	0.008
1967	0.029	0.009
1968	0.016	0.009
1969	0.016	0.008
1970	0.013	0.009
1971	0.014	0.010
1972	0.032	0.024
1973	0.014	0.014
1974	0.015	0.010
1975	0.022	0.009
1976	0.015	0.009
1977	0.002	0.007
1978	0.013	0.010
1979	0.008	0.007
1980	0.037	0.025
1981	0.012	0.009
1982	0.024	0.019
1983	0.021	0.010
1984	0.012	0.008
1985	0.007	0.008
1986	0.033	0.018
1987	0.029	0.022
1988	0.011	0.008
1989	0.008	0.007
1990	0.069	0.029
1991	0.036	0.029
1992	0.015	0.010
1993	0.015	0.008
1994	0.005	0.007
1995	0.021	0.011
1996	0.048	0.047
1997	0.037	0.032
1998	0.009	0.008
1999	0.041	0.022
2000	0.014	0.009
2001	0.003	0.007
2002	0.017	0.016
2003	0.025	0.008
2004	0.027	0.029
2005	0.020	0.010
2006	0.022	0.013
2007	0.052	0.043
2008	0.063	0.034
2009	0.030	0.018

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	**Predeveloped**	**Mitigated**
1	0.0688	0.0493
2	0.0634	0.0469
3	0.0520	0.0426

4	0.0482	0.0342
5	0.0415	0.0323
6	0.0408	0.0293
7	0.0372	0.0290
8	0.0371	0.0290
9	0.0365	0.0274
10	0.0326	0.0248
11	0.0315	0.0239
12	0.0295	0.0224
13	0.0292	0.0218
14	0.0287	0.0192
15	0.0286	0.0189
16	0.0268	0.0176
17	0.0260	0.0175
18	0.0258	0.0164
19	0.0251	0.0142
20	0.0241	0.0140
21	0.0224	0.0134
22	0.0219	0.0126
23	0.0215	0.0111
24	0.0208	0.0098
25	0.0208	0.0097
26	0.0206	0.0097
27	0.0199	0.0096
28	0.0191	0.0095
29	0.0186	0.0095
30	0.0168	0.0094
31	0.0168	0.0094
32	0.0164	0.0094
33	0.0162	0.0094
34	0.0160	0.0094
35	0.0160	0.0093
36	0.0157	0.0092
37	0.0155	0.0091
38	0.0154	0.0090
39	0.0149	0.0087
40	0.0145	0.0087
41	0.0145	0.0086
42	0.0145	0.0086
43	0.0140	0.0085
44	0.0135	0.0084
45	0.0130	0.0084
46	0.0130	0.0083
47	0.0128	0.0082
48	0.0127	0.0081
49	0.0124	0.0080
50	0.0122	0.0079
51	0.0116	0.0079
52	0.0113	0.0078
53	0.0105	0.0077
54	0.0098	0.0075
55	0.0091	0.0075
56	0.0079	0.0071
57	0.0075	0.0069
58	0.0074	0.0069
59	0.0049	0.0069
60	0.0026	0.0067
61	0.0023	0.0065

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0095	17075	10667	62	Pass
0.0100	15481	6521	42	Pass
0.0104	14067	6053	43	Pass
0.0109	12810	5694	44	Pass
0.0113	11569	5369	46	Pass
0.0118	10532	5172	49	Pass
0.0122	9569	4990	52	Pass
0.0127	8765	4798	54	Pass
0.0131	8044	4635	57	Pass
0.0136	7347	4500	61	Pass
0.0141	6744	4329	64	Pass
0.0145	6192	4128	66	Pass
0.0150	5739	3933	68	Pass
0.0154	5311	3756	70	Pass
0.0159	4924	3568	72	Pass
0.0163	4571	3369	73	Pass
0.0168	4237	3202	75	Pass
0.0172	3957	3022	76	Pass
0.0177	3645	2845	78	Pass
0.0182	3388	2697	79	Pass
0.0186	3133	2571	82	Pass
0.0191	2915	2402	82	Pass
0.0195	2706	2250	83	Pass
0.0200	2490	2098	84	Pass
0.0204	2314	1941	83	Pass
0.0209	2136	1831	85	Pass
0.0214	1972	1695	85	Pass
0.0218	1826	1557	85	Pass
0.0223	1702	1434	84	Pass
0.0227	1579	1345	85	Pass
0.0232	1443	1269	87	Pass
0.0236	1325	1179	88	Pass
0.0241	1233	1069	86	Pass
0.0245	1147	936	81	Pass
0.0250	1086	857	78	Pass
0.0255	1020	818	80	Pass
0.0259	947	779	82	Pass
0.0264	887	732	82	Pass
0.0268	824	679	82	Pass
0.0273	761	614	80	Pass
0.0277	725	567	78	Pass
0.0282	674	516	76	Pass
0.0286	623	455	73	Pass
0.0291	589	392	66	Pass
0.0296	549	353	64	Pass
0.0300	506	325	64	Pass
0.0305	469	294	62	Pass
0.0309	427	260	60	Pass
0.0314	388	240	61	Pass
0.0318	356	217	60	Pass
0.0323	328	193	58	Pass
0.0327	298	168	56	Pass
0.0332	270	132	48	Pass

0.0337	241	101	41	Pass
0.0341	218	77	35	Pass
0.0346	198	48	24	Pass
0.0350	174	26	14	Pass
0.0355	152	23	15	Pass
0.0359	130	22	16	Pass
0.0364	119	19	15	Pass
0.0369	104	18	17	Pass
0.0373	95	15	15	Pass
0.0378	83	14	16	Pass
0.0382	74	14	18	Pass
0.0387	69	14	20	Pass
0.0391	61	13	21	Pass
0.0396	53	13	24	Pass
0.0400	46	12	26	Pass
0.0405	39	10	25	Pass
0.0410	29	9	31	Pass
0.0414	25	9	36	Pass
0.0419	22	9	40	Pass
0.0423	20	8	40	Pass
0.0428	17	6	35	Pass
0.0432	14	6	42	Pass
0.0437	12	6	50	Pass
0.0441	8	5	62	Pass
0.0446	7	5	71	Pass
0.0451	7	5	71	Pass
0.0455	7	4	57	Pass
0.0460	6	4	66	Pass
0.0464	6	3	50	Pass
0.0469	6	2	33	Pass
0.0473	6	2	33	Pass
0.0478	6	2	33	Pass
0.0483	5	2	40	Pass
0.0487	5	2	40	Pass
0.0492	5	1	20	Pass
0.0496	5	0	0	Pass
0.0501	5	0	0	Pass
0.0505	5	0	0	Pass
0.0510	5	0	0	Pass
0.0514	4	0	0	Pass
0.0519	4	0	0	Pass
0.0524	3	0	0	Pass
0.0528	3	0	0	Pass
0.0533	3	0	0	Pass
0.0537	3	0	0	Pass
0.0542	3	0	0	Pass
0.0546	3	0	0	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Tank 1 POC	☐	56.45			☐	0.00			
Total Volume Infiltrated		56.45	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

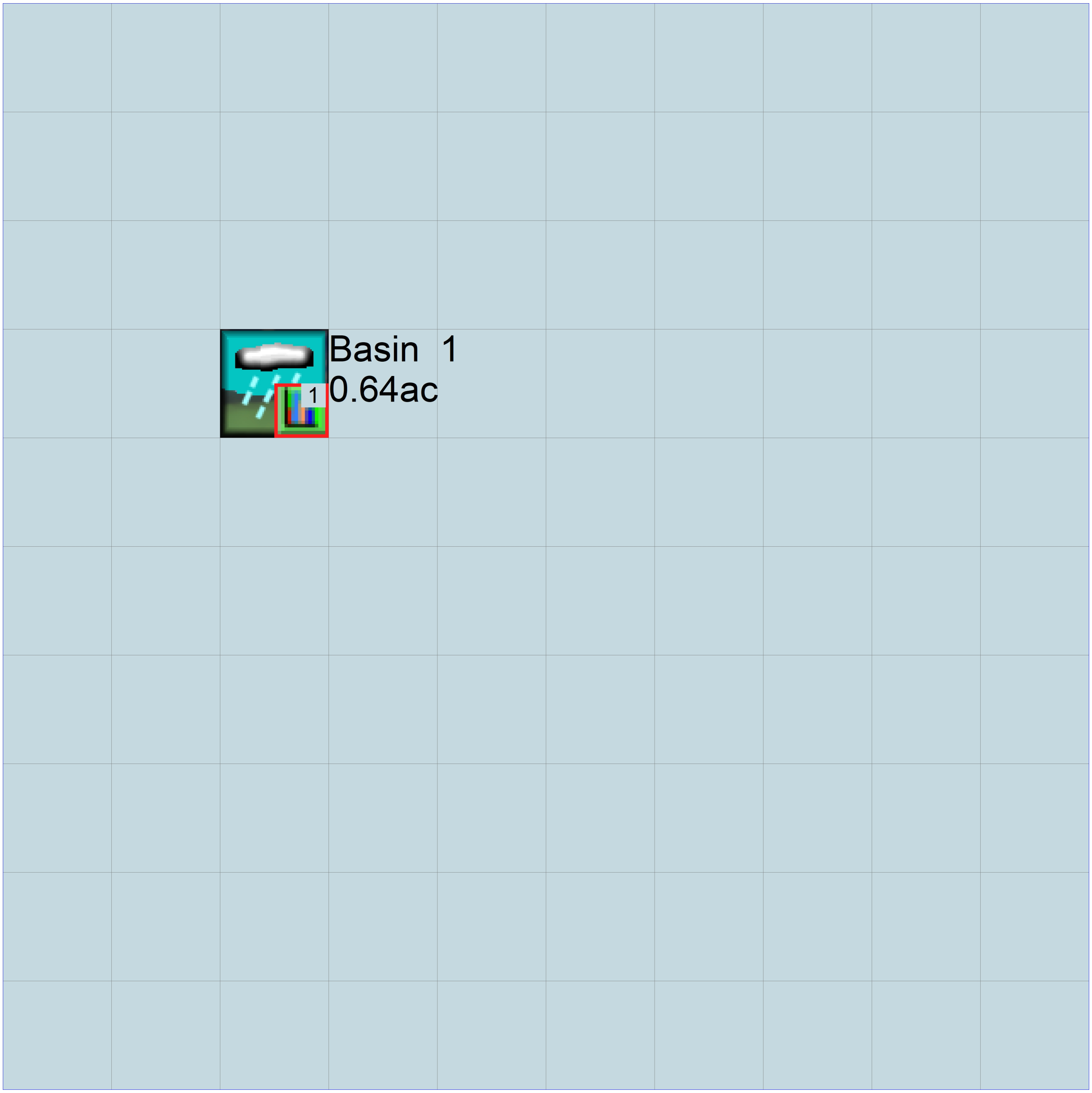
PERLND Changes

No PERLND changes have been made.

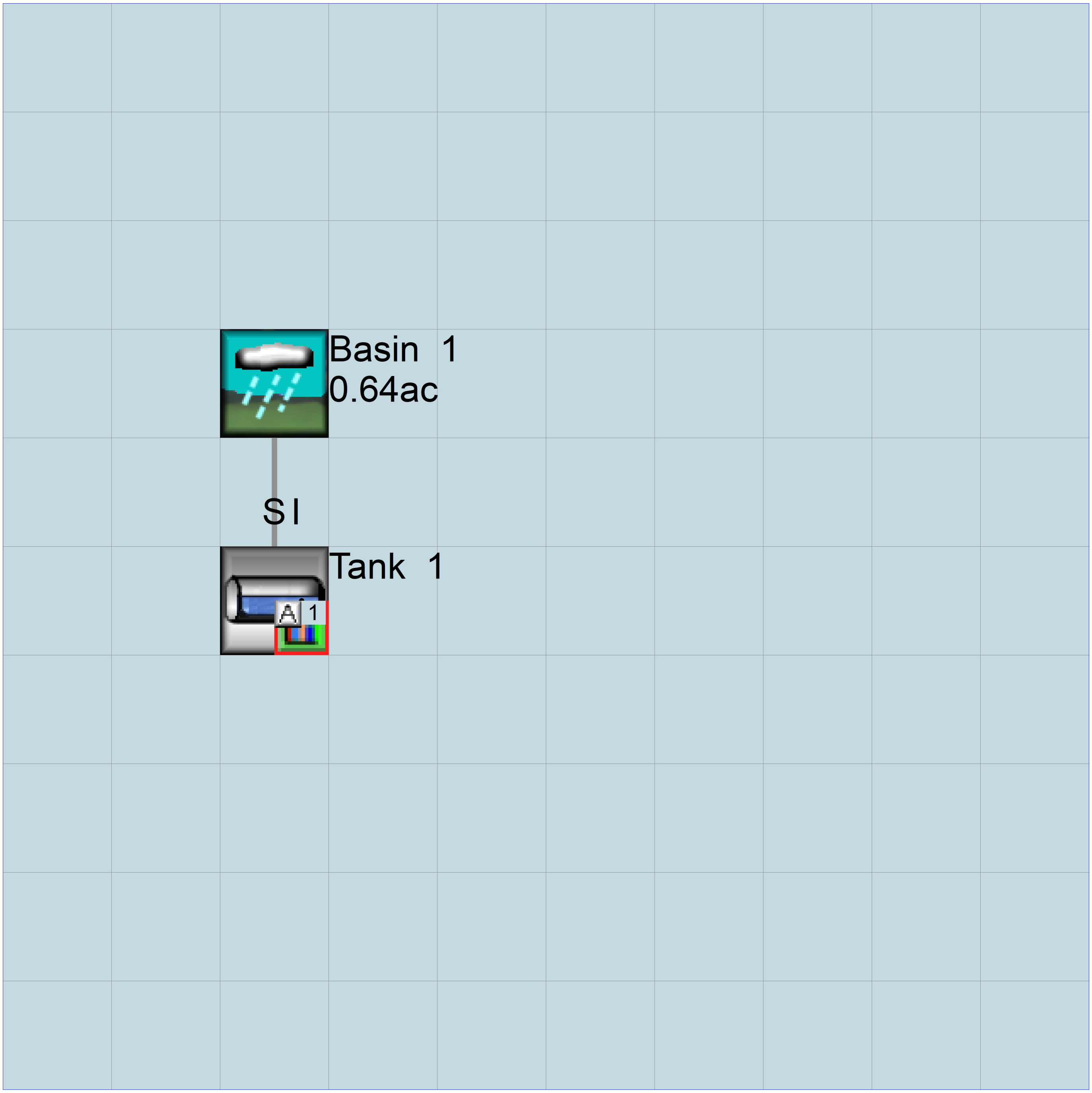
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   pipe.wdm
MESSU      25   Prepipe.MES
           27   Prepipe.L61
           28   Prepipe.L62
           30   POCpipe1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      11
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1        1    1
  501        1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   11     C, Forest, Mod          1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   11         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   11         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   11         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   11              0       4.5      0.08       400       0.1       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   11              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   11            0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

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

END PERLND

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

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

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

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

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

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  11                       0.638     COPY   501     12
PERLND  11                       0.638     COPY   501     13

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

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



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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

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

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

END EXT SOURCES

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

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

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


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

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

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   pipe.wdm
MESSU      25   Mitpipe.MES
           27   Mitpipe.L61
           28   Mitpipe.L62
           30   POCpipe1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      13
      IMPLND       4
      IMPLND       1
      IMPLND       8
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Tank  1                     MAX                     1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   13     C, Pasture, Flat        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   13         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
```

```
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   13         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   13         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   13             0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   13             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                     ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   13           0.15       0.4       0.3         6       0.5       0.4
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   13             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

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

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    4         0    0    1    0    0    0
    1         0    0    1    0    0    0
    8         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    4         0    0    4    0    0    4    1    9
    1         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI    ***
    4         0    0    0    0    0
    1         0    0    0    0    0
    8         0    0    0    0    0
```

```
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    4            400      0.01       0.1       0.1
    1            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    4              0         0
    1              0         0
    8              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4              0         0
    1              0         0
    8              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  13                       0.364     RCHRES   1      2
PERLND  13                       0.364     RCHRES   1      3
IMPLND   4                       0.178     RCHRES   1      5
IMPLND   1                        0.09     RCHRES   1      5
IMPLND   8                       0.006     RCHRES   1      5

******Routing******
PERLND  13                       0.364     COPY     1     12
IMPLND   4                       0.178     COPY     1     15
IMPLND   1                        0.09     COPY     1     15
IMPLND   8                       0.006     COPY     1     15
PERLND  13                       0.364     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

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



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

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***
    1     Tank  1                1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

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

```
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                        ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1             1      0.02       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                           ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1          0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE       1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.000000  0.000000  0.000000
  0.088889  0.004197  0.000249  0.001360
  0.177778  0.005902  0.000703  0.001923
  0.266667  0.007187  0.001286  0.002356
  0.355556  0.008251  0.001974  0.002720
  0.444444  0.009171  0.002749  0.003041
  0.533333  0.009987  0.003601  0.003331
  0.622222  0.010723  0.004522  0.003598
  0.711111  0.011394  0.005505  0.003847
  0.800000  0.012011  0.006546  0.004080
  0.888889  0.012582  0.007639  0.004301
  0.977778  0.013114  0.008782  0.004511
  1.066667  0.013610  0.009970  0.004711
  1.155556  0.014075  0.011200  0.004904
  1.244444  0.014511  0.012471  0.005089
  1.333333  0.014921  0.013779  0.005267
  1.422222  0.015307  0.015123  0.005440
  1.511111  0.015671  0.016500  0.005608
  1.600000  0.016015  0.017908  0.005770
  1.688889  0.016339  0.019346  0.005928
  1.777778  0.016645  0.020812  0.006082
  1.866667  0.016934  0.022305  0.006232
  1.955556  0.017206  0.023822  0.006379
  2.044444  0.017463  0.025363  0.006523
  2.133333  0.017705  0.026926  0.006663
  2.222222  0.017933  0.028510  0.006800
  2.311111  0.018146  0.030114  0.006935
  2.400000  0.018347  0.031736  0.007067
  2.488889  0.018535  0.033375  0.007197
  2.577778  0.018710  0.035031  0.007324
  2.666667  0.018873  0.036701  0.007449
  2.755556  0.019025  0.038386  0.007572
```

```
  2.844444  0.019165  0.040083  0.007694
  2.933333  0.019293  0.041792  0.007813
  3.022222  0.019411  0.043513  0.007930
  3.111111  0.019518  0.045243  0.008046
  3.200000  0.019614  0.046982  0.008160
  3.288889  0.019699  0.048730  0.008273
  3.377778  0.019775  0.050484  0.008384
  3.466667  0.019840  0.052245  0.008493
  3.555556  0.019894  0.054011  0.008602
  3.644444  0.019939  0.055781  0.008708
  3.733333  0.019974  0.057555  0.008814
  3.822222  0.019999  0.059332  0.008918
  3.911111  0.020013  0.061110  0.009021
  4.000000  0.020018  0.062890  0.009123
  4.088889  0.020013  0.064669  0.009224
  4.177778  0.019999  0.066447  0.009324
  4.266667  0.019974  0.068224  0.009423
  4.355556  0.019939  0.069998  0.009520
  4.444444  0.019894  0.071768  0.009617
  4.533333  0.019840  0.073534  0.009713
  4.622222  0.019775  0.075295  0.009807
  4.711111  0.019699  0.077049  0.011185
  4.800000  0.019614  0.078797  0.013846
  4.888889  0.019518  0.080536  0.015381
  4.977778  0.019411  0.082266  0.016598
  5.066667  0.019293  0.083987  0.017644
  5.155556  0.019165  0.085696  0.018580
  5.244444  0.019025  0.087393  0.019435
  5.333333  0.018873  0.089078  0.020229
  5.422222  0.018710  0.090748  0.020975
  5.511111  0.018535  0.092404  0.021680
  5.600000  0.018347  0.094043  0.022352
  5.688889  0.018146  0.095665  0.022994
  5.777778  0.017933  0.097269  0.023612
  5.866667  0.017705  0.098853  0.024207
  5.955556  0.017463  0.100416  0.024782
  6.044444  0.017206  0.101957  0.026398
  6.133333  0.016934  0.103474  0.027714
  6.222222  0.016645  0.104967  0.028774
  6.311111  0.016339  0.106433  0.029721
  6.400000  0.016015  0.107871  0.030597
  6.488889  0.015671  0.109279  0.031421
  6.577778  0.015307  0.110656  0.032206
  6.666667  0.014921  0.112000  0.032958
  6.755556  0.014511  0.113308  0.033683
  6.844444  0.014075  0.114579  0.034384
  6.933333  0.013610  0.115809  0.035064
  7.022222  0.013114  0.116997  0.088462
  7.111111  0.012582  0.118140  0.624174
  7.200000  0.012011  0.119233  1.441462
  7.288889  0.011394  0.120274  2.412336
  7.377778  0.010723  0.121257  3.424498
  7.466667  0.009987  0.122178  4.364830
  7.555556  0.009171  0.123030  5.136736
  7.644444  0.008251  0.123805  5.689369
  7.733333  0.007187  0.124493  6.054497
  7.822222  0.005902  0.125076  6.466996
  7.911111  0.004197  0.125530  6.805972
  8.000000  0.001000  0.125779  7.128795
  END FTABLE  1
END FTABLES

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

```
END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1        1      WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

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

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

  MASS-LINK       16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK   16

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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APPENDIX C

Geotechnical Report

Earth Solutions NW LLC

Geotechnical Engineering
Construction Observation/Testing
Environmental Services

GEOTECHNICAL ENGINEERING STUDY
LORENZINI SHORT PLAT
4719 – 86TH AVENUE SOUTHEAST AND
84XX SOUTHEAST 47TH STREET
MERCER ISLAND, WASHINGTON

ES-8009.01

15365 N.E. 90th Street, Suite 100   Redmond, WA 98052
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www.earthsolutionsnw.com

PREPARED FOR

DESIGN BUILT HOMES, LLC

February 1, 2022

Stephen H. Avril
Project Manager

02/01/2022

Kyle R. Campbell, P.E.
Principal Engineer

GEOTECHNICAL ENGINEERING STUDY
LORENZINI SHORT PLAT
4719 – 86TH AVENUE SOUTHEAST AND 84XX SOUTHEAST 47TH STREET
MERCER ISLAND, WASHINGTON

ES-8009.01

Earth Solutions NW, LLC
15365 Northeast 90th Street, Suite 100
Redmond, Washington 98052
Phone: 425-449-4704 | Fax: 425-449-4711
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Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

February 1, 2022
ES-8009.01

Design Built Homes, LLC
11400 Southeast 8th Street, Suite 415
Bellevue, Washington 98004

Attention: Mr. Todd Sherman

Dear Mr. Sherman:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, Lorenzini Short Plat, 4719 – 86th Avenue Southeast and 84XX Southeast 47th Street, Mercer Island, Washington".

The native soil underlying the site consists of glacial till based on our observation of the subsurface conditions. In our opinion, the proposed residence can be supported on conventional continuous and spread footing foundations bearing on competent native soils, competent existing fill, or new structural fill. We anticipate suitable bearing soils will be encountered at depths of approximately two feet below existing grades. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material will be necessary.

Groundwater seepage was not observed during our fieldwork (December 22, 2021). However, the client should anticipate groundwater seepage on the site at the contact with the unweathered glacial till. The maximum depth-of-exploration was seven and one-half feet below the existing surface elevations.

We performed infiltration testing at the request of the design team. We observed no infiltration during the testing procedure. We recommend full infiltration not be pursued on the subject site as a result. Limited infiltration measures can be considered, such as permeable pavement. Where permeable pavement is to be utilized, an overflow capacity should be designed into the system.

Recommendations for foundation design, site preparation, drainage, and other pertinent recommendations are provided in this study. We appreciate the opportunity to be of service to you on this project. If you have questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Stephen H. Avril
Project Manager

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ES-8009.01

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Cont'd

ES-8009.01

GEOTECHNICAL ENGINEERING STUDY
LORENZINI SHORT PLAT
4719 – 86TH AVENUE SOUTHEAST AND
84XX SOUTHEAST 47TH STREET
MERCER ISLAND, WASHINGTON

ES-8009.01

INTRODUCTION

General

The subject site is located on the west side of 86th Avenue Southeast, south of the intersection with Southeast 47th Street in Mercer Island, Washington. The site is currently developed with a single-family residential structure, driveway, and general landscape areas. Site development plans include the construction of three single-family residences and associated improvements following demolition of the existing structure.

The purpose of this study was to explore subsurface conditions across the site and develop geotechnical recommendations for the proposed development. Our scope of services for completing this geotechnical engineering study included the following:

- Site exploration consisting of test pits advanced within four locations on the property;
- Laboratory testing of soil samples obtained during subsurface exploration;
- Engineering analyses of data gathered during site exploration, and;
- Preparation of this report.

The following documents/maps were reviewed as part of our report preparation:

- Geologic Map of Washington, Northwest Quadrant, Dragovich, Logan, et al, 2002, and;
- Washington USDA Soil Conservation Survey (SCS).

Project Description

Final site design was not complete at the time of report production; however, we understand the properties will be redeveloped with three new single-family residences and associated improvements.

Given the topographic change of about 25 feet across the site, grading activities will likely involve cuts and fills up to about ten feet to establish the final design grades.

Building construction is anticipated to consist of relatively lightly loaded wood framing and slab-on-grade floors. Perimeter foundation loading is expected to range from approximately one to two kips per foot. Slab-on-grade loading is expected to be on the order of 150 pounds per square foot (psf).

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations in this report. ESNW should review the final design to confirm that the geotechnical recommendations included in this report have been incorporated into the project plans.

SITE CONDITIONS

Surface

The subject site is located on the west side of 86th Avenue Southeast, south of the intersection with Southeast 47th Street in Mercer Island, Washington. The site is comprised of a single tax parcel, and was occupied by a single-family residence at the time of report production.

The existing site topography is sloped in nature, descending from east to west, with topographic relief on the order of 25 feet across the entirety of the site. Taken overall, slope inclinations across the entirety of the site are on the order of 10 percent, with the steepest section in the western portion of the site inclined at approximately 14 percent.

Subsurface

ESNW representatives observed, logged and sampled four test pits, associated with this report. The test pits were advanced using an excavator and operator contracted by the client. The approximate location of the test pits is depicted on the Test Pit Location Plan (Plate 2). Please refer to the soil logs provided in Appendix A for a more detailed description of the subsurface conditions. Test pit TP-4 was terminated at a shallow depth due to the presence of an irrigation pipe within the test pit.

Topsoil

Topsoil was encountered at the test locations on the order off six to 14 inches in thickness. Where topsoil is encountered during site grading activities, it is not suitable for use as structural fill nor should it be mixed with material to be used as structural fill. Topsoil or otherwise unsuitable material can be used in landscaping areas if desired.

Fill

Fill soil was not encountered at the test locations during our fieldwork. Fill soil may likely be encountered surrounding the existing buildings, roads, and utility alignments, and will have to be evaluated during construction for use as structural fill.

Native Soil

Underlying the topsoil at the test locations, native soils consisting of silty sand (Unified Soil Classification, SM) were encountered. The native soils were generally observed in a medium dense grading to very dense condition. These soil types were observed extending to the maximum exploration depth of seven and one-half feet below existing grades.

Geologic Setting

The referenced geologic map resource identifies glacial till (Qvt) deposits. The referenced SCS soil survey describes Alderwood gravelly sandy loam (AgC) 8 to 15 percent slope series soils for the majority of the site; and Kitsap silt loam (KpB) 2 to 8 percent slope series soils for the western portion of the site. Alderwood series of soil is typified by loamy glacial drift over glaciomarine deposits. Whereas Kitsap series soils are typically comprised of lacustrine depositional environments. The majority of the native soil observed at the test locations are consistent with glacial till which is a component of glacial drift.

Groundwater

Groundwater seepage was not observed during the fieldwork (December 2021). Seepage can be present on sites underlain by glacial till and will typically be in a perched condition atop the unweathered till. Seepage should be expected within excavations at this site; particularly during the winter, spring, and early summer months. Groundwater seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the wetter, winter months. However, the groundwater table was not observed on the subject site.

ENVIRONMENTALLY CRITICAL AREA ASSESSMENT

As part of our report preparation, we assessed the site for potential critical areas utilizing the Mercer Island online GIS resources (critical areas maps). The subject site is not described as possessing geologic hazard areas with the exception of a historic scarp and a seismic hazard delineated for portions of the site.

The existing site topography is sloped in nature, descending from east to west, with topographic relief on the order of 25 feet across the entirety of the site. Taken overall, slope inclinations across the entirety of the site are on the order of 10 percent, with the steepest section in the western portion of the site inclined at approximately 14 percent.

The historic scarp is located on the subject site according to our review of the online GIS website provided by the City of Mercer Island. The scarp is shown bisecting the current residence, and is semi-circle in shape with the limits of the scarp described for the west side of the current residence and on the southern neighboring property. We observed no surficial signs that the scarp was active during our visual site reconnaissance.

With respect to the seismic hazard, liquefaction is a phenomenon where saturated or loose soil suddenly loses internal strength and behaves as a fluid. This behavior is in response to increased pore water pressures resulting from an earthquake or another intense ground shaking. In our opinion, site susceptibility to liquefaction may be considered negligible. The absence of a shallow groundwater table and the relative density of the native glacial till soil are the primary bases for this opinion.

DISCUSSION AND RECOMMENDATIONS

General

In our opinion, construction of the proposed structure is feasible from a geotechnical standpoint. The proposed buildings can be supported on conventional continuous and spread footing foundations bearing on competent native soils, competent existing fill, or new structural fill. Native soil capable of supporting residential foundations will be encountered at a depth of approximately two feet below existing grade in most areas. Slab-on-grade floors should be supported on competent native soil or structural fill. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material will be necessary. Recommendations for foundation design, site preparation, drainage, and other pertinent geotechnical recommendations are provided in the following sections of this study.

This study has been prepared for the exclusive use of Design Built Homes, LLC and their representatives. No warranty, expressed or implied, is made. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

Site preparation activities will involve demolition of the existing structures, site clearing and stripping, and implementation of temporary erosion control measures. The primary geotechnical considerations associated with site preparation activities include erosion control installation, building pad subgrade preparation, retaining wall construction, underground utility installations, and preparation of pavement subgrade areas.

Temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls (potentially placed over geotextile) can be considered in order to minimize off-site soil tracking and to provide a stable access entrance surface. Erosion control measures should consist of silt fencing placed along the down gradient side of the site. Soil stockpiles should be covered or otherwise protected to reduce soil erosion. Temporary sedimentation ponds or other approaches for controlling surface water runoff should be in place prior to beginning earthwork activities.

Where encountered, topsoil and organic-rich soil is not suitable for foundation support, nor is it suitable for use as structural fill. Topsoil or organic-rich soil can be used in non-structural areas if desired. Over-stripping of the site, however, should be avoided. A representative of ESNW should observe the initial stripping operations, to provide recommendations for stripping depths based on the soil conditions exposed during stripping.

Structural fill soils placed throughout foundation, slab, and pavement areas should be placed over a firm base. Loose or otherwise unsuitable areas of native soil exposed at subgrade elevations should be compacted to structural fill requirements or overexcavated and replaced with a suitable structural fill material. Where structural fill soils are used to construct foundation subgrade areas, the soil should be compacted to the requirements of structural fill described in the following section. Foundation subgrade areas should be protected from disturbance, construction traffic, and excessive moisture. Where instability develops below structural fill areas, use of a woven geotextile below the structural fill areas may be required. A representative of ESNW should observe structural fill placement in foundation, slab, and pavement areas.

The process of removing existing structures may produce voids where foundations and basements were present. Complete restoration of voids caused by the removal of existing structure must be executed as part of overall subgrade and building pad preparation activities, unless the excavation for the new building will be lower than existing basements (where present). The following guidelines for preparing building subgrade areas should be incorporated into the final design:

- Removal of the existing stem walls to an elevation where a four-foot vertical separation between the bottom of new foundations is maintained, and demolition of the slab present in the existing basement, or;

- Complete removal of all foundation elements, stem walls, footing drains, sewer and storm drainage pipes, etc. within the footprint of the existing structure.

- Where voids and related demolition disturbances extend below planned subgrade elevations, restoration of these areas should be completed. Structural fill should be used to restore voids or unstable areas resulting from the removal of existing structural improvements.

- Where pipes for stormwater and sanitary sewer are encountered, they should be plugged and abandoned.

- Recompact, or overexcavate and replace, areas of existing fill, if present, exposed at building subgrade elevations. ESNW should confirm subgrade conditions and the required level of recompaction, or overexcavation and replacement, during site preparation activities. Overexcavations should extend into competent native soils, and structural fill should be used to restore subgrades areas.

- ESNW should confirm the overall suitability of prepared subgrade areas following site preparation activities.

In-situ Soils

The soils encountered at the test sites have a moderate sensitivity to moisture and were generally in a moist condition at the time of the exploration (December 2021). In this respect, the in-situ soils may not be suitable for use as structural fill if the soil moisture content is more than about 3 percent above the optimum level at the time of construction. In general, soils encountered during the site excavations that are excessively over the optimum moisture content will require moisture conditioning prior to placement and compaction. Conversely, soils that are below the optimum moisture content will require moisture conditioning through the addition of water prior to use as structural fill. If the in-situ soils are determined to not be suitable for use as structural fill, then use of a suitable imported soil may be necessary. In our opinion, a contingency should be included in the project budget for exporting unsuitable soil and importing structural fill; or moisture conditioning recommendations can be provided upon request based on field observations during the construction phase of on-site work.

Imported Soils

Imported soil intended for use as structural fill should consist of a well graded granular soil with a moisture content that is at or near the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well graded granular soil with a fines content of 5 percent or less defined as the percent passing the #200 sieve, based on the minus three-quarter inch fraction.

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, and roadway areas. Fills placed to construct permanent slopes and throughout retaining wall and utility trench backfill areas are also considered structural fill. Soils placed in structural areas should be placed in loose lifts of 12 inches or less and compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D-1557). Additionally, more stringent compaction specifications may be required for utility trench backfill zones, depending on the responsible utility district or jurisdiction.

Foundations

Based on the results of our study, the proposed residential structures can be supported on conventional spread and continuous footings bearing on competent native soils, competent existing fill or new structural fill. Based on the soil conditions encountered at the test sites, competent native soils suitable for support of foundations should be encountered at depths of approximately two feet below existing grades. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with structural fill, may be necessary.

Provided foundations will be supported as described above, the following parameters can be used for design of new foundations:

- Allowable soil bearing capacity 2,500 psf
- Passive earth pressure 300 pcf (equivalent fluid)
- Coefficient of friction 0.40

A one-third increase in the allowable soil bearing capacity can be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of about one-half inch is anticipated. The majority of the settlements should occur during construction, as dead loads are applied.

Seismic Design Considerations

The 2018 International Building Code (2018 IBC) recognizes the most recent edition of the Minimum Design Loads for Buildings and Other Structures manual (ASCE 7-16) for seismic design, specifically with respect to earthquake loads. Based on the soil conditions encountered at the test pit locations, the parameters and values provided below are recommended for seismic design per the 2018 IBC.

Parameter	**Value**
Site Class	D*
Mapped short period spectral response acceleration, S_S (*g*)	1.438
Mapped 1-second period spectral response acceleration, S_1 (*g*)	0.499
Short period site coefficient, F_a	1.000
Long period site coefficient, F_v	1.800
Adjusted short period spectral response acceleration, S_{MS} (*g*)	1.438
Adjusted 1-second period spectral response acceleration, S_{M1} (*g*)	0.898
Design short period spectral response acceleration, S_{DS} (*g*)	0.959
Design 1-second period spectral response acceleration, S_{D1} (*g*)	0.599

* *Assumes very dense soil conditions, encountered to a maximum depth of 7.5 feet bgs during the December 2021 field exploration, remain very dense to at least 100 feet bgs. Based on our experience with the project geologic setting (glacial till) across the Puget Sound region, soil conditions are likely consistent with this assumption.*

Further discussion between the project structural engineer, the project owner (or their representative), and ESNW may be prudent to determine the possible impacts to the structural design due to increased earthquake load requirements under the 2018 IBC. ESNW can provide additional consulting services to aid with design efforts, including supplementary geotechnical and geophysical investigation, upon request.

Liquefaction is a phenomenon where saturated or loose soil suddenly loses internal strength and behaves as a fluid. This behavior is in response to increased pore water pressures resulting from an earthquake or another intense ground shaking. In our opinion, site susceptibility to liquefaction may be considered negligible. The absence of a shallow groundwater table and the dense characteristics of the native soil were the primary bases for this opinion.

Slab-On-Grade Floors

Slab-on-grade floors for the proposed buildings constructed at this site should be supported on a firm and unyielding subgrade. Where feasible, the soil exposed at the slab-on-grade subgrade level can be compacted in place to the specifications of structural fill. Unstable or yielding areas of the subgrade should be recompacted or overexcavated and replaced with suitable structural fill prior to construction of the slab. A capillary break consisting of a minimum of four inches of free draining crushed rock or gravel should be placed below the slab. The free draining material should have a fines content of 5 percent or less (percent passing the #200 sieve, based on the minus three-quarter inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the manufacturer's specifications.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters can be used for retaining wall design:

- Active earth pressure (yielding condition) — 35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 55 pcf
- Traffic surcharge for passenger vehicles (where applicable) — 70 psf (rectangular distribution)
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.40
- Seismic surcharge (active condition) — 8H (where H equals retained height)

Additional surcharge loading from adjacent foundations, sloped backfill, or other loads should be included in the retaining wall design. Drainage should be provided behind retaining walls such that hydrostatic pressures do not develop. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Retaining walls should be backfilled with free draining material that extends along the height of the wall, and a distance of at least 18 inches behind the wall. The upper one foot of the wall backfill can consist of a less permeable soil, if desired. A perforated drain pipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3.

Drainage

Seepage will likely be encountered in excavations on the site, particularly during winter, spring, and early summer months. Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and to provide recommendations to reduce the potential for instability related to seepage effects.

Finish grades must slope away from the building at an inclination of at least 2 percent for a distance of at ten feet or as adjacent building setbacks allow. In addition, surface water should be controlled utilizing best management practices (BMP) during, and after, construction on the subject site.

Footing drains should be installed given the nature of the soils on the site. A typical foundation drain detail for footings not placed directly against shoring is provided as Plate 4.

Infiltration Evaluation

The subject site is underlain by glacial till deposits within the proposed infiltration location, based on our observation of the subsurface conditions. The soil underlying the site consists of dense to very dense glacial till. These soils typically have very low or negligible infiltration capacity.

A Pilot Infiltration Test (PIT) was performed in test pit TP-2 at a depth of four feet below existing grades. No infiltration was observed during the test procedure.

Based on our experience targeted infiltration such as permeable pavement may be feasible on the subject site given a one-foot vertical separation is maintained from the cemented glacial till material present on the site. Additionally, where limited infiltration is employed, overflow should be considered such as underdrains in permeable pavement areas.

Excavations and Slopes

The Federal Occupation Safety and Health Administration (OSHA) and the Washington Industrial Safety and Health Act (WISHA) provide soil classification in terms of temporary slope inclinations. Based on the soil conditions encountered at the test locations, existing fill, loose native soil and any soil where groundwater seepage is exposed, are classified as Type C by OSHA/WISHA. Temporary slopes over four feet in height in Type C soils must be sloped no steeper than 1.5H:1V (Horizontal:Vertical). The presence of perched groundwater may cause caving of the temporary slopes due to hydrostatic pressure. The native silty sand glacial till soils observed are classified as Type A. Temporary slopes over four feet in height in Type A soils must be sloped no steeper than 0.75H:1V. Temporary excavations with inclinations steeper than those described may be acceptable from a geotechnical standpoint. ESNW should be consulted during the design phase to provide recommendations for steeper temporary excavations if necessary. ESNW should observe site excavations to confirm the soil type and allowable slope inclination. If the recommended temporary slope inclination cannot be achieved, temporary shoring may be necessary to support excavations. Additionally, due to the presence of slopes on the subject site, slope surcharging should be taken into consideration when planning open cuts.

Permanent slopes should maintain a gradient of 2H:1V, or flatter, and should be planted with vegetation to enhance stability and to minimize erosion. A representative of ESNW should observe temporary and permanent slopes to confirm the slope inclinations, and to provide additional excavation and slope recommendations, as necessary.

Utility Support and Trench Backfill

In our opinion, the soils anticipated to be exposed in utility excavations should generally be suitable for support of utilities. Organic or highly compressible soils encountered in the trench excavations should not be used for supporting utilities. The on-site soil may not be suitable for use as trench backfill if the soil moisture content is too high at the time of compaction. Utility trench backfill should be placed and compacted to the specifications of structural fill provided in this report, or to the applicable City of Mercer Island specifications. Seepage should be anticipated within utility trench excavations.

LIMITATIONS

The recommendations and conclusions provided in this geotechnical engineering study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is not expressed or implied. Variations in the soil and groundwater conditions observed at the test locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions in this geotechnical engineering study if variations are encountered.

Additional Services

ESNW should have an opportunity to review the final design with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services during construction.

NORTH

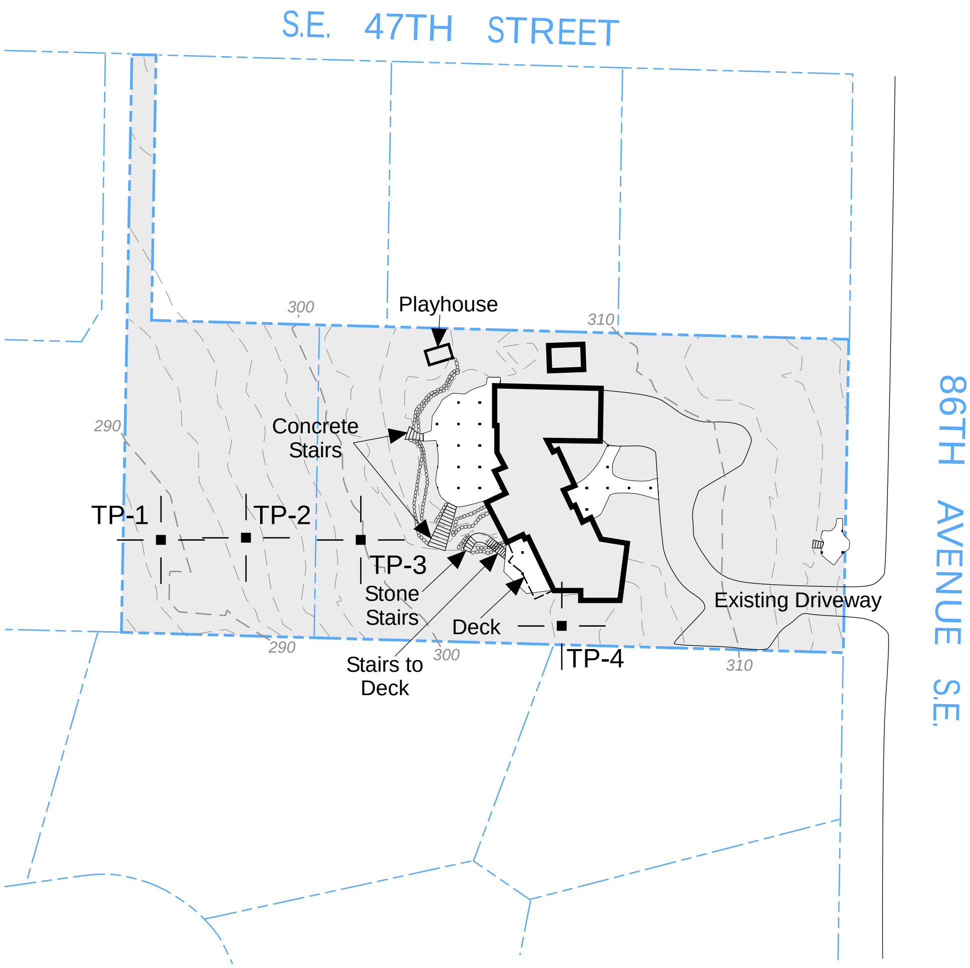
Reference:
King County, Washington
OpenStreetMap.org

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Lorenzini Short Plat
Mercer Island, Washington

Drwn. CAM	Date 01/12/2022	Proj. No. 8009.01
Checked BCS	Date Jan. 2022	Plate 1



LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-8009.01, Dec. 2021

Subject Site

Existing Building

Concrete

Rockery

NORTH

1"=80'

0 40 80 160

Scale in Feet

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

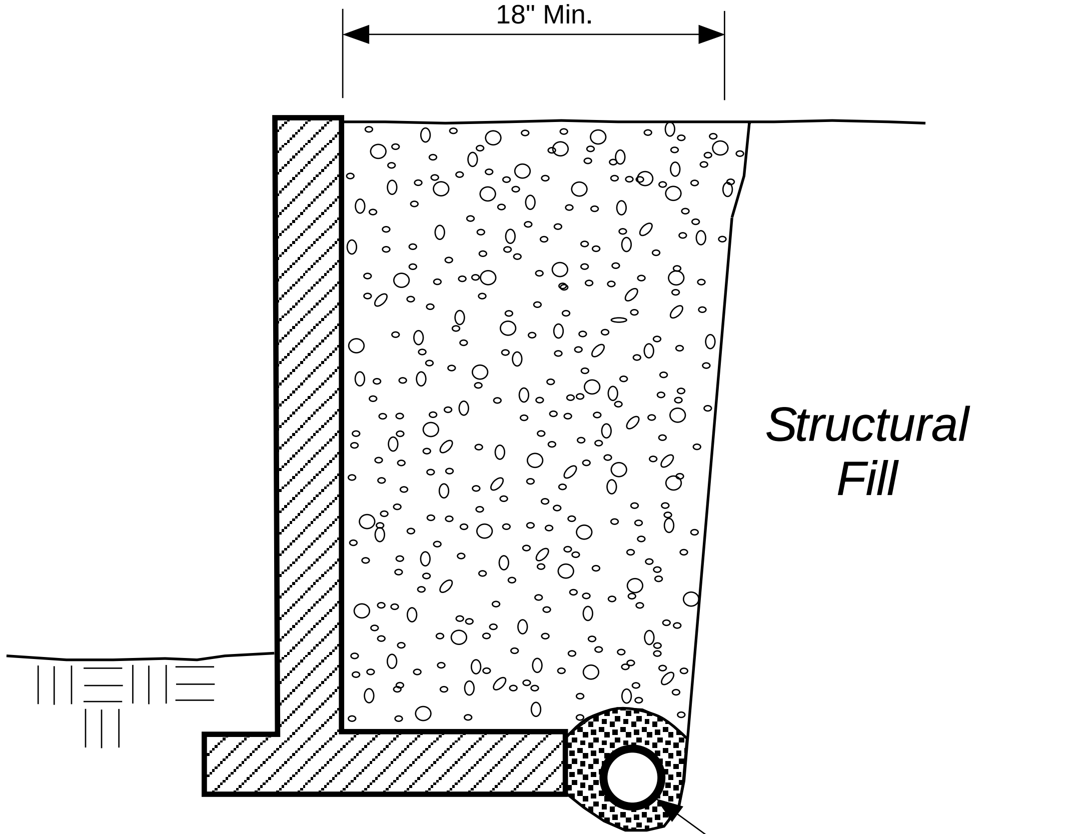
Earth Solutions NW LLC

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Test Pit Location Plan
Lorenzini Short Plat
Mercer Island, Washington

Drwn. CAM	Date 01/12/2022	Proj. No. 8009.01
Checked BCS	Date Jan. 2022	Plate 2

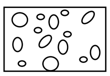


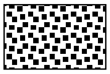
NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

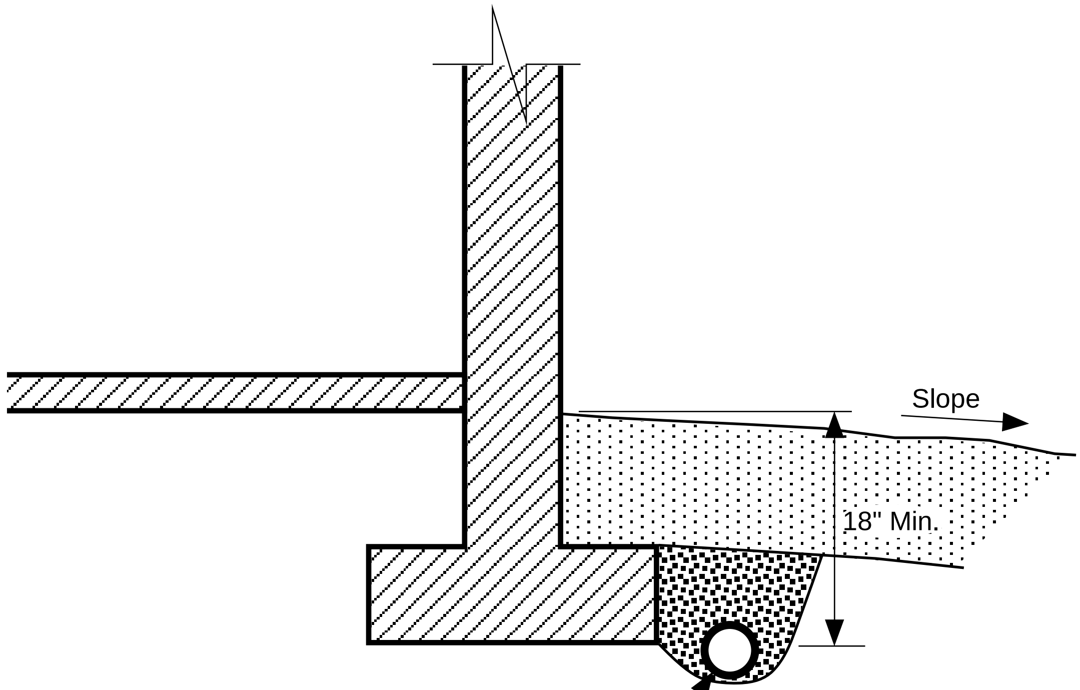

Free-draining Structural Backfill


1-inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Retaining Wall Drainage Detail
Lorenzini Short Plat
Mercer Island, Washington

Drwn. CAM	Date 01/12/2022	Proj. No. 8009.01
Checked BCS	Date Jan. 2022	Plate 3



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

LEGEND:

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Footing Drain Detail
Lorenzini Short Plat
Mercer Island, Washington

Drwn. CAM	Date 01/12/2022	Proj. No. 8009.01
Checked BCS	Date Jan. 2022	Plate 4

Appendix A

Subsurface Exploration
Test Pit Logs

ES-8009.01

The subsurface conditions at the site were explored by excavating a total of four test pits across accessible portions of the property. The subsurface explorations were completed in December of 2021. The approximate test locations are illustrated on Plate 2 of this report. Logs of the test pits are provided in this Appendix. The test pits were excavated to a maximum depth of seven and one-half feet below existing grades.

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

PROJECT NUMBER ES-8009.01
PROJECT NAME Lorenzini Short Plat
DATE STARTED 12/22/21 **COMPLETED** 12/22/21
GROUND ELEVATION 289 ft
EXCAVATION CONTRACTOR Client Provided
LATITUDE 47.56128 **LONGITUDE** -122.22549
EXCAVATION METHOD
GROUND WATER LEVEL:
LOGGED BY BCS **CHECKED BY** SHA
▽ **AT TIME OF EXCAVATION**
NOTES Depth of Topsoil & Sod 10"-12": lawn grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		Dark brown TOPSOIL	
1.0						288.0
		MC = 16.6%	SM		Brown silty SAND, medium dense, moist to wet -becomes gray -sparse gravel -moderate iron oxide staining	
		MC = 13.3%			-becomes very dense, weakly cemented	
5						
7.5		MC = 16.3% Fines = 35.6%			[USDA Classification: slightly gravelly sandy LOAM]	281.5

Test pit terminated at 7.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
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TEST PIT NUMBER TP-2

PROJECT NUMBER ES-8009.01
PROJECT NAME Lorenzini Short Plat
DATE STARTED 12/22/21 **COMPLETED** 12/22/21
GROUND ELEVATION 293 ft
EXCAVATION CONTRACTOR Client Provided
LATITUDE 47.56129 **LONGITUDE** -122.22542
EXCAVATION METHOD
GROUND WATER LEVEL:
LOGGED BY BCS **CHECKED BY** SHA
∇ **AT TIME OF EXCAVATION**
NOTES Depth of Topsoil & Sod ~14": lawn grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL		Dark brown TOPSOIL	
				1.2		291.8
			SM		Brown silty SAND, medium dense to dense, moist to wet	
		MC = 17.6%				
					-becomes gray	
					-becomes very dense, light to moderate iron oxide staining, weak cementation	
		MC = 14.2% Fines = 35.5%			-infiltration test at 4' [USDA Classification: gravelly sandy LOAM]	
5						
		MC = 10.0%				
		MC = 10.9%		7.0		286.0
					Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.	

Earth Solutions NW, LLC
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TEST PIT NUMBER TP-3

PROJECT NUMBER ES-8009.01
PROJECT NAME Lorenzini Short Plat
DATE STARTED 12/22/21 **COMPLETED** 12/22/21
GROUND ELEVATION 300 ft
EXCAVATION CONTRACTOR Client Provided
LATITUDE 47.56127 **LONGITUDE** -122.22519
EXCAVATION METHOD
GROUND WATER LEVEL:
LOGGED BY BCS **CHECKED BY** SHA
▽ **AT TIME OF EXCAVATION**
NOTES Depth of Topsoil & Sod 6"-8": lawn grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			TPSL	0.8	Dark brown TOPSOIL -large 4" diameter tree roots	299.2
		MC = 16.8% Fines = 33.7%	SM		Brown silty SAND with gravel, medium dense, moist to wet [USDA Classification: gravelly fine sandy LOAM]	
					-becomes gray dense	
		MC = 11.7%			-becomes very dense, weakly cemented	
5						
		MC = 12.7%		6.0		294.0

Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Earth Solutions NW, LLC
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Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

PROJECT NUMBER ES-8009.01
PROJECT NAME Lorenzini Short Plat
DATE STARTED 12/22/21 **COMPLETED** 12/22/21
GROUND ELEVATION 302 ft
EXCAVATION CONTRACTOR Client Provided
LATITUDE 47.56118 **LONGITUDE** -122.2249
EXCAVATION METHOD
GROUND WATER LEVEL:
LOGGED BY BCS **CHECKED BY** SHA
▽ **AT TIME OF EXCAVATION**
NOTES Depth of Topsoil & Sod 12": lawn grass

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION	Elevation
0			TPSL		1.0	Dark brown TOPSOIL	301.0
		MC = 14.1%	SM		1.5	Gray silty SAND, very dense, moist to wet -moderate to heavy iron oxide staining, weakly cemented	300.5

Test pit terminated at 1.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

Appendix B

Laboratory Test Results

ES-8009.01

Earth Solutions NW, LLC
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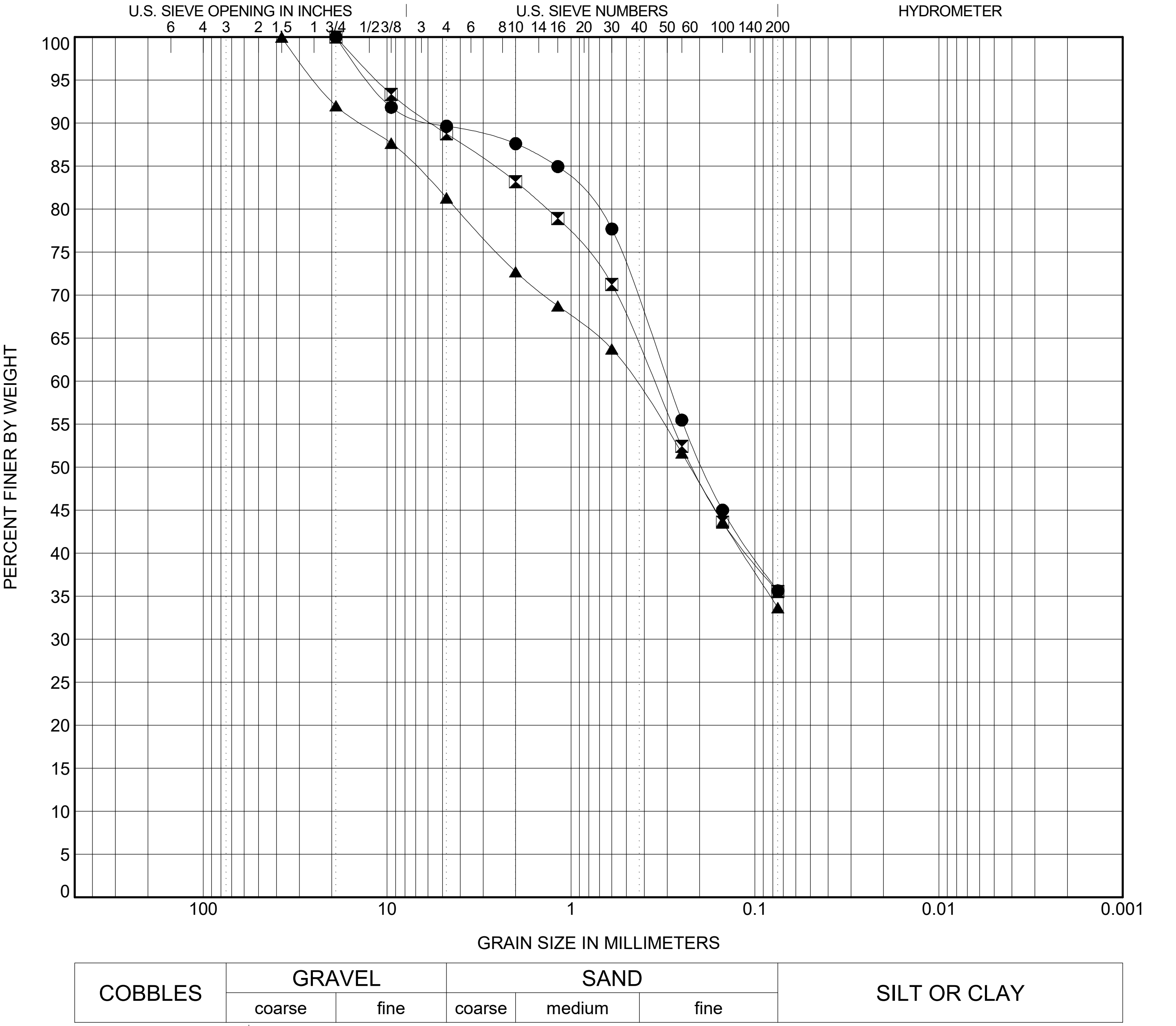
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-8009.01 **PROJECT NAME** Lorenzini Short Plat



Specimen Identification			Classification	Cc	Cu
●	**TP-01**	**7.50ft.**	**USDA: Gray Slightly Gravelly Sandy Loam. USCS: SM.**		
⧗	**TP-02**	**4.00ft.**	**USDA: Gray Gravelly Sandy Loam. USCS: SM.**		
▲	**TP-03**	**1.00ft.**	**USDA: Brown Gravelly Fine Sandy Loam. USCS: SM with Gravel.**		

Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**TP-01**	**7.5ft.**	**19**	**0.299**						**35.6**	
⧗	**TP-02**	**4.0ft.**	**19**	**0.355**						**35.5**	
▲	**TP-03**	**1.0ft.**	**37.5**	**0.457**						**33.7**	

Report Distribution

ES-8009.01

<u>EMAIL ONLY</u> **Design Built Homes, LLC**
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Attention: Mr. Todd Sherman