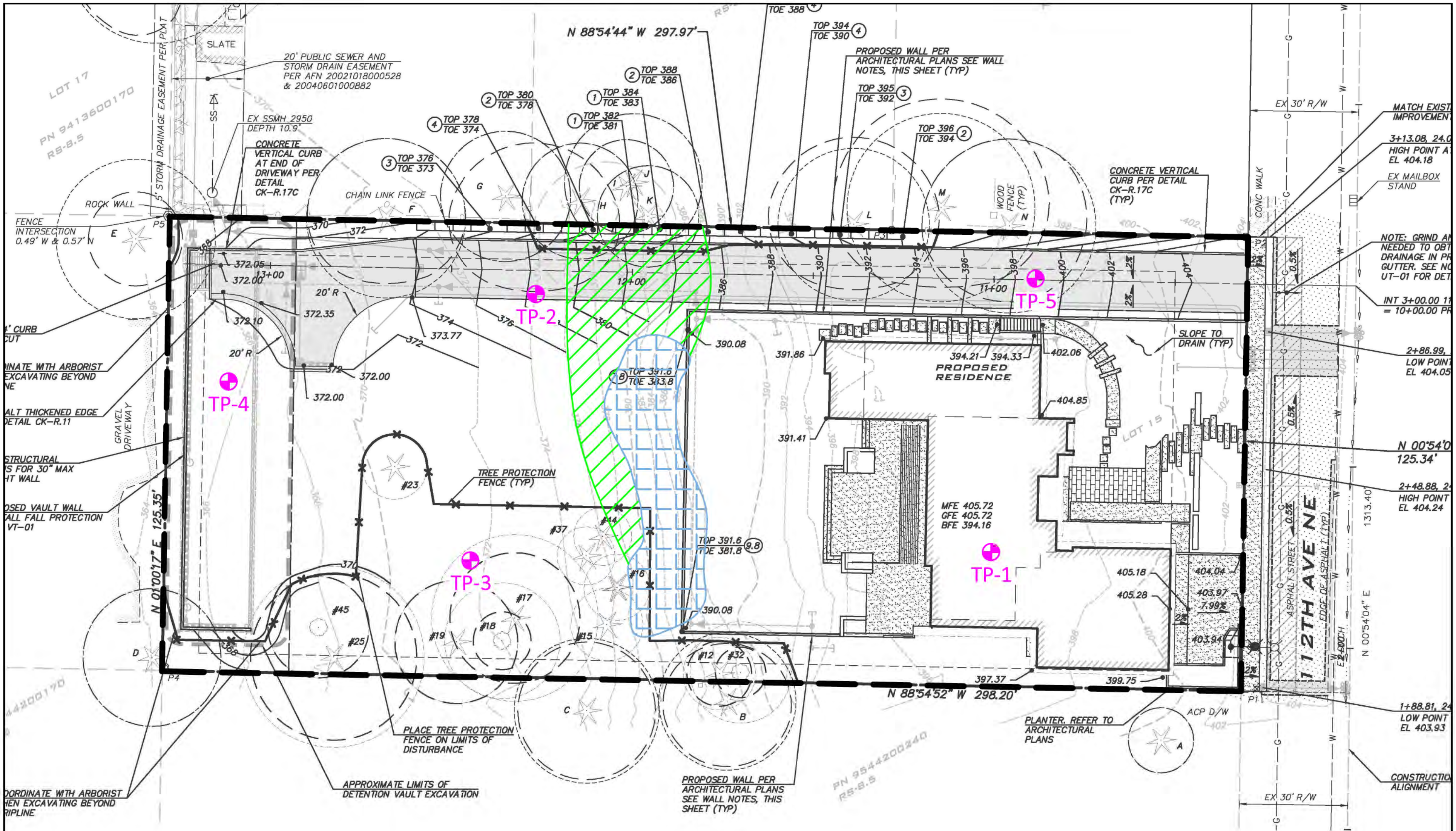

= Slope > 40%

= Slope > 15%

= Test probe by RGI, 5/10/18

= Site boundary

Approximate Scale: 1"=40'

0 20 40 80

N

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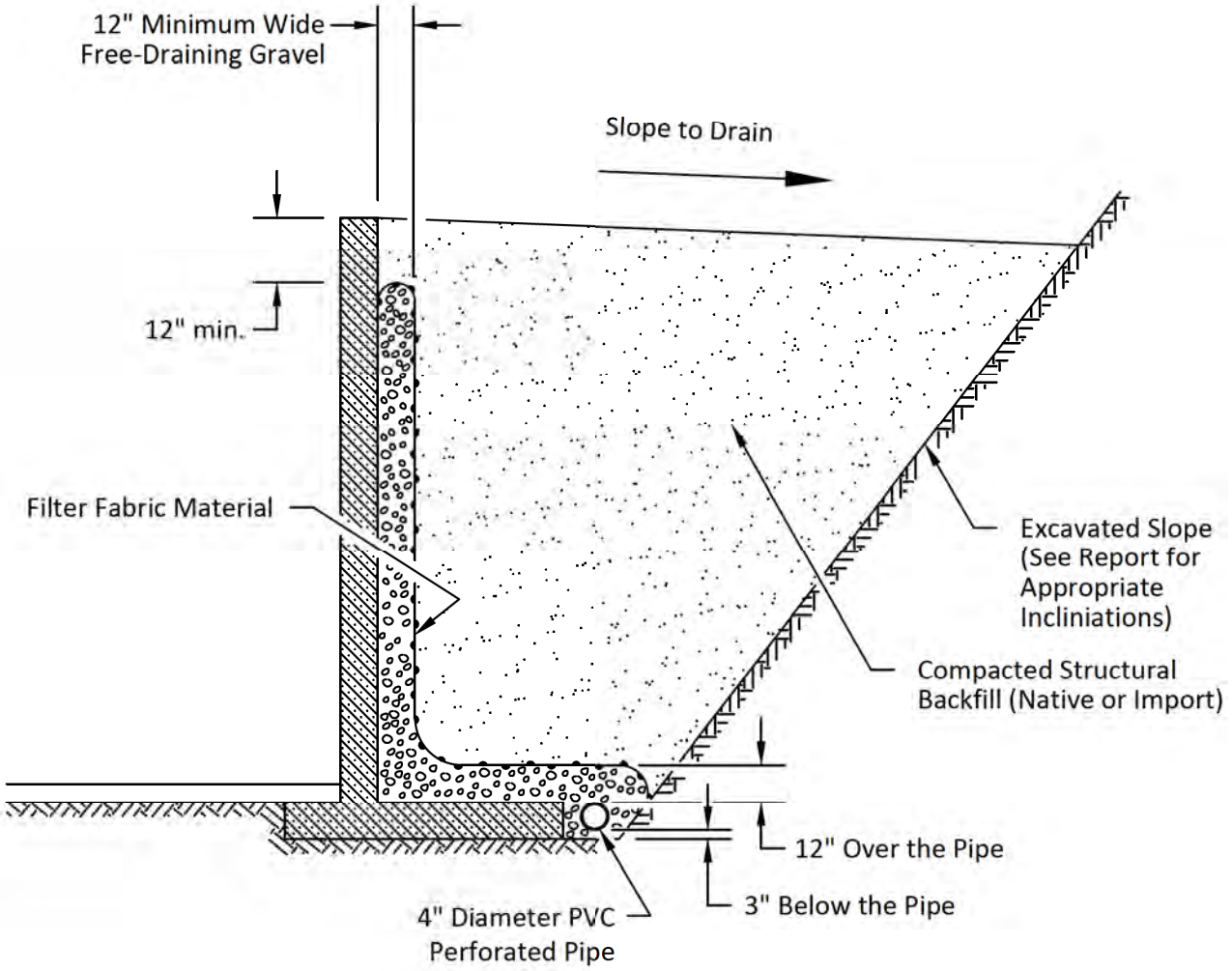
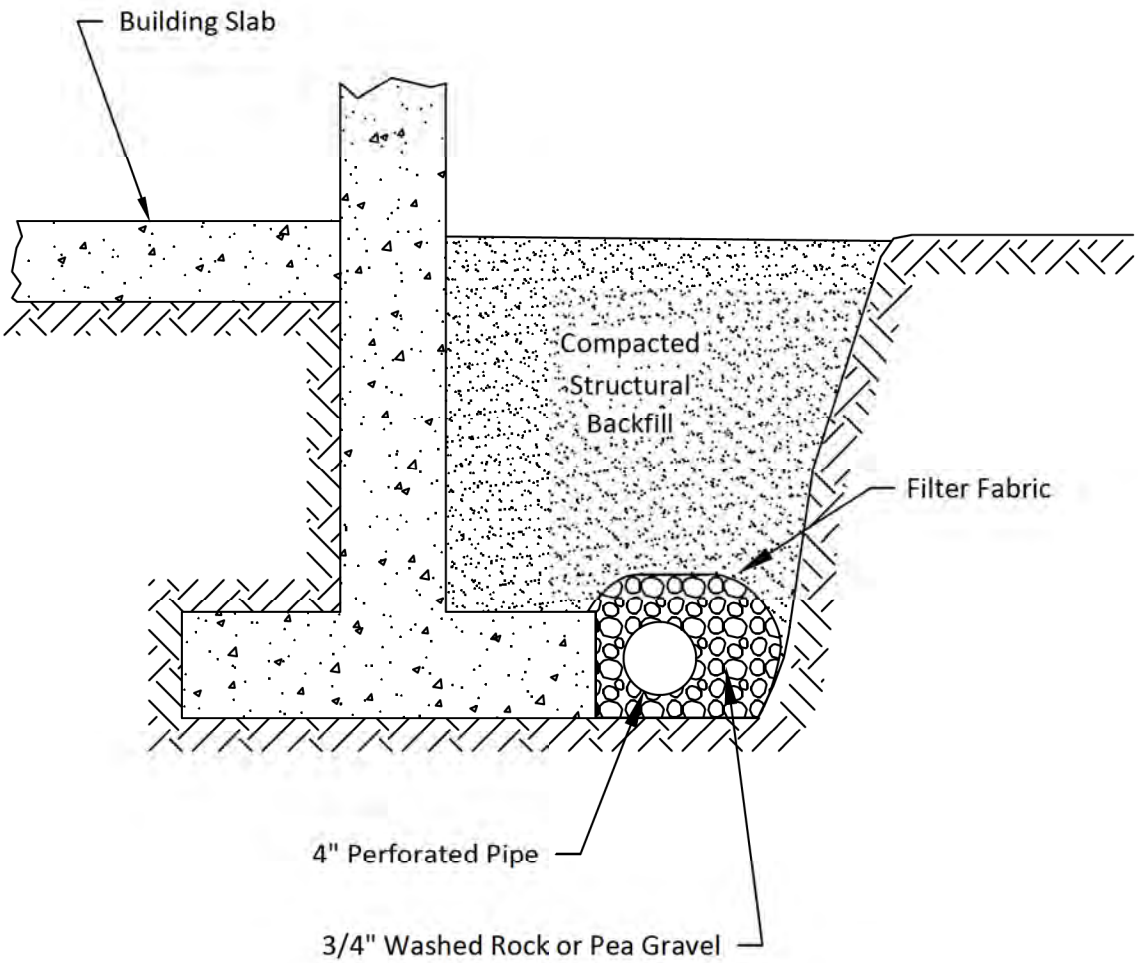
Blueprint 112th		Figure 2
RGI Project Number 2018-122	Geotechnical Exploration Plan	Date Drawn: 04/2020
Address: 4559 112th Avenue Northeast, Kirkland, Washington 98033		



Not to Scale

Corporate Office 17522 Bothell Way Northeast Bothell, Washington 98011 Phone: 425.415.0551 Fax: 425.415.0311	Blueprint 112th	Figure 3
	RGI Project Number 2018-122	Retaining Wall Drainage Detail Date Drawn: 04/2020
	Address: 4559 112th Avenue Northeast, Kirkland, Washington 98033	



Not to Scale

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Blueprint 112th		Figure 4
RGI Project Number 2018-122	Typical Footing Drain Detail	Date Drawn: 04/2020
Address: 4559 112th Avenue Northeast, Kirkland, Washington 98033		

APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING

On May 10, 2018, RGI performed field explorations using limited access equipment including a pneumatic jack-hammer to drive the steel soil probe rods. We explored subsurface soil conditions at the site by observing the boring of 5 test direct push test probes to a maximum depth of 12 feet below existing grade. The test probes locations are shown on Figure 2. The test probes locations were approximately determined by measurements from existing property lines and paved roads.

A geologist from our office conducted the field exploration and classified the soil conditions encountered, maintained a log of each test exploration, obtained representative soil samples, and observed pertinent site features. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS).

Representative soil samples obtained from the explorations were placed in closed containers and taken to our laboratory for further examination and testing. As a part of the laboratory testing program, the soil samples were classified in our in house laboratory based on visual observation, texture, plasticity, and the limited laboratory testing described below.

Moisture Content Determinations

Moisture content determinations were performed in accordance with ASTM D2216-10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass (ASTM D2216) on representative samples obtained from the exploration in order to aid in identification and correlation of soil types. The moisture content of typical sample was measured and is reported on the test probes logs.

Grain Size Analysis

A grain size analysis indicates the range in diameter of soil particles included in a particular sample. Grain size analyses was determined using D6913-04(2009) Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis (ASTM D6913) on two of the samples.

Project Name: **Blueprint 112th** Project Number: **2018-122** Client: **Blueprint Capital Services, LLC**	RILEYGROUP **Test Probe No.: TP-1** **Sheet 1 of 1**

Date(s) Drilled: **05/10/18**	Logged By: **LC**	Surface Conditions: **Top Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type:	Total Depth of Borehole: **12 feet bgs**
Drill Rig Type: **Geoprobe**	Drilling Contractor: **Standard Probe**	Approximate Surface Elevation: **n/a**
Groundwater Level: **Not encountered**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Native Soil**	Location: **4559 112th Avenue Northeast, Kirkland, Washington 98033**	

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Brown, silty SAND with gravel and organics, medium dense, moist (fill)	
						Brown, silty SAND with some gravel, very dense, moist, heavily mottled	
					5		
						Brown, SILT with sand, stiff, moist	
					10		
						Test probe terminated 12 feet bgs No groundwater encountered	
					15		

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Project Name: **Blueprint 112th** Project Number: **2018-122** Client: **Blueprint Capital Services, LLC**	RILEYGROUP **Test Probe No.: TP-2** **Sheet 1 of 1**

Date(s) Drilled: **05/10/18**	Logged By: **LC**	Surface Conditions: **Top Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type:	Total Depth of Borehole: **11 feet bgs**
Drill Rig Type: **Geoprobe**	Drilling Contractor: **Standard Probe**	Approximate Surface Elevation: **n/a**
Groundwater Level: **Not encountered**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Native Soil**	Location: **4559 112th Avenue Northeast, Kirkland, Washington 98033**	

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Dark brown, silty SAND (top soil)	
						Brown, silty, gravelly SAND, medium dense, moist	
					5		
						Some mottling, density increases	
					10		
						Test probe terminated 11 feet bgs	
						No groundwater encountered	
					15		

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Project Name: **Blueprint 112th** Project Number: **2018-122** Client: **Blueprint Capital Services, LLC**	RILEYGROUP **Test Probe No.: TP-3** **Sheet 1 of 1**

Date(s) Drilled: **05/10/18**	Logged By: **LC**	Surface Conditions: **Top Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type:	Total Depth of Borehole: **11 feet bgs**
Drill Rig Type: **Geoprobe**	Drilling Contractor: **Standard Probe**	Approximate Surface Elevation: **n/a**
Groundwater Level: **6.7'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Native Soil**	Location: **4559 112th Avenue Northeast, Kirkland, Washington 98033**	

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Top soil	
						Brown, silty, gravelly SAND, loose to medium dense, moist	
					5		
				▽		Density increases	
					10		
						Test probe terminated 11 feet bgs	
						Groundwater encountered 6.7 feet bgs	
					15		

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Project Name: **Blueprint 112th**
Project Number: **2018-122**
Client: **Blueprint Capital Services, LLC**

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Test Probe No.: TP-4

Sheet 1 of 1

Date(s) Drilled: **05/10/18**	Logged By: **LC**	Surface Conditions: **Top Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type:	Total Depth of Borehole: **11 feet bgs**
Drill Rig Type: **Geoprobe**	Drilling Contractor: **Standard Probe**	Approximate Surface Elevation: **n/a**
Groundwater Level: **6.5'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Native Soil**	Location: **4559 112th Avenue Northeast, Kirkland, Washington 98033**	

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Top soil	
						Brown, silty, gravelly SAND, loose to medium dense, moist	
					5		
				▽			
						Density increases	
					10		
						Test probe terminated 11 feet bgs	
						Groundwater encountered 6.5 feet bgs	
					15		

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Project Name: **Blueprint 112th**
Project Number: **2018-122**
Client: **Blueprint Capital Services, LLC**

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Test Probe No.: TP-5

Sheet 1 of 1

Date(s) Drilled: **05/10/18**	Logged By: **LC**	Surface Conditions: **Top Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type:	Total Depth of Borehole: **6 feet bgs**
Drill Rig Type: **Geoprobe**	Drilling Contractor: **Standard Probe**	Approximate Surface Elevation: **n/a**
Groundwater Level: **6.5'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Native Soil**	Location: **4559 112th Avenue Northeast, Kirkland, Washington 98033**	

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Top soil	
						Brown, silty SAND with some gravel, dense to very dense, moist (lodgement till)	
					5		
						Test probe terminated 6 feet bgs	
						No groundwater encountered	
					10		
					15		

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Project Name: **Blueprint 112th**
Project Number: **2018-122**
Client: **Blueprint Capital Services, LLC**

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Boring Log Key

Sheet 1 of 1

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
1	2	3	4	5	6	7	8

COLUMN DESCRIPTIONS

1. PID Reading, ppm: The reading from a photo-ionization detector, in parts per million.
2. Sample ID: Sample identification number.
3. Sample Type: Type of soil sample collected at the depth interval shown.
4. Recovery (percent): Percent Recovery
5. GW Depth: Groundwater depth in feet below the ground surface.
6. Depth (feet): Depth in feet below the ground surface.
7. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
8. Graphic Log: Graphic depiction of the subsurface material encountered.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

SILT, SILT w/SAND, SANDY SILT (ML)
Silty SAND (SM)
Poorly graded SAND with Silt (SP-SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

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17522 Bothell Way NE
Bothell, WA 98011

PHONE: (425) 415-0551
FAX: (425) 415-0311

GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Blueprint 112th - Hydro		SAMPLE ID/TYPE	TP1	Soil
PROJECT NO.	2018-122		SAMPLE DEPTH	3'	
TECH/TEST DATE	LC 5/24		DATE RECEIVED	5/21/2018	

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	620.1
Wt Dry Soil & Tare (gm)	(w2)	554.9
Weight of Tare (gm)	(w3)	15.7
Weight of Water (gm)	(w4=w1-w2)	65.2
Weight of Dry Soil (gm)	(w5=w2-w3)	539.2
Moisture Content (%)	(w4/w5)*100	12

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

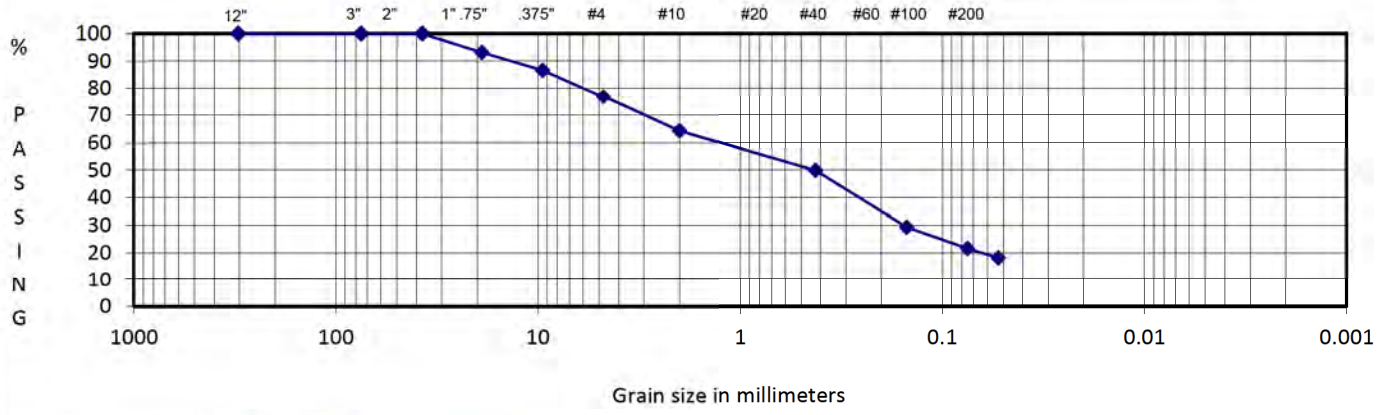
Weight Of Sample (gm)		554.9
Tare Weight (gm)		15.7
(W6) Total Dry Weight (gm)		539.2

% COBBLES	0.0
% C GRAVEL	6.8
% F GRAVEL	16.4
% C SAND	12.5
% M SAND	14.4
% F SAND	28.3
% FINES	21.6
% TOTAL	100.0

D10 (mm)	
D30 (mm)	
D60 (mm)	
Cu	
Cc	

SIEVE ANALYSIS

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	15.7	0.00	0.00	100.00	cobbles
3.0"	15.7	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"	15.7	0.00	0.00	100.00	coarse gravel
1.5"	15.7	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	52.2	36.50	6.77	93.23	fine gravel
0.50"					fine gravel
0.375"	87.4	71.70	13.30	86.70	fine gravel
#4	140.5	124.80	23.15	76.85	coarse sand
#10	208.0	192.30	35.66	64.34	medium sand
#20					medium sand
#40	285.5	269.80	50.04	49.96	fine sand
#60					fine sand
#100	396.7	381.00	70.66	29.34	fine sand
#200	438.2	422.50	78.36	21.64	fine sand
#270	456.5	440.80	81.75	18.25	fine sand



DESCRIPTION	Silty SAND with some gravel.
USCS	SM

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Bothell, WA 98011

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FAX: (425) 415-0311

GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Blueprint 112th - Hydro		SAMPLE ID/TYPE	TP3	Soil
PROJECT NO.	2018-122		SAMPLE DEPTH	3'	
TECH/TEST DATE	LC 5/24		DATE RECEIVED	5/21/2018	

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	854.0
Wt Dry Soil & Tare (gm)	(w2)	773.0
Weight of Tare (gm)	(w3)	15.7
Weight of Water (gm)	(w4=w1-w2)	81.0
Weight of Dry Soil (gm)	(w5=w2-w3)	757.3
Moisture Content (%)	(w4/w5)*100	11

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

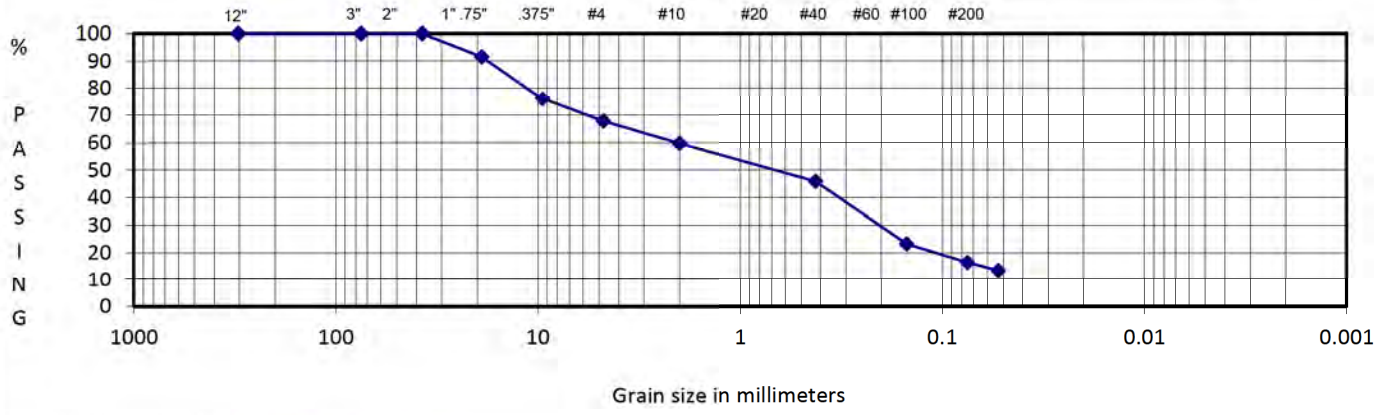
Weight Of Sample (gm)		773.0
Tare Weight (gm)		15.7
(W6) Total Dry Weight (gm)		757.3

% COBBLES	0.0
% C GRAVEL	8.5
% F GRAVEL	23.7
% C SAND	8.0
% M SAND	13.8
% F SAND	29.6
% FINES	16.4
% TOTAL	100.0

D10 (mm)	0.03
D30 (mm)	0.21
D60 (mm)	2
Cu	66.7
Cc	0.7

SIEVE ANALYSIS

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	15.7	0.00	0.00	100.00	cobbles
3.0"	15.7	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"	15.7	0.00	0.00	100.00	coarse gravel
1.5"	15.7	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	79.9	64.20	8.48	91.52	fine gravel
0.50"					fine gravel
0.375"	197.4	181.70	23.99	76.01	fine gravel
#4	259.6	243.90	32.21	67.79	coarse sand
#10	320.5	304.80	40.25	59.75	medium sand
#20					medium sand
#40	424.7	409.00	54.01	45.99	fine sand
#60					fine sand
#100	597.1	581.40	76.77	23.23	fine sand
#200	648.6	632.90	83.57	16.43	fine sand
#270	670.1	654.40	86.41	13.59	fine sand



DESCRIPTION	Silty gravelly SAND.
USCS	SM

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June 5, 2018

Darin Granger
Blueprint Capital Services, LLC
4147 California Avenue Southwest
Seattle, Washington 98116

Subject: **LID Infiltration Feasibility Study**
Blueprint 112th Avenue Northeast Site
4559 112th Avenue Northeast
Kirkland, Washington
RGI Project No. 2018-122

Dear Mr. Granger:

As requested, The Riley Group, Inc. (RGI) is pleased to provide the results of our recent subsurface characterization services at 4559 112th Ave Northeast in Kirkland, Washington (Figure 1).

Subsurface Conditions

RGI observed the completion of five direct push test probe borings (TP-1, TP-2, TP-3, TP-4, and TP-5) to assess shallow subsurface soil and groundwater conditions for potential infiltration of stormwater. The test probes were completed using subcontracted geoprobe services provided by Standard Probe. The test probes were completed using a limited access equipment including a pneumatic jack-hammer to drive the steel soil probe rods. The probe rods were extracted with pneumatic jacks and soil cores extruded. Temporary PVC casings with slotted screen were installed to determine if groundwater was present and at what depths below grade. The temporary casings were removed and the soil borings backfilled with bentonite upon completion. The location of the five test probe borings are shown on Figure 2. Soil samples were collected and returned to our office for grain size analyses.

Review of the *Geologic Map of Kirkland Quadrangle, Washington,* by James Minard (1983) indicates that the soil in the project vicinity is mapped as Vashon-age advance outwash (Qva), which is a nonsorted mixture of dense sand with varying amounts of silt, gravel and cobbles.

Soil conditions were variable across the Site. On the eastern portion of the Site soil conditions encountered in test probes TP-1 and TP-5 consists of very dense silty sand interpreted to be Vashon-age lodgment till to a depth of approximately 8 feet, a brown silt unit was encountered below the lodgment till in test probe TP-1.

On the western portion of the Site silty sand and silty gravelly sand were encountered. All there test probes completed on the western portion of the property (TP-2, TP-3, and TP-4) were completed to a depth of 11 feet below existing grade. The silty sand and silty gravelly sand unit extended to the depths explored. Groundwater was encountered at approximately 6.5 feet on

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the western portion of the Site.

Infiltration Feasibility

Infiltration feasibility was evaluated under City of Kirkland Department of Public Works Pre-Approved Plans Policy: Policy D-8 "Soil Information for Stormwater Development to Meet Flow Control BMP Requirements". Site soil types were logged in the field per ASTM D-2487 soil description protocol. As described above lodgment till soils encountered on the eastern portion of the Site falls under the ASTM silty sand soil classification. Grain size analyses of the lodgment till falls under the USDA soil classification for loamy sand which meets the City of Kirkland soil textural requirement of Sand, Loam, Sandy Loam or Loamy Sand for stormwater Best Management Practices. However the very dense nature of the lodgment till soils will limit the infiltration potential.

The silty sand and silty gravelly sand encountered on the western portion of the Site fall under the the USDA soil classification for loamy sand which meets the City of Kirkland soil textural requirement of Sand, Loam, Sandy Loam or Loamy Sand for stormwater Best Management Practices.

Project Limitations

This report is the property of Blueprint Capital Services, LLC and their authorized representatives or affiliates and was prepared in a manner consistent with the level of skill and care ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. This report is intended for specific application to the property located at 4559 112th Avenue Northeast, Kirkland, Washington. No other warranty, expressed or implied, is made. Please call us at (425) 415-0551 if you have any questions or need additional information.

Respectfully submitted,

THE RILEY GROUP, INC.

David J. Baumgarten, LHG
Hydrogeologist

Attachments: Figure 1, Site Vicinity Map
Figure 2, Site Plan with Test Probe Locations
Test Probe Logs
Grain Size Analysis

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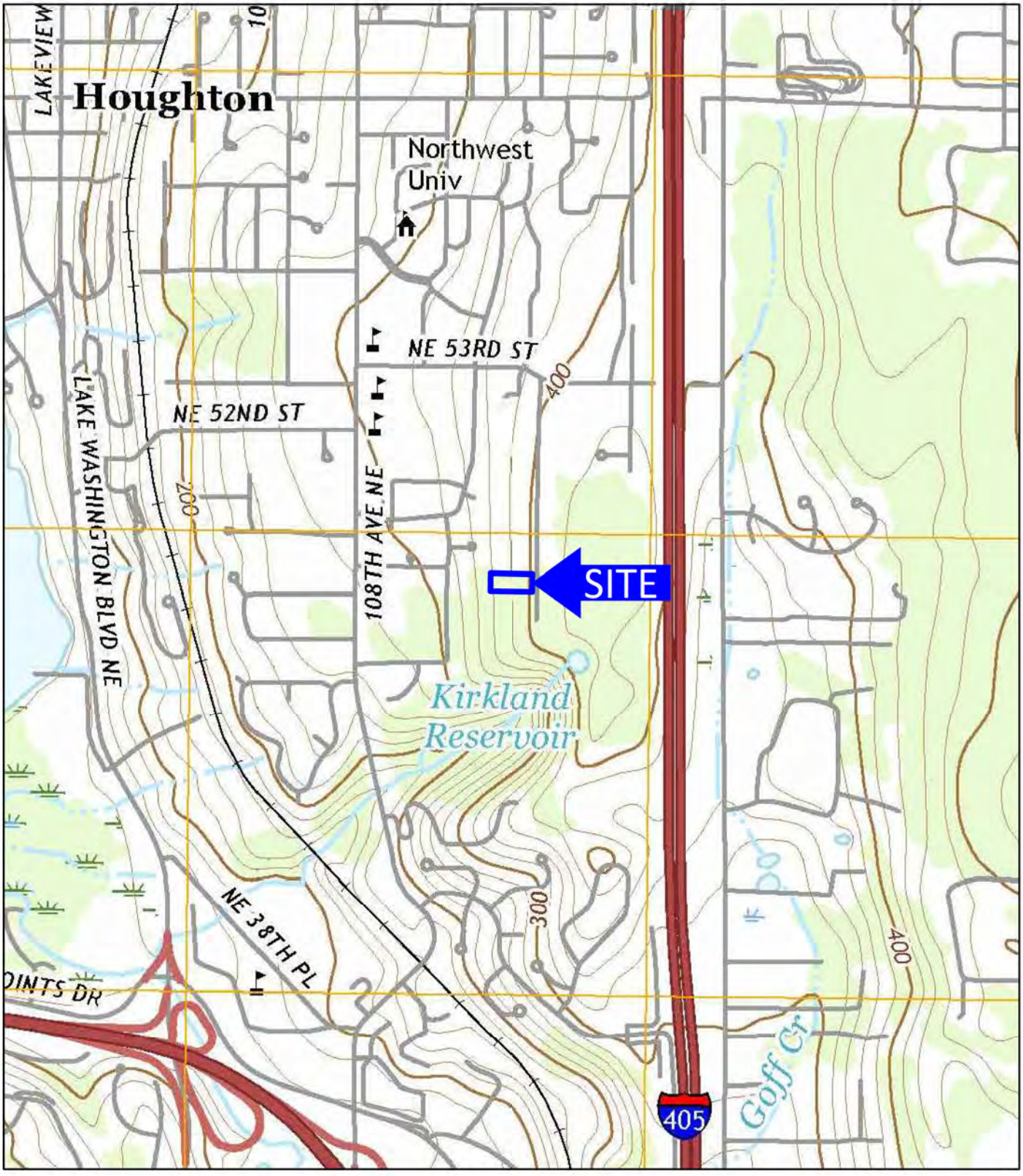

USGS, 2017, Kirkland, Washington
7.5-Minute Quadrangle

Approximate Scale: 1"=1000'
0 500 1000 2000
N

Corporate Office 17522 Bothell Way Northeast Bothell, Washington 98011 Phone: 425.415.0551 Fax: 425.415.0311	Blueprint 112th	Figure 1
	RGI Project Number 2018-122	Site Vicinity Map Date Drawn: 05/2018
	Address: 4559 112th Avenue Northeast, Kirkland, Washington 98033	

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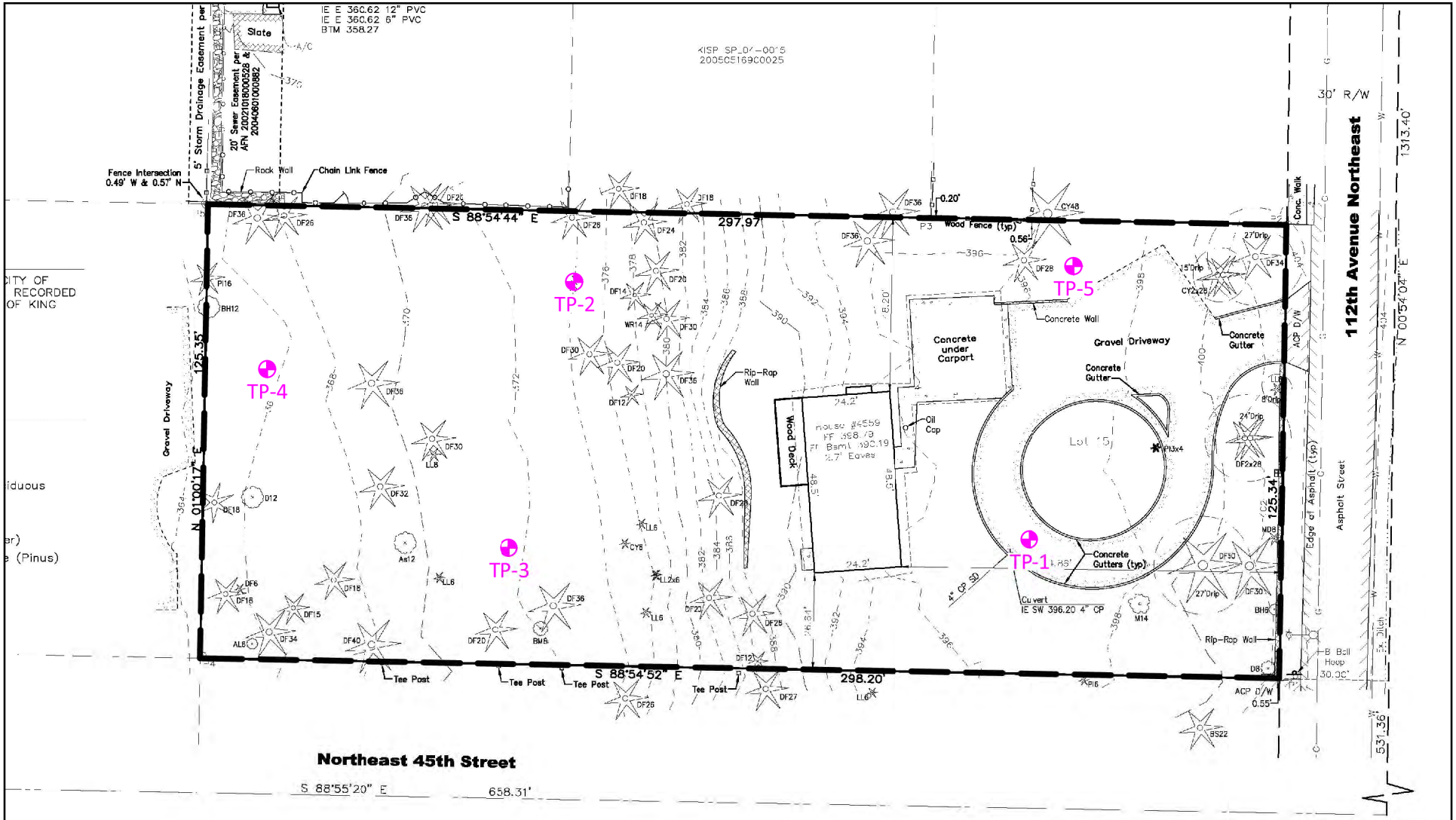

= Test probe by RGI, 5/10/18

= Site boundary

Approximate Scale: 1"=40'

0 20 40 80

N

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Phone: 425.415.0551
Fax: 425.415.0311

Blueprint 112th		Figure 2
RGI Project Number 2018-122	Site Plan with Test Probe Locations	Date Drawn: 05/2018
Address: 4559 112th Avenue Northeast, Kirkland, Washington 98033		

Project Name: **Blueprint 112th**
Project Number: **2018-122**
Client: **Blueprint Capital Services, LLC**

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Test Probe No.: TP-1

Sheet 1 of 1

Date(s) Drilled: **05/10/18**	Logged By: **LC**	Surface Conditions: **Top Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type:	Total Depth of Borehole: **12 feet bgs**
Drill Rig Type: **Geoprobe**	Drilling Contractor: **Standard Probe**	Approximate Surface Elevation: **n/a**
Groundwater Level: **Not encountered**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Native Soil**	Location: **4559 112th Avenue Northeast, Kirkland, Washington 98033**	

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Brown, silty SAND with gravel and organics, medium dense, moist (fill)	
						Brown, silty SAND with some gravel, very dense, moist, heavily mottled	
					5		
						Brown, SILT with sand, stiff, moist	
					10		
						Test probe terminated 12 feet bgs	
						No groundwater encountered	
					15		

The Riley Group, Inc.
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Project Name: **Blueprint 112th**
Project Number: **2018-122**
Client: **Blueprint Capital Services, LLC**

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Test Probe No.: TP-2

Sheet 1 of 1

Date(s) Drilled: **05/10/18**	Logged By: **LC**	Surface Conditions: **Top Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type:	Total Depth of Borehole: **11 feet bgs**
Drill Rig Type: **Geoprobe**	Drilling Contractor: **Standard Probe**	Approximate Surface Elevation: **n/a**
Groundwater Level: **Not encountered**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Native Soil**	Location: **4559 112th Avenue Northeast, Kirkland, Washington 98033**	

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Dark brown, silty SAND (top soil)	
						Brown, silty, gravelly SAND, medium dense, moist	
					5		
						Some mottling, density increases	
					10		
						Test probe terminated 11 feet bgs	
						No groundwater encountered	
					15		

The Riley Group, Inc.
17522 Bothell Way NE, Bothell, WA 98011

Project Name: **Blueprint 112th** Project Number: **2018-122** Client: **Blueprint Capital Services, LLC**	RILEYGROUP **Test Probe No.: TP-3** **Sheet 1 of 1**

Date(s) Drilled: **05/10/18**	Logged By: **LC**	Surface Conditions: **Top Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type:	Total Depth of Borehole: **11 feet bgs**
Drill Rig Type: **Geoprobe**	Drilling Contractor: **Standard Probe**	Approximate Surface Elevation: **n/a**
Groundwater Level: **6.7'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Native Soil**	Location: **4559 112th Avenue Northeast, Kirkland, Washington 98033**	

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Top soil	
						Brown, silty, gravelly SAND, loose to medium dense, moist	
					5		
				▽		Density increases	
					10		
						Test probe terminated 11 feet bgs	
						Groundwater encountered 6.7 feet bgs	
					15		

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Project Name: **Blueprint 112th** Project Number: **2018-122** Client: **Blueprint Capital Services, LLC**	RILEYGROUP **Test Probe No.: TP-4** **Sheet 1 of 1**

Date(s) Drilled: **05/10/18**	Logged By: **LC**	Surface Conditions: **Top Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type:	Total Depth of Borehole: **11 feet bgs**
Drill Rig Type: **Geoprobe**	Drilling Contractor: **Standard Probe**	Approximate Surface Elevation: **n/a**
Groundwater Level: **6.5'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Native Soil**	Location: **4559 112th Avenue Northeast, Kirkland, Washington 98033**	

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Top soil	
						Brown, silty, gravelly SAND, loose to medium dense, moist	
					5		
				▽			
						Density increases	
					10		
						Test probe terminated 11 feet bgs	
						Groundwater encountered 6.5 feet bgs	
					15		

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Project Name: **Blueprint 112th**
Project Number: **2018-122**
Client: **Blueprint Capital Services, LLC**

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Test Probe No.: TP-5

Sheet 1 of 1

Date(s) Drilled: **05/10/18**	Logged By: **LC**	Surface Conditions: **Top Soil**
Drilling Method(s): **Direct Push**	Drill Bit Size/Type:	Total Depth of Borehole: **6 feet bgs**
Drill Rig Type: **Geoprobe**	Drilling Contractor: **Standard Probe**	Approximate Surface Elevation: **n/a**
Groundwater Level: **6.5'**	Sampling Method(s): **Continuous**	Hammer Data : **n/a**
Borehole Backfill: **Native Soil**	Location: **4559 112th Avenue Northeast, Kirkland, Washington 98033**	

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
					0	Top soil	
						Brown, silty SAND with some gravel, dense to very dense, moist (lodgement till)	
					5		
						Test probe terminated 6 feet bgs	
						No groundwater encountered	
					10		
					15		

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Project Name: **Blueprint 112th**
Project Number: **2018-122**
Client: **Blueprint Capital Services, LLC**

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Boring Log Key

Sheet 1 of 1

PID Reading, ppm	Sample ID	Sample Type	Recovery (percent)	GW Depth	Depth (feet)	MATERIAL DESCRIPTION	Graphic Log
1	2	3	4	5	6	7	8

COLUMN DESCRIPTIONS

1. PID Reading, ppm: The reading from a photo-ionization detector, in parts per million.
2. Sample ID: Sample identification number.
3. Sample Type: Type of soil sample collected at the depth interval shown.
4. Recovery (percent): Percent Recovery
5. GW Depth: Groundwater depth in feet below the ground surface.
6. Depth (feet): Depth in feet below the ground surface.
7. MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
8. Graphic Log: Graphic depiction of the subsurface material encountered.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

SILT, SILT w/SAND, SANDY SILT (ML)
Silty SAND (SM)
Poorly graded SAND with Silt (SP-SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

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GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Blueprint 112th - Hydro		SAMPLE ID/TYPE	TP1	Soil
PROJECT NO.	2018-122		SAMPLE DEPTH	3'	
TECH/TEST DATE	LC 5/24		DATE RECEIVED	5/21/2018	

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	620.1
Wt Dry Soil & Tare (gm)	(w2)	554.9
Weight of Tare (gm)	(w3)	15.7
Weight of Water (gm)	(w4=w1-w2)	65.2
Weight of Dry Soil (gm)	(w5=w2-w3)	539.2
Moisture Content (%)	(w4/w5)*100	12

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

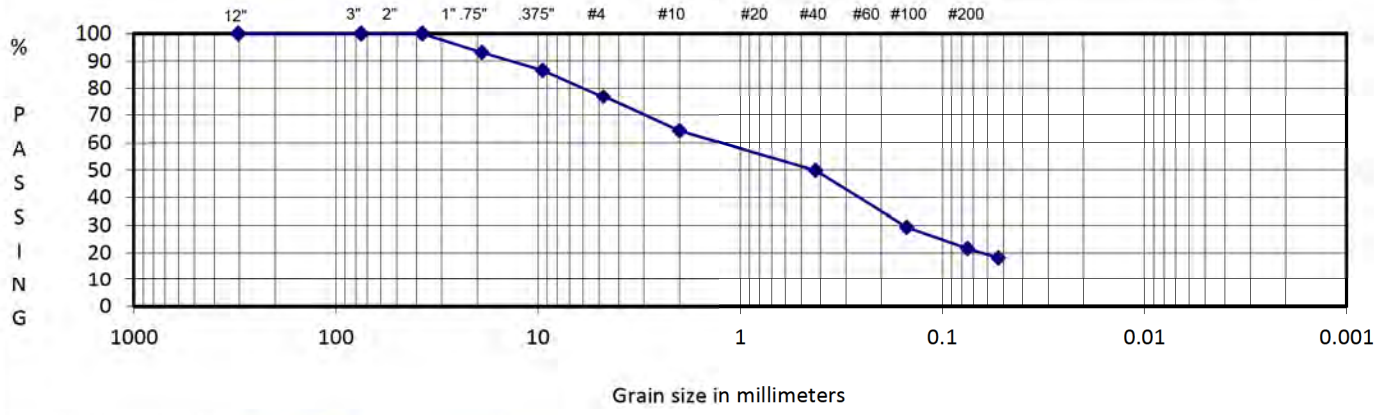
Weight Of Sample (gm)		554.9
Tare Weight (gm)		15.7
(W6) Total Dry Weight (gm)		539.2

% COBBLES	0.0
% C GRAVEL	6.8
% F GRAVEL	16.4
% C SAND	12.5
% M SAND	14.4
% F SAND	28.3
% FINES	21.6
% TOTAL	100.0

D10 (mm)	
D30 (mm)	
D60 (mm)	
Cu	
Cc	

SIEVE ANALYSIS

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	15.7	0.00	0.00	100.00	cobbles
3.0"	15.7	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"	15.7	0.00	0.00	100.00	coarse gravel
1.5"	15.7	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	52.2	36.50	6.77	93.23	fine gravel
0.50"					fine gravel
0.375"	87.4	71.70	13.30	86.70	fine gravel
#4	140.5	124.80	23.15	76.85	coarse sand
#10	208.0	192.30	35.66	64.34	medium sand
#20					medium sand
#40	285.5	269.80	50.04	49.96	fine sand
#60					fine sand
#100	396.7	381.00	70.66	29.34	fine sand
#200	438.2	422.50	78.36	21.64	fine sand
#270	456.5	440.80	81.75	18.25	fine sand



DESCRIPTION	Silty SAND with some gravel.
USCS	SM

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GRAIN SIZE ANALYSIS
ASTM D421, D422, D1140, D2487, D6913

PROJECT TITLE	Blueprint 112th - Hydro		SAMPLE ID/TYPE	TP3	Soil
PROJECT NO.	2018-122		SAMPLE DEPTH	3'	
TECH/TEST DATE	LC 5/24		DATE RECEIVED	5/21/2018	

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	854.0
Wt Dry Soil & Tare (gm)	(w2)	773.0
Weight of Tare (gm)	(w3)	15.7
Weight of Water (gm)	(w4=w1-w2)	81.0
Weight of Dry Soil (gm)	(w5=w2-w3)	757.3
Moisture Content (%)	(w4/w5)*100	11

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

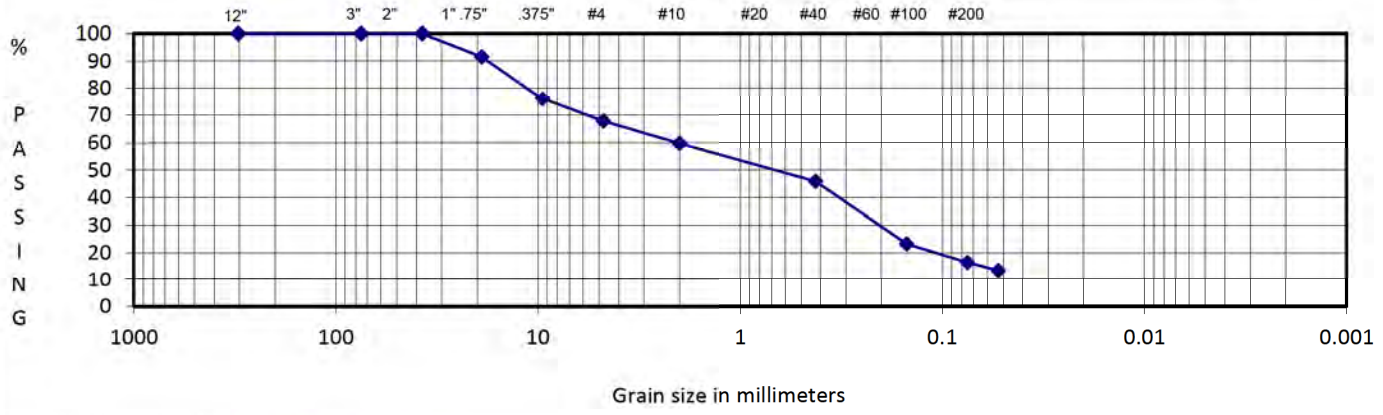
Weight Of Sample (gm)		773.0
Tare Weight (gm)		15.7
(W6) Total Dry Weight (gm)		757.3

% COBBLES	0.0
% C GRAVEL	8.5
% F GRAVEL	23.7
% C SAND	8.0
% M SAND	13.8
% F SAND	29.6
% FINES	16.4
% TOTAL	100.0

D10 (mm)	0.03
D30 (mm)	0.21
D60 (mm)	2
Cu	66.7
Cc	0.7

SIEVE ANALYSIS

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	
12.0"	15.7	0.00	0.00	100.00	cobbles
3.0"	15.7	0.00	0.00	100.00	coarse gravel
2.5"					coarse gravel
2.0"	15.7	0.00	0.00	100.00	coarse gravel
1.5"	15.7	0.00	0.00	100.00	coarse gravel
1.0"					coarse gravel
0.75"	79.9	64.20	8.48	91.52	fine gravel
0.50"					fine gravel
0.375"	197.4	181.70	23.99	76.01	fine gravel
#4	259.6	243.90	32.21	67.79	coarse sand
#10	320.5	304.80	40.25	59.75	medium sand
#20					medium sand
#40	424.7	409.00	54.01	45.99	fine sand
#60					fine sand
#100	597.1	581.40	76.77	23.23	fine sand
#200	648.6	632.90	83.57	16.43	fine sand
#270	670.1	654.40	86.41	13.59	fine sand



DESCRIPTION	Silty gravelly SAND.
USCS	SM

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Section 7 Other Permits

A demolition permit will be required to demolish existing building and hardscapes.

Section 8 TESC Analysis and Design

The temporary erosion and sedimentation control plan will be designed to reduce the discharge of sediment-laden runoff from the site. The plan will be comprised of temporary measures (rock entrance, filter fence, straw mulch, etc.) as well as permanent measures (hydroseeding and landscaping). A TESC plan will be submitted with the Enhanced Land Surface Modification (ELSM) plans, to be provided at final engineering.

- **Mark Clearing Limits / Minimize Clearing –** Prior to any site clearing or grading, the clearing limits are to be marked in the field. The trees to remain will have tree protection measures installed per City of Kirkland detail on sheet TD-01 of ELSM plans, to be provided at final engineering.

- **Minimize Sediment Tracked Offsite** – A stabilized construction entrance shall be installed as the first step in clearing and grading. The construction entrance is to be installed per City of Kirkland Standard Plan No. CK-E.01 at the location shown on sheet TD-01 of ELSM plans, to be provided at final engineering.

- **Control Sediment** – Perimeter protection to filter sediment from sheetwash shall be located downslope of all disturbed areas and shall be installed prior to upslope grading. The silt fence will be installed along the boundary of the site to retain all sediment on site. Additionally, storm drain inlet protection measures will be applied to all catch basins within the project vicinity. See sheet TD-01 of ELSM plans, to be provided at final engineering.

- **Stabilize Exposed Soils –** Temporary and permanent cover measures shall be provided to protect all disturbed areas. Cover measures include the use of surface roughening, mulch, erosion control nets and blankets, plastic covering, seeding, and sodding. See sheet TD-01 of ELSM plans, to be provided at final engineering.

- **Control Runoff–** All drainage will remain in a sheet flow condition during construction. Therefore, this requirement is not applicable.

- **Control Dewatering–** Any runoff generated by dewatering shall be treated by releasing the water to a well vegetated, gently sloping area. See notes on sheet TD-01 of ELSM plans, to be provided at final engineering.

- **Control Other Pollutants** – Pollutants shall be controlled per TESC notes shown on sheet TD-01 of ELSM plans, to be provided at final engineering.

- **Final Stabilization** – Prior to final construction approval, the project site shall be stabilized to prevent sediment-laden water from leaving the site after project completion. All disturbed areas shall be vegetated or otherwise permanently stabilized. See sheet TD-01 TD-01 of of ELSM plans, to be provided at final engineering.

Section 9 Bond Quantities and Facilities Summary

A City of Kirkland Improvement Package (IEP) will be provided with the final engineering submittal.

Section 10 Operations and Maintenance

The individual owner will be responsible for the permeable paver driveway to their cottage. The detention vault, fencing around vault, 4'x6' BioPod Biofilter System, the drainage lines and structures within the private access road and ROW will be the maintained by the City of Kirkland.

Operation and Maintenance information from the City of Kirkland and 2016 KCSWDM included on the following pages is summarized as follows:

No. 3 – Detention Tanks and Vaults (p. A-5)
No. 4 – Control Structure/Flow Restrictor (p. A-7)
No. 5 – Catch Basins and Manholes (p. A-9)
No. 6 – Conveyance Pipes and Ditches (p. A-11)
No. 9 – Fencing (p. A-14)
No. 11 – Grounds (Landscaping) (p. A-16)
No. 12 – Access Roads (p. A-17)
No. 24 – Catch Basin Insert (p. A-34)
No. 30 – Permeable Pavement BMP (p. A-38)
BioPod System Inspection & Maintenance Guide

NO. 3 – DETENTION TANKS AND VAULTS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash and debris	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Tank or Vault Storage Area	Trash and debris	Any trash and debris accumulated in vault or tank (includes floatables and non-floatables).	No trash or debris in vault.
	Sediment accumulation	Accumulated sediment depth exceeds 10% of the diameter of the storage area for ½ length of storage vault or any point depth exceeds 15% of diameter. Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than ½ length of tank.	All sediment removed from storage area.
Tank Structure	Plugged air vent	Any blockage of the vent.	Tank or vault freely vents.
	Tank bent out of shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape.	Tank repaired or replaced to design.
	Gaps between sections, damaged joints or cracks or tears in wall	A gap wider than ½-inch at the joint of any tank sections or any evidence of soil particles entering the tank at a joint or through a wall.	No water or soil entering tank through joints or walls.
Vault Structure	Damage to wall, frame, bottom, and/or top slab	Cracks wider than ½-inch, any evidence of soil entering the structure through cracks or qualified inspection personnel determines that the vault is not structurally sound.	Vault is sealed and structurally sound.
Inlet/Outlet Pipes	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

NO. 3 – DETENTION TANKS AND VAULTS

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Access Manhole	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open manhole requires immediate maintenance.**	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Ladder rungs unsafe	Missing rungs, misalignment, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat; covers access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the structure opening or is blocking capacity of the structure by more than 10%.	No Trash or debris blocking or potentially blocking entrance to structure.
		Trash or debris in the structure that exceeds $^1/_3$ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the structure.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Sediment	Sediment exceeds 60% of the depth from the bottom of the structure to the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section or is within 6 inches of the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section.	Sump of structure contains no sediment.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering structure through cracks, or maintenance person judges that structure is unsound.	Structure is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering structure through cracks.	No cracks more than $^1/_4$ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Structure has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Ladder rungs missing or unsafe	Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
FROP-T Section	Damage	T section is not securely attached to structure wall and outlet pipe structure should support at least 1,000 lbs of up or down pressure.	T section securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight or show signs of deteriorated grout.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes—other than designed holes—in the structure.	Structure has no holes other than designed holes.

NO. 4 – CONTROL STRUCTURE/FLOW RESTRICTOR

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Cleanout Gate	Damaged or missing	Cleanout gate is missing.	Replace cleanout gate.
		Cleanout gate is not watertight.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
Orifice Plate	Damaged or missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
	Deformed or damaged lip	Lip of overflow pipe is bent or deformed.	Overflow pipe does not allow overflow at an elevation lower than design
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.
Metal Grates (If Applicable)	Unsafe grate opening	Grate with opening wider than $^{7}/_{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open structure requires urgent maintenance**.	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Structure	Sediment	Sediment exceeds 60% of the depth from the bottom of the catch basin to the invert of the lowest pipe into or out of the catch basin or is within 6 inches of the invert of the lowest pipe into or out of the catch basin.	Sump of catch basin contains no sediment.
	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the catch basin opening or is blocking capacity of the catch basin by more than 10%.	No Trash or debris blocking or potentially blocking entrance to catch basin.
		Trash or debris in the catch basin that exceeds $^1/_3$ the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the catch basin.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within catch basin.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Damage to frame and/or top slab	Corner of frame extends more than ¾ inch past curb face into the street (If applicable).	Frame is even with curb.
		Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering catch basin through cracks, or maintenance person judges that catch basin is unsound.	Catch basin is sealed and is structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	No cracks more than $^1/_4$ inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the catch basin at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
Inlet/Outlet Pipe	Sediment accumulation	Sediment filling 20% or more of the pipe.	Inlet/outlet pipes clear of sediment.
	Trash and debris	Trash and debris accumulated in inlet/outlet pipes (includes floatables and non-floatables).	No trash or debris in pipes.
	Damaged	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering at the joints of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of the inlet/outlet pipe.

NO. 5 – CATCH BASINS AND MANHOLES

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Metal Grates (Catch Basins)	Unsafe grate opening	Grate with opening wider than $^{7}/_{8}$ inch.	Grate opening meets design standards.
	Trash and debris	Trash and debris that is blocking more than 20% of grate surface.	Grate free of trash and debris. footnote to guidelines for disposal
	Damaged or missing	Grate missing or broken member(s) of the grate. **Any open structure requires urgent maintenance**.	Grate is in place and meets design standards.
Manhole Cover/Lid	Cover/lid not in place	Cover/lid is missing or only partially in place. **Any open structure requires urgent maintenance**.	Cover/lid protects opening to structure.
	Locking mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to Remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.

NO. 6 – CONVEYANCE PIPES AND DITCHES

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Pipes	Sediment & debris accumulation	Accumulated sediment or debris that exceeds 20% of the diameter of the pipe.	Water flows freely through pipes.
	Vegetation/roots	Vegetation/roots that reduce free movement of water through pipes.	Water flows freely through pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.
Ditches	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet of ditch and slopes.	Trash and debris cleared from ditches.
	Sediment accumulation	Accumulated sediment that exceeds 20% of the design depth.	Ditch cleaned/flushed of all sediment and debris so that it matches design.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Vegetation	Vegetation that reduces free movement of water through ditches.	Water flows freely through ditches.
	Erosion damage to slopes	Any erosion observed on a ditch slope.	Slopes are not eroding.
	Rock lining out of place or missing (If Applicable)	One layer or less of rock exists above native soil area 5 square feet or more, any exposed native soil.	Replace rocks to design standards.

NO. 9 – FENCING

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Erosion or holes under fence	Erosion or holes more than 4 inches high and 12-18 inches wide permitting access through an opening under a fence.	No access under the fence.
Wood Posts, Boards and Cross Members	Missing or damaged parts	Missing or broken boards, post out of plumb by more than 6 inches or cross members broken	No gaps on fence due to missing or broken boards, post plumb to within 1½ inches, cross members sound.
	Weakened by rotting or insects	Any part showing structural deterioration due to rotting or insect damage	All parts of fence are structurally sound.
	Damaged or failed post foundation	Concrete or metal attachments deteriorated or unable to support posts.	Post foundation capable of supporting posts even in strong wind.
Metal Posts, Rails and Fabric	Damaged parts	Post out of plumb more than 6 inches.	Post plumb to within 1½ inches.
		Top rails bent more than 6 inches.	Top rail free of bends greater than 1 inch.
		Any part of fence (including post, top rails, and fabric) more than 1 foot out of design alignment.	Fence is aligned and meets design standards.
		Missing or loose tension wire.	Tension wire in place and holding fabric.
	Deteriorated paint or protective coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.
	Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	Fabric mesh openings within 50% of grid size.

NO. 11 – GROUNDS (LANDSCAPING)

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash or litter	Any trash and debris which exceed 1 cubic foot per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one standard size office garbage can). In general, there should be no visual evidence of dumping.	Trash and debris cleared from site.
	Noxious weeds	Any noxious or nuisance vegetation which may constitute a hazard to County personnel or the public.	Noxious and nuisance vegetation removed according to applicable regulations. No danger of noxious vegetation where County personnel or the public might normally be.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Grass/groundcover	Grass or groundcover exceeds 18 inches in height.	Grass or groundcover mowed to a height no greater than 6 inches.
Trees and Shrubs	Hazard	Any tree or limb of a tree identified as having a potential to fall and cause property damage or threaten human life. **A hazard tree identified by a qualified arborist must be removed as soon as possible.**	No hazard trees in facility.
	Damaged	Limbs or parts of trees or shrubs that are split or broken which affect more than 25% of the total foliage of the tree or shrub.	Trees and shrubs with less than 5% of total foliage with split or broken limbs.
		Trees or shrubs that have been blown down or knocked over.	No blown down vegetation or knocked over vegetation. Trees or shrubs free of injury.
		Trees or shrubs which are not adequately supported or are leaning over, causing exposure of the roots.	Tree or shrub in place and adequately supported; dead or diseased trees removed.

NO. 12 – ACCESS ROADS

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Site	Trash and debris	Trash and debris exceeds 1 cubic foot per 1,000 square feet (i.e., trash and debris would fill up one standards size garbage can).	Roadway drivable by maintenance vehicles.
		Debris which could damage vehicle tires or prohibit use of road.	Roadway drivable by maintenance vehicles.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Blocked roadway	Any obstruction which reduces clearance above road surface to less than 14 feet.	Roadway overhead clear to 14 feet high.
		Any obstruction restricting the access to a 10- to 12 foot width for a distance of more than 12 feet or any point restricting access to less than a 10 foot width.	At least 12-foot of width on access road.
Road Surface	Erosion, settlement, potholes, soft spots, ruts	Any surface defect which hinders or prevents maintenance access.	Road drivable by maintenance vehicles.
	Vegetation on road surface	Trees or other vegetation prevent access to facility by maintenance vehicles.	Maintenance vehicles can access facility.
Shoulders and Ditches	Erosion	Erosion within 1 foot of the roadway more than 8 inches wide and 6 inches deep.	Shoulder free of erosion and matching the surrounding road.
	Weeds and brush	Weeds and brush exceed 18 inches in height or hinder maintenance access.	Weeds and brush cut to 2 inches in height or cleared in such a way as to allow maintenance access.
Modular Grid Pavement	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Damaged or missing	Access surface compacted because of broken on missing modular block.	Access road surface restored so road infiltrates.

NO. 23 – COALESCING PLATE OIL/WATER SEPARATOR

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Large access doors/plate	Damaged or difficult to open	Large access doors or plates cannot be opened/removed using normal equipment.	Replace or repair access door so it can opened as designed.
	Gaps, doesn't cover completely	Large access doors not flat and/or access opening not completely covered.	Doors close flat and cover access opening completely.
	Lifting Rings missing, rusted	Lifting rings not capable of lifting weight of door or plate.	Lifting rings sufficient to lift or remove door or plate.

NO. 24 – CATCH BASIN INSERT

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Media Insert	Visible Oil	Visible oil sheen passing through media	Media inset replaced.
	Insert does not fit catch basin properly	Flow gets into catch basin without going through media.	All flow goes through media.
	Filter media plugged	Filter media plugged.	Flow through filter media is normal.
	Oil absorbent media saturated	Media oil saturated.	Oil absorbent media replaced.
	Water saturated	Catch basin insert is saturated with water, which no longer has the capacity to absorb.	Insert replaced.
	Service life exceeded	Regular interval replacement due to typical average life of media insert product, typically one month.	Media replaced at manufacturer's recommended interval.
	Seasonal maintenance	When storms occur and during the wet season.	Remove, clean and replace or install new insert after major storms, monthly during the wet season or at manufacturer's recommended interval.

NO. 30 – PERMEABLE PAVEMENT BMP

Maintenance Component	Defect or Problem	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Preventative	Surface cleaning/ vegetation control	Media surface vacuumed or pressure washed annually, vegetation controlled to design maximum. Weed growth suggesting sediment accumulation.	No dirt, sediment, or debris clogging porous media, or vegetation limiting infiltration.
Porous Concrete, Porous Asphaltic Concrete, and Permeable Pavers	Trash and debris	Trash and debris on the pavement interfering with infiltration; leaf drop in fall season.	No trash or debris interfering with infiltration.
	Sediment accumulation	Sediment accumulation on the pavement interfering with infiltration; runoff from adjacent areas depositing sediment/debris on pavement.	Pavement infiltrates as designed; adjacent areas stabilized.
	Infiltration rate	Pavement does not infiltrate at a rate of 10 inches per hour.	Pavement infiltrates at a rate greater than 10 inches per hour.
	Ponding	Standing water for a long period of time on the surface of the pavement.	Standing water infiltrates at the desired rate.
	Broken or cracked pavement	Pavement is broken or cracked.	No broken pavement or cracks on the surface of the pavement.
	Settlement	Uneven pavement surface indicating settlement of the subsurface layer.	Pavement surface is uniformly level.
	Moss growth	Moss growing on pavement interfering with infiltration.	No moss interferes with infiltration.
	Inflow	Inflow to the pavement is diverted, restricted, or depositing sediment and debris on the pavement.	Inflow to pavement is unobstructed and not bringing sediment or debris to the pavement.
	Underdrain	Underdrain is not flowing when pavement has been infiltrating water.	Underdrain flows freely when water is present.
	Overflow	Overflow not controlling excess water to desired location; native soil is exposed or other signs of erosion damage are present.	Overflow permits excess water to leave the site at the desired location; Overflow is stabilized and appropriately armored.
Permeable Pavers	Broken or missing pavers	Broken or missing paving blocks on surface of pavement.	No missing or broken paving blocks interfering with infiltration.
	Level surface	Uneven surface due to settlement or scour of fill in the interstices of the paving blocks.	Pavement surface is uniformly level.
	Compaction	Poor infiltration due to soil compaction between paving blocks.	No soil compaction in the interstices of the paver blocks limiting infiltration.
	Dead grass	Grass in the interstices of the paving blocks is dead.	Healthy grass is growing in the interstices of the paver blocks.
Inspection	Frequency	Annually and after large storms, and as needed seasonally to control leaf drop, evergreen needles etc.	Permeable pavement is functioning normally.

Oldcastle Infrastructure™
A CRH COMPANY

BIOPOD™ SYSTEM

WITH STORMMIX™ MEDIA

Inspection and Maintenance Guide

Water

BioPod™ Biofilter with StormMix™ Biofiltration Media

Description

The BioPod™ Biofilter System (BioPod) is a stormwater biofiltration treatment system used to remove pollutants from stormwater runoff. Impervious surfaces and other urban and suburban landscapes generate a variety of contaminants that can enter stormwater and pollute downstream receiving waters unless treatment is provided. The BioPod system uses proprietary StormMix™ biofiltration media to capture and retain pollutants including total suspended solids (TSS), metals, nutrients, gross solids, trash and debris as well as petroleum hydrocarbons.

Function

The BioPod system uses engineered, high-flow rate filter media to remove stormwater pollutants, allowing for a smaller footprint than conventional bioretention systems. Contained within a compact precast concrete vault, the BioPod system consists of a biofiltration chamber and an optional integrated high-flow bypass with a contoured inlet rack to minimize scour. The biofiltration chamber is filled with horizontal layers of aggregate (which may or may not include an underdrain), biofiltration media and mulch. Stormwater passes vertically down through the mulch and biofiltration media for treatment. The mulch provides pretreatment by retaining most of the solids or sediment. The biofiltration media provides further treatment by retaining finer sediment and dissolved pollutants. The aggregate allows the media bed to drain evenly for discharge through an underdrain pipe or by infiltration.

Configuration

The BioPod system can be configured with either an internal or external bypass. The internal bypass allows both water quality and bypass flows to enter the treatment vault. The water quality flows are directed to the biofiltration chamber while the excess flows are diverted over the bypass weir without entering the biofiltration chamber. Both the treatment and bypass flows are combined in the outlet area prior to discharge from the structure. BioPod units without an internal bypass are designed such that only treatment flows enter the treatment structure. When the system has exceeded its treatment capacity, ponding will force bypass flows to continue down the gutter to the nearest standard catch basin or other external bypass structure.

The BioPod system can be configured as a tree box filter with tree and grated inlet, as a planter box filter with shrubs, grasses and an open top, or as an underground filter with access risers, doors and a subsurface inlet pipe. The optional internal bypass may be incorporated with any of these configurations. In addition, an open bottom configuration may be used to promote infiltration and groundwater recharge. The configuration and size of the BioPod system is designed to meet the requirements of a specific project.

Inspection & Maintenance Overview

State and local regulations require all stormwater management systems to be inspected on a regular basis and maintained as necessary to ensure performance and protect downstream receiving waters. Without maintenance, excessive pollutant buildup can limit system performance by reducing the operating capacity of the system and increasing the potential for scouring of pollutants during periods of high flow.

Some configurations of the BioPod may require periodic irrigation to establish and maintain vegetation. Vegetation will typically become established about two years after planting. Irrigation requirements are ultimately dependent on climate, rainfall and the type of vegetation selected.

Maintenance Frequency

Periodic inspection is essential for consistent system performance and is easily completed. Inspection is typically conducted a minimum of twice per year, but since pollutant transport and deposition varies from site to site, a site-specific maintenance frequency should be established during the first two or three years of operation.

Inspection Equipment

The following equipment is helpful when conducting BioPod inspections:

- Recording device (pen and paper form, voice recorder, iPad, etc.)
- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Flashlight
- Tape measure

Inspection Procedures

BioPod inspections are visual and are conducted without entering the unit. To complete an inspection, safety measures including traffic control should be deployed before the access covers or tree grates are removed. Once the covers have been removed, the following items should be checked and recorded (see form provided on page 6) to determine whether maintenance is required:

- If the BioPod unit is equipped with an internal bypass, inspect the contoured inlet rack and outlet chamber and note whether there are any broken or missing parts. In the unlikely event that internal parts are broken or missing, contact Oldcastle Stormwater at (800) 579-8819 to determine appropriate corrective action.
- Note whether the curb inlet, inlet pipe, or – if the unit is equipped with an internal bypass – the inlet rack is blocked or obstructed.
- If the unit is equipped with an internal bypass, observe, quantify and record the accumulation of trash and debris in the inlet rack. The significance of accumulated trash and debris is a matter of judgment. Often, much of the trash and debris may be removed manually at the time of inspection if a separate maintenance visit is not yet warranted.
- If it has not rained within the past 24 hours, note whether standing water is observed in the biofiltration chamber.
- Finally, observe, quantify and record presence of invasive vegetation and the amount of trash and debris and sediment load in the biofiltration chamber. Erosion of the mulch and biofiltration media bed should also be recorded. Sediment load may be rated light, medium or heavy depending on the conditions. Loading characteristics may be determined as follows:
  - Light sediment load – sediment is difficult to distinguish among the mulch fibers at the top of the mulch layer; the mulch appears almost new.
  - Medium sediment load – sediment accumulation is apparent and may be concentrated in some areas; probing the mulch layer reveals lighter sediment loads under the top 1" of mulch.
  - Heavy sediment load – sediment is readily apparent across the entire top of the mulch layer; individual mulch fibers are difficult to distinguish; probing the mulch layer reveals heavy sediment load under the top 1" of mulch.

Often, much of the invasive vegetation and trash and debris may be removed manually at the time of inspection if a separate maintenance visit is not yet warranted.

Maintenance Indicators

Maintenance should be scheduled if any of the following conditions are identified during inspection:

- The concrete structure is damaged or the tree grate or access cover is damaged or missing.
- The curb inlet or inlet rack is obstructed.
- Standing water is observed in the biofiltration chamber more than 24 hours after a rainfall event (use discretion if the BioPod is located downstream of a storage system that attenuates flow).
- Trash and debris in the inlet rack cannot be easily removed at the time of inspection.
- Trash and debris, invasive vegetation or sediment load in the biofiltration chamber is heavy or excessive erosion has occurred.

Maintenance Equipment

The following equipment is helpful when conducting BioPod maintenance:

- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Flashlight
- Tape measure
- Rake, hoe, shovel and broom
- Bucket
- Pruners
- Vacuum truck (optional)

Maintenance Procedures

Maintenance should be conducted during dry weather when no flows are entering the system. All maintenance may be conducted without entering the BioPod structure. Once safety measures such as traffic control are deployed, the access covers may be removed and the following activities may be conducted to complete maintenance:

- Remove all trash and debris from the curb inlet and inlet rack manually or by using a vacuum truck as required.
- Remove all trash and debris and invasive vegetation from the biofiltration chamber manually or by using a vacuum truck as required.
- If the sediment load is medium or light but erosion of the biofiltration media bed is evident, redistribute the mulch with a rake or replace missing mulch as appropriate. If erosion persists, rocks may be placed in the eroded area to help dissipate energy and prevent recurring erosion.
- If the sediment load is heavy, remove the mulch layer using a hoe, rake, shovel and bucket, or by using a vacuum truck as required. If the sediment load is particularly heavy, inspect the surface of the biofiltration media once the mulch has been removed. If the media appears clogged with sediment, remove and replace one or two inches of biofiltration media prior to replacing the mulch layer.
- Prune vegetation as appropriate and replace damaged or dead plants as required.
- Replace the tree grate and/or access covers and sweep the area around the BioPod to leave the site clean.
- All material removed from the BioPod during maintenance must be disposed of in accordance with local environmental regulations. In most cases, the material may be handled in the same manner as disposal of material removed from sumped catch basins or manholes.

Natural, shredded hardwood mulch should be used in the BioPod. Timely replacement of the mulch layer according to the maintenance indicators described above should protect the biofiltration media below the mulch layer from clogging due to sediment accumulation. However, whenever the mulch is replaced, the BioPod should be visited 24 hours after the next major storm event to ensure that there is no standing water in the biofiltration chamber. Standing water indicates that the biofiltration media below the mulch layer is clogged and must be replaced. Please contact Oldcastle Infrastructure at (800) 579-8819 to purchase the proprietary StormMix™ biofiltration media.

BioPod Tree Module

BioPod Media Module

BioPod Planter Module

BioPod Media Vault

BioPod Inspection & Maintenance Log

BioPod Model_____ Inspection Date_____

Location_____

Condition of Internal Components Notes:

☐ Good ☐ Damaged ☐ Missing

Curb Inlet or Inlet Rack Blocked Notes:

☐ Yes ☐ No

Standing Water in Biofiltration Chamber Notes:

☐ Yes ☐ No

Trash and Debris in Inlet Rack Notes:

☐ Yes ☐ No

Trash and Debris in Biofiltration Chamber Notes:

☐ Yes ☐ No

Invasive Vegetation in Biofiltration Chamber Notes:

☐ Yes ☐ No

Sediment in Biofiltration Chamber Notes:

☐ Light ☐ Medium ☐ Heavy

Erosion in Biofiltration Chamber Notes:

☐ Yes ☐ No

Maintenance Requirements

☐ **Yes - Schedule Maintenance** ☐ **No - Schedule Re-Inspection**

BIOPOD™ SYSTEM

WITH STORMMIX™ MEDIA

OUR MARKETS

BUILDING STRUCTURES | COMMUNICATIONS | WATER | ENERGY | TRANSPORTATION

Appendix

A. EAST BASIN WWHM OUTPUT

WWHM2012
PROJECT REPORT

Project Name: east basin
Site Name: 4559 112th Ave NE
Site Address:
City :
Report Date: 12/29/2020
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
(adjusted) **Precip Scale:** 0.00
Version Date: 2019/09/13
Version : 4.2.17

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : East Basin (Pre-Developed)
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	.04
Pervious Total	0.04

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.04

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : East Basin (Post-Developed)
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
ROADS MOD	0.04
Impervious Total	0.04
Basin Total	0.04

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.04
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0
Total Impervious Area:0.04

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.001191
5 year	0.001952
10 year	0.002441
25 year	0.003022
50 year	0.003425
100 year	0.003802

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.01776
5 year	0.022549
10 year	0.025816
25 year	0.030068
50 year	0.033331
100 year	0.03668

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.001	0.022
1950	0.002	0.023
1951	0.003	0.013
1952	0.001	0.012
1953	0.001	0.014
1954	0.001	0.014
1955	0.002	0.017
1956	0.001	0.016
1957	0.001	0.017
1958	0.001	0.014
1959	0.001	0.016
1960	0.002	0.015
1961	0.001	0.015
1962	0.001	0.013
1963	0.001	0.015
1964	0.001	0.015
1965	0.001	0.017
1966	0.001	0.013
1967	0.002	0.020
1968	0.001	0.027
1969	0.001	0.016
1970	0.001	0.016
1971	0.001	0.020
1972	0.002	0.020
1973	0.001	0.013
1974	0.001	0.018
1975	0.001	0.020
1976	0.001	0.015
1977	0.000	0.015
1978	0.001	0.022
1979	0.000	0.026
1980	0.002	0.027
1981	0.001	0.017
1982	0.002	0.024
1983	0.001	0.020
1984	0.001	0.013
1985	0.000	0.017
1986	0.002	0.015
1987	0.002	0.023
1988	0.001	0.015
1989	0.000	0.024
1990	0.004	0.028
1991	0.002	0.025
1992	0.001	0.013
1993	0.001	0.017
1994	0.000	0.014
1995	0.001	0.015
1996	0.003	0.020
1997	0.002	0.016
1998	0.001	0.017
1999	0.003	0.035
2000	0.001	0.016
2001	0.000	0.020
2002	0.001	0.021

2003	0.002	0.021
2004	0.002	0.034
2005	0.001	0.014
2006	0.001	0.013
2007	0.003	0.032
2008	0.004	0.023
2009	0.002	0.025

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0043	0.0355
2	0.0040	0.0345
3	0.0033	0.0325
4	0.0030	0.0281
5	0.0026	0.0273
6	0.0026	0.0271
7	0.0023	0.0262
8	0.0023	0.0252
9	0.0023	0.0249
10	0.0020	0.0243
11	0.0020	0.0240
12	0.0019	0.0234
13	0.0018	0.0230
14	0.0018	0.0229
15	0.0018	0.0225
16	0.0017	0.0218
17	0.0016	0.0211
18	0.0016	0.0209
19	0.0016	0.0205
20	0.0015	0.0204
21	0.0014	0.0202
22	0.0014	0.0198
23	0.0014	0.0197
24	0.0013	0.0197
25	0.0013	0.0195
26	0.0013	0.0183
27	0.0012	0.0174
28	0.0012	0.0170
29	0.0012	0.0170
30	0.0011	0.0167
31	0.0011	0.0166
32	0.0010	0.0166
33	0.0010	0.0166
34	0.0010	0.0164
35	0.0010	0.0162
36	0.0010	0.0161
37	0.0010	0.0160
38	0.0010	0.0160
39	0.0009	0.0155
40	0.0009	0.0154
41	0.0009	0.0154
42	0.0009	0.0153
43	0.0009	0.0153
44	0.0008	0.0152
45	0.0008	0.0148

46	0.0008	0.0147
47	0.0008	0.0147
48	0.0008	0.0146
49	0.0008	0.0145
50	0.0008	0.0145
51	0.0007	0.0142
52	0.0007	0.0139
53	0.0007	0.0135
54	0.0006	0.0134
55	0.0006	0.0131
56	0.0005	0.0130
57	0.0005	0.0129
58	0.0005	0.0128
59	0.0003	0.0126
60	0.0002	0.0125
61	0.0001	0.0116

B. WEST BASIN WWHM OUTPUT

WWHM2012
PROJECT REPORT

Project Name: west basin
Site Name: 4559 112th Ave NE
Site Address:
City :
Report Date: 1/28/2021
Gage : Seatac
Data Start : 1948/10/01
Data End : 2009/09/30
(adjusted) **Precip Scale:** 0.00
Version Date: 2019/09/13
Version : 4.2.17

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Mod	.86
Pervious Total	0.86

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.86

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Lawn, Mod	.19
Pervious Total	0.19

Impervious Land Use	acre
ROADS FLAT	0.07
ROADS MOD	0.23
ROOF TOPS FLAT	0.21
Impervious Total	0.51
Basin Total	0.7

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Vault 1
Width : 18 ft.
Length : 98 ft.
Depth: 7 ft.

Discharge Structure

Riser Height: 6.5 ft.
Riser Diameter: 12 in.
Orifice 1 Diameter: 0.4375 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 0.6875 in. **Elevation:** 4 ft.
Orifice 3 Diameter: 0.625 in. **Elevation:** 5.5 ft.

Element Flows To:

Outlet 1	Outlet 2

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.040	0.000	0.000	0.000
0.0778	0.040	0.003	0.001	0.000
0.1556	0.040	0.006	0.002	0.000
0.2333	0.040	0.009	0.002	0.000
0.3111	0.040	0.012	0.002	0.000
0.3889	0.040	0.015	0.003	0.000
0.4667	0.040	0.018	0.003	0.000
0.5444	0.040	0.022	0.003	0.000
0.6222	0.040	0.025	0.004	0.000
0.7000	0.040	0.028	0.004	0.000
0.7778	0.040	0.031	0.004	0.000
0.8556	0.040	0.034	0.004	0.000
0.9333	0.040	0.037	0.005	0.000
1.0111	0.040	0.040	0.005	0.000

1.0889	0.040	0.044	0.005	0.000
1.1667	0.040	0.047	0.005	0.000
1.2444	0.040	0.050	0.005	0.000
1.3222	0.040	0.053	0.006	0.000
1.4000	0.040	0.056	0.006	0.000
1.4778	0.040	0.059	0.006	0.000
1.5556	0.040	0.063	0.006	0.000
1.6333	0.040	0.066	0.006	0.000
1.7111	0.040	0.069	0.006	0.000
1.7889	0.040	0.072	0.006	0.000
1.8667	0.040	0.075	0.007	0.000
1.9444	0.040	0.078	0.007	0.000
2.0222	0.040	0.081	0.007	0.000
2.1000	0.040	0.085	0.007	0.000
2.1778	0.040	0.088	0.007	0.000
2.2556	0.040	0.091	0.007	0.000
2.3333	0.040	0.094	0.007	0.000
2.4111	0.040	0.097	0.008	0.000
2.4889	0.040	0.100	0.008	0.000
2.5667	0.040	0.103	0.008	0.000
2.6444	0.040	0.107	0.008	0.000
2.7222	0.040	0.110	0.008	0.000
2.8000	0.040	0.113	0.008	0.000
2.8778	0.040	0.116	0.008	0.000
2.9556	0.040	0.119	0.008	0.000
3.0333	0.040	0.122	0.009	0.000
3.1111	0.040	0.126	0.009	0.000
3.1889	0.040	0.129	0.009	0.000
3.2667	0.040	0.132	0.009	0.000
3.3444	0.040	0.135	0.009	0.000
3.4222	0.040	0.138	0.009	0.000
3.5000	0.040	0.141	0.009	0.000
3.5778	0.040	0.144	0.009	0.000
3.6556	0.040	0.148	0.009	0.000
3.7333	0.040	0.151	0.010	0.000
3.8111	0.040	0.154	0.010	0.000
3.8889	0.040	0.157	0.010	0.000
3.9667	0.040	0.160	0.010	0.000
4.0444	0.040	0.163	0.013	0.000
4.1222	0.040	0.166	0.015	0.000
4.2000	0.040	0.170	0.016	0.000
4.2778	0.040	0.173	0.017	0.000
4.3556	0.040	0.176	0.018	0.000
4.4333	0.040	0.179	0.019	0.000
4.5111	0.040	0.182	0.020	0.000
4.5889	0.040	0.185	0.021	0.000
4.6667	0.040	0.189	0.021	0.000
4.7444	0.040	0.192	0.022	0.000
4.8222	0.040	0.195	0.023	0.000
4.9000	0.040	0.198	0.023	0.000
4.9778	0.040	0.201	0.024	0.000
5.0556	0.040	0.204	0.024	0.000
5.1333	0.040	0.207	0.025	0.000
5.2111	0.040	0.211	0.026	0.000
5.2889	0.040	0.214	0.026	0.000
5.3667	0.040	0.217	0.027	0.000
5.4444	0.040	0.220	0.027	0.000

5.5222	0.040	0.223	0.029	0.000
5.6000	0.040	0.226	0.031	0.000
5.6778	0.040	0.229	0.033	0.000
5.7556	0.040	0.233	0.034	0.000
5.8333	0.040	0.236	0.036	0.000
5.9111	0.040	0.239	0.037	0.000
5.9889	0.040	0.242	0.038	0.000
6.0667	0.040	0.245	0.039	0.000
6.1444	0.040	0.248	0.040	0.000
6.2222	0.040	0.252	0.041	0.000
6.3000	0.040	0.255	0.042	0.000
6.3778	0.040	0.258	0.042	0.000
6.4556	0.040	0.261	0.043	0.000
6.5333	0.040	0.264	0.109	0.000
6.6111	0.040	0.267	0.435	0.000
6.6889	0.040	0.270	0.884	0.000
6.7667	0.040	0.274	1.364	0.000
6.8444	0.040	0.277	1.784	0.000
6.9222	0.040	0.280	2.077	0.000
7.0000	0.040	0.283	2.252	0.000
7.0778	0.040	0.286	2.443	0.000
7.1556	0.000	0.000	2.600	0.000

Name : Basin 2
Bypass: Yes

GroundWater: No

Pervious Land Use	**acre**
C, Lawn, Mod	.16
Pervious Total	**0.16**

Impervious Land Use	**acre**
Impervious Total	**0**
Basin Total	**0.16**

Element Flows To:

Surface	**Interflow**	**Groundwater**

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.86
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.35
Total Impervious Area:0.51

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.025607
5 year	0.041959
10 year	0.052473
25 year	0.06498
50 year	0.073643
100 year	0.081735

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.024143
5 year	0.037961
10 year	0.048578
25 year	0.063677
50 year	0.076166
100 year	0.089737

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.029	0.036
1950	0.035	0.041
1951	0.056	0.047
1952	0.018	0.013
1953	0.014	0.014
1954	0.022	0.017
1955	0.035	0.018
1956	0.028	0.030
1957	0.023	0.026
1958	0.025	0.017
1959	0.022	0.015
1960	0.039	0.039
1961	0.021	0.023
1962	0.013	0.010
1963	0.018	0.020
1964	0.026	0.021
1965	0.017	0.025
1966	0.016	0.016
1967	0.039	0.040
1968	0.022	0.024
1969	0.022	0.024
1970	0.017	0.018
1971	0.020	0.027
1972	0.042	0.038
1973	0.019	0.023

1974	0.021	0.025
1975	0.029	0.028
1976	0.021	0.020
1977	0.003	0.014
1978	0.018	0.017
1979	0.011	0.010
1980	0.050	0.047
1981	0.016	0.018
1982	0.032	0.052
1983	0.028	0.023
1984	0.017	0.014
1985	0.010	0.017
1986	0.044	0.024
1987	0.039	0.034
1988	0.015	0.013
1989	0.010	0.011
1990	0.093	0.076
1991	0.049	0.053
1992	0.020	0.018
1993	0.020	0.013
1994	0.007	0.011
1995	0.028	0.022
1996	0.065	0.054
1997	0.050	0.044
1998	0.012	0.021
1999	0.055	0.061
2000	0.020	0.022
2001	0.004	0.010
2002	0.023	0.035
2003	0.034	0.031
2004	0.036	0.045
2005	0.027	0.022
2006	0.030	0.027
2007	0.070	0.074
2008	0.085	0.062
2009	0.040	0.032

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0927	0.0764
2	0.0854	0.0736
3	0.0701	0.0617
4	0.0649	0.0606
5	0.0559	0.0544
6	0.0549	0.0533
7	0.0501	0.0520
8	0.0500	0.0471
9	0.0492	0.0468
10	0.0439	0.0446
11	0.0425	0.0441
12	0.0398	0.0409
13	0.0393	0.0400
14	0.0387	0.0388
15	0.0386	0.0380
16	0.0361	0.0356

17	0.0350	0.0355
18	0.0348	0.0341
19	0.0338	0.0322
20	0.0324	0.0306
21	0.0301	0.0300
22	0.0295	0.0279
23	0.0290	0.0269
24	0.0281	0.0267
25	0.0280	0.0257
26	0.0277	0.0253
27	0.0268	0.0249
28	0.0257	0.0241
29	0.0251	0.0238
30	0.0226	0.0238
31	0.0226	0.0234
32	0.0221	0.0234
33	0.0218	0.0234
34	0.0216	0.0221
35	0.0215	0.0217
36	0.0212	0.0215
37	0.0209	0.0215
38	0.0208	0.0213
39	0.0201	0.0202
40	0.0196	0.0202
41	0.0195	0.0183
42	0.0195	0.0182
43	0.0188	0.0181
44	0.0181	0.0178
45	0.0176	0.0173
46	0.0175	0.0172
47	0.0173	0.0171
48	0.0171	0.0169
49	0.0167	0.0156
50	0.0164	0.0146
51	0.0157	0.0138
52	0.0153	0.0137
53	0.0142	0.0135
54	0.0132	0.0132
55	0.0123	0.0128
56	0.0106	0.0126
57	0.0101	0.0112
58	0.0099	0.0108
59	0.0066	0.0102
60	0.0035	0.0101
61	0.0030	0.0098

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0128	17085	16788	98	Pass
0.0134	15500	13340	86	Pass
0.0140	14070	11176	79	Pass

0.0146	12808	9659	75	Pass
0.0153	11567	8588	74	Pass
0.0159	10523	7895	75	Pass
0.0165	9561	7366	77	Pass
0.0171	8754	6941	79	Pass
0.0177	8046	6581	81	Pass
0.0183	7347	6171	83	Pass
0.0189	6742	5771	85	Pass
0.0196	6192	5373	86	Pass
0.0202	5732	5043	87	Pass
0.0208	5309	4742	89	Pass
0.0214	4924	4438	90	Pass
0.0220	4569	4156	90	Pass
0.0226	4237	3931	92	Pass
0.0233	3951	3690	93	Pass
0.0239	3645	3480	95	Pass
0.0245	3390	3296	97	Pass
0.0251	3133	3069	97	Pass
0.0257	2917	2873	98	Pass
0.0263	2706	2671	98	Pass
0.0269	2490	2479	99	Pass
0.0276	2314	2310	99	Pass
0.0282	2136	2138	100	Pass
0.0288	1972	1985	100	Pass
0.0294	1825	1831	100	Pass
0.0300	1702	1681	98	Pass
0.0306	1577	1523	96	Pass
0.0312	1443	1378	95	Pass
0.0319	1325	1223	92	Pass
0.0325	1232	1097	89	Pass
0.0331	1147	971	84	Pass
0.0337	1086	817	75	Pass
0.0343	1020	694	68	Pass
0.0349	947	603	63	Pass
0.0355	885	518	58	Pass
0.0362	824	481	58	Pass
0.0368	760	450	59	Pass
0.0374	725	414	57	Pass
0.0380	675	383	56	Pass
0.0386	623	360	57	Pass
0.0392	589	334	56	Pass
0.0398	549	298	54	Pass
0.0405	506	273	53	Pass
0.0411	469	251	53	Pass
0.0417	427	230	53	Pass
0.0423	388	212	54	Pass
0.0429	356	191	53	Pass
0.0435	328	173	52	Pass
0.0441	298	158	53	Pass
0.0448	270	140	51	Pass
0.0454	241	126	52	Pass
0.0460	218	115	52	Pass
0.0466	197	102	51	Pass
0.0472	173	89	51	Pass
0.0478	152	84	55	Pass
0.0484	130	79	60	Pass
0.0491	119	75	63	Pass

0.0497	104	71	68	Pass
0.0503	95	67	70	Pass
0.0509	83	61	73	Pass
0.0515	74	56	75	Pass
0.0521	69	49	71	Pass
0.0527	61	43	70	Pass
0.0534	53	30	56	Pass
0.0540	46	22	47	Pass
0.0546	39	8	20	Pass
0.0552	29	8	27	Pass
0.0558	25	7	28	Pass
0.0564	22	7	31	Pass
0.0571	20	6	30	Pass
0.0577	17	6	35	Pass
0.0583	14	6	42	Pass
0.0589	12	5	41	Pass
0.0595	8	5	62	Pass
0.0601	7	5	71	Pass
0.0607	7	4	57	Pass
0.0614	7	3	42	Pass
0.0620	6	2	33	Pass
0.0626	6	2	33	Pass
0.0632	6	2	33	Pass
0.0638	6	2	33	Pass
0.0644	6	2	33	Pass
0.0650	5	2	40	Pass
0.0657	5	2	40	Pass
0.0663	5	2	40	Pass
0.0669	5	2	40	Pass
0.0675	5	2	40	Pass
0.0681	5	2	40	Pass
0.0687	5	2	40	Pass
0.0693	4	2	50	Pass
0.0700	4	2	50	Pass
0.0706	3	2	66	Pass
0.0712	3	2	66	Pass
0.0718	3	2	66	Pass
0.0724	3	2	66	Pass
0.0730	3	2	66	Pass
0.0736	3	1	33	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.0697 **acre-feet**
On-line facility target flow: 0.0856 **cfs.**
Adjusted for 15 min: 0.0856 **cfs.**
Off-line facility target flow: 0.048 **cfs.**
Adjusted for 15 min: 0.048 **cfs.**

LID Report

LID Technique	Used for Treatment?	Total Volume Needs Treatment	Volume Through Facility	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration	Percent Volume	Comment	Water Quality	Percent Water Quality

	Infiltrated	Treated			Credit	
			(ac-ft)	(ac-ft)		
Vault 1 POC		N	87.18		N	0.00
Total Volume Infiltrated			87.18	0.00	0.00	0.00

0.00 0% No Treat. Credit
Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

Date: October 21, 2021

To: Lindsey Fedak
The Blueline Group

We have reviewed the plans sent to us regarding garbage and recycle service for:

"8 Cottages" located at 4559 112th Ave NE in Kirkland, Wa

We find these plans to be acceptable for service by Waste Management, North Sound Division equipment and hereby approve them with the following exceptions:

Waste Management can service toters from curbside at this location. The service area must be kept clear and accessible.

Thank you,

Waste Management North Sound

Tim Miller
Route Manager – North Sound WM

August 18, 2004

To The Property Owner:

We recently sent out a letter and a survey to you and 27 other property owners on 112th Ave NE south of NE 53rd St, regarding the installation of a modified street improvement standard (see attached letter). Once again, the main difference between the modified street improvements and traditional street improvements is the use of a flat gutter instead of a vertical curb. The modified street standard is similar to the Street Edge Alternative (SEA) standard used by the City of Seattle.

We received back 14 survey responses. 9 responses indicated that they felt the modified street improvement standard would be an acceptable alternative to traditional street improvements, while the remaining 5 indicated otherwise.

Since a majority of the survey respondents favored the modified street improvement standard, we shall proceed with requiring those who subdivide their property to install the modified street improvements. If you have any questions, you may contact me at 425-828-1237, or email me at rjammerman@ci.kirkland.wa.us.

Sincerely,

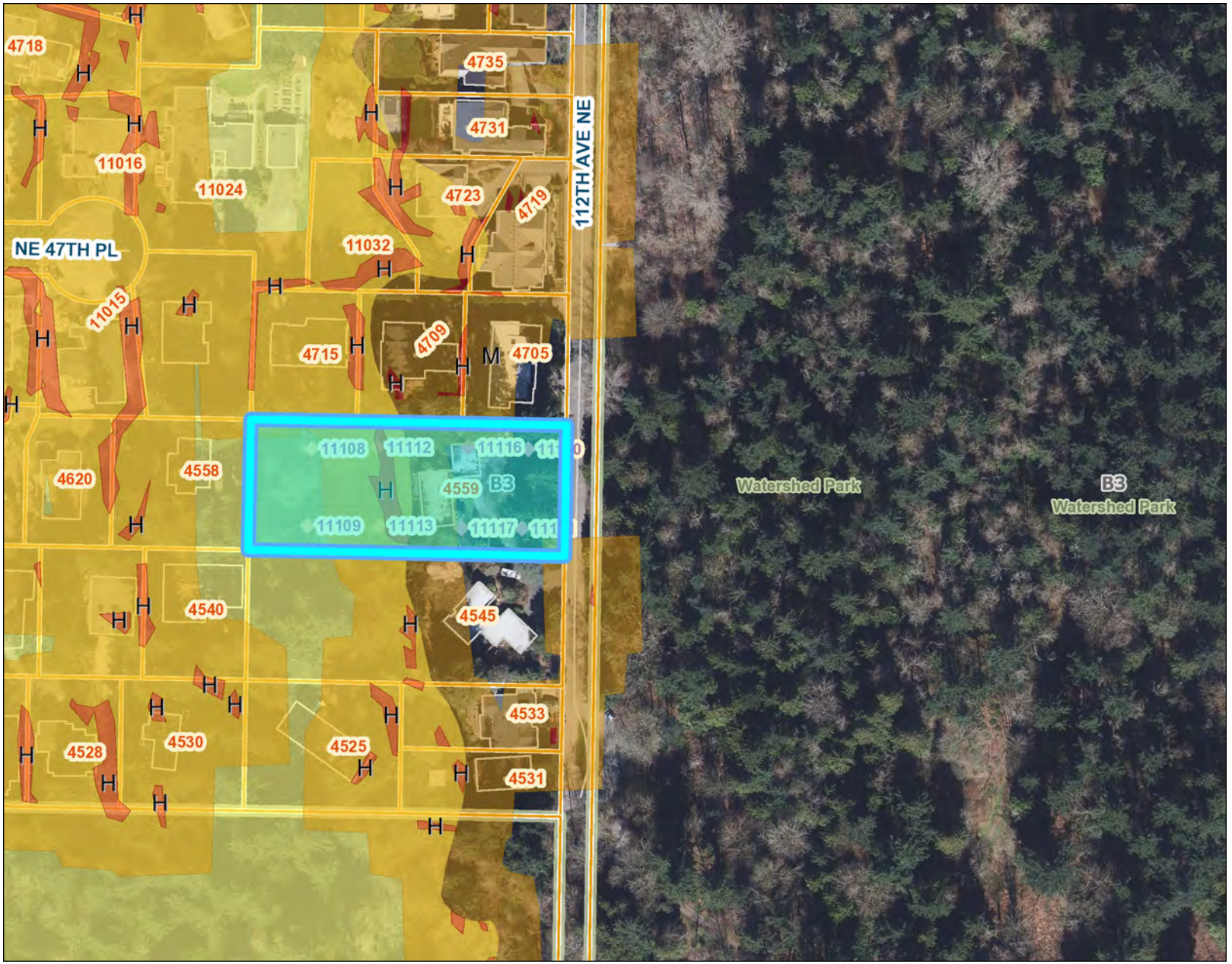
DEPARTMENT OF PUBLIC WORKS

Rob Jammerman
Development Engineering Manager

Attachment (1)

RJ:kc:112th NE SEA letter2.doc

KIRKLAND SENSITIVE AREAS MAP
4559 112TH AVE NE



Legend

- Streams
  - Open
  - Pipe
- Landslide
  - Deposit Areas
  - Head Scarps
  - High Susceptibility
  - Moderate Susceptibility
- Wetlands
- Liquefaction Potential
  - High
  - Medium or Mixed
- Address
  - Other Address
  - Current Address
  - Current ADU
  - Pending Address
- City Limits
- Grid
- QQ Grid
- Cross Kirkland Corridor
- Regional Rail Corridor
- Streets
- Parcels
- Place Names
- Buildings

1: 1,684

Notes

280.7 0 140.35 280.7 Feet

NAD_1983_StatePlane_Washington_North_FIPS_4601_Feet

GEOTECHNICAL ENGINEERING REPORT

PREPARED BY:

THE RILEY GROUP, INC.
17522 BOTHELL WAY NORTHEAST
BOTHELL, WASHINGTON 98011

PREPARED FOR:

DC GRANGER HOMES
PO BOX 16438
SEATTLE, WASHINGTON 98116

RGI PROJECT NO. 2018-122

GRAVITY RIDES EVERYTHING
4559 112TH AVENUE NORTHEAST
KIRKLAND, WASHINGTON

APRIL 29, 2020

Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone 425.415.0551 ♦ Fax 425.415.0311

www.riley-group.com

RILEYGROUP

April 29, 2020

Mr. Darin Granger
DC Granger Homes
PO Box 16438
Seattle, Washington 98116

Subject: **Geotechnical Engineering Report**
Gravity Rides Everything
4559 112th Avenue Northeast
Kirkland, Washington
RGI Project No. 2018-122

Dear Mr. Granger:

As requested, The Riley Group, Inc. (RGI) has performed a Geotechnical Engineering Report (GER) for the Gravity Rides Everything located at 4559 112th Avenue Northeast, Kirkland, Washington. The information in this GER is based on our understanding of the proposed construction, and the soil and groundwater conditions encountered in the test probes completed by RGI at the site on May 10, 2018.

RGI reviewed the civil plans submitted for the project in preparing this report. RGI recommends that a representative of our firm be present on site during portions of the project construction to confirm that the soil and groundwater conditions are consistent with those that form the basis for the engineering recommendations in this GER.

If you have any questions or require additional information, please contact us.

Respectfully submitted,

THE RILEY GROUP, INC.

FOR:

Elizabeth Wratten, GIT
Project Geologist

KRISTINA MARIE WELLER
STATE OF WASHINGTON
33182
REGISTERED
PROFESSIONAL ENGINEER
4/29/20

Kristina M. Weller, PE
Principal Geotechnical Engineer

Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone 425.415.0551 ♦ Fax 425.415.0311

www.riley-group.com

TABLE OF CONTENTS

LIST OF FIGURES AND APPENDICES

Executive Summary

This Executive Summary should be used in conjunction with the entire Geotechnical Engineering Report (GER) for design and/or construction purposes. It should be recognized that specific details were not included or fully developed in this section, and the GER must be read in its entirety for a comprehensive understanding of the items contained herein. Section 7.0 should be read for an understanding of limitations.

RGI's geotechnical scope of work included the advancement of 5 test probes to approximate depths of 12 feet below existing site grades. RGI previously provided a report entitled LID Infiltration Feasibility Study dated June 5, 2018.

Based on the information obtained from our subsurface exploration, the site is suitable for development of the proposed project. The following geotechnical considerations were identified:

Soil Conditions: The soils encountered during field exploration include medium to very dense silty sand with some gravel grading to silty gravely sand (till), overlain by loose to medium dense silty sand with gravel and organics (fill). Underneath the very dense silty sand with gravel, stiff silt with sand was observed in test probe-1.

Groundwater: Light groundwater seepage was encountered at 6.5 feet below ground surface during our subsurface exploration.

Foundations: Foundations for the proposed building may be supported on conventional spread footings bearing on medium dense to dense native soil or structural fill.

Slab-on-grade: Slab-on-grade floors and slabs for the proposed building can be supported on medium dense to dense native soil or structural fill.

Pavements: The following pavement sections are recommended:

- **For the access roadway**: 2 inches of Hot Mix Asphalt (HMA) over 4 inches of Asphalt Treated Base (ATB) over 4 inches of crushed rock base (CRB)
- **For general parking areas**: 2 inches of HMA over 4 inches of CRB
- **For concrete pavement areas**: 5 inches of concrete over 4 inches of CRB

1.0 Introduction

This Geotechnical Engineering Report (GER) presents the results of the geotechnical engineering services provided for the Gravity Rides Everything in Kirkland, Washington. The purpose of this evaluation is to assess subsurface conditions and provide geotechnical recommendations for the construction of a single family residence with a detention vault, and access roadway. Our scope of services included field explorations, laboratory testing, engineering analyses, and preparation of this GER.

The recommendations in the following sections of this GER are based upon our current understanding of the proposed site development as outlined below. If actual features vary or changes are made, RGI should review them in order to modify our recommendations as required. In addition, RGI requests to review the site grading plan, final design drawings and specifications when available to verify that our project understanding is correct and that our recommendations have been properly interpreted and incorporated into the project design and construction.

2.0 Project description

The project site is located at 4559 112th Avenue Northeast in Kirkland, Washington. The approximate location of the site is shown on Figure 1.

The site currently consists of a single family residence with dense vegetation and trees surrounding the building and driveway. The single family residence on the site will be replaced by a new single family residence.

At the time of preparing this GER, building plans were not available for our review. Based on our experience with similar construction, RGI anticipates that the proposed building will be supported on perimeter walls with bearing loads of two to eight kips per linear foot, and a series of columns with a maximum load up to 30 kips. Slab-on-grade floor loading of 250 pounds per square foot (psf) are expected.

3.0 Field Exploration and Laboratory Testing

3.1 Field Exploration

On May 10, 2018, RGI observed the drilling of 5 test probes. The approximate exploration locations are shown on Figure 2.

Field logs of each exploration were prepared by the geotechnical engineer or geologist that continuously observed the drilling. These logs included visual classifications of the materials encountered during drilling as well as our interpretation of the subsurface conditions between samples. The test probes logs included in Appendix A represent an

interpretation of the field logs and include modifications based on laboratory observation and analysis of the samples.

3.2 LABORATORY TESTING

During the field exploration, a representative portion of each recovered sample was sealed in containers and transported to our laboratory for further visual and laboratory examination. Selected samples retrieved from the test probes were tested for moisture content and grain size analysis, to aid in soil classification and provide input for the recommendations provided in this GER. The results and descriptions of the laboratory tests are enclosed in Appendix A.

4.0 Site Conditions

4.1 SURFACE

The subject site is a rectangular-shaped parcel of land approximately 0.86 acres in size. The site is bound to the north, south and west by residential property, and to the east by 112th Avenue Northeast.

The existing site is a single family residence covered by trees and other vegetation. The site slopes down from the east to the west with a steep slope about half way through, the total elevation change is approximately 34 feet, with a third of the elevation change happening in the center of the site.

4.2 GEOLOGY

Review of the *Geologic Map of the Kirkland Quadrangle, Washington,* by J. P. Minard (1983) indicates that the soil in the project vicinity is mapped as Vashon outwash (Qva) which is a nonsorted mixture of dense sand with varying amount of silt, gravel, and cobbles. Vashon till (Qt), is also located nearby, which is light to dark gray, nonsorted, nonstratified mixture of clay, silt, sand, and gravel. The till deposit is generally very stiff and impermeable, often resulting in poorly drained bogs developing in relatively flat area. The deposit is usually 1 to 2 meters thick, but locally can be as much as 25 meters. These descriptions are generally similar to the findings in our field explorations. The soil conditions were variable across the site, to the east very dense silty sand interpreted as Vashon-age lodgement till, to the west dense silty sand and silty gravelly sand.

4.3 SOILS

The soils encountered during field exploration include medium to very dense silty sand with some gravel grading to silty gravely sand (till), overlain by loose to medium dense silty sand with gravel. Underneath the very dense silty sand with gravel, stiff silt with sand was observed in test probe-1.

More detailed descriptions of the subsurface conditions encountered are presented in the test probes included in Appendix A. Sieve analysis was performed on two selected soil samples. Grain size distribution curves are included in Appendix A.

4.4 GROUNDWATER

Light groundwater seepage was encountered 6.5 feet below the ground surface during our subsurface exploration. The groundwater appears to be perched over the top of the dense glacial till layer.

It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the explorations were performed. In addition, perched water can develop within seams and layers contained in fill soils or higher permeability soils overlying less permeable soils following periods of heavy or prolonged precipitation. Therefore, groundwater levels during construction or at other times in the future may be higher or lower than the levels indicated on the logs. Groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.5 SEISMIC CONSIDERATIONS

Based on the International Building Code (IBC), RGI recommends the follow seismic parameters for design.

Table 1 2015/2018 IBC

Parameter	2015 Value	2018 Value
Site Soil Class[1]	D[2]	
Site Latitude	47.6516417	
Site Longitude	-122.1915685	
Short Period Spectral Response Acceleration, S_S (g)	1.27	1.281
1-Second Period Spectral Response Acceleration, S_1 (g)	0.487	0.445
Adjusted Short Period Spectral Response Acceleration, S_{MS} (g)	1.27	1.281
Adjusted 1-Sec Period Spectral Response Acceleration, S_{M1} (g)	0.737	0.826[3]
Numeric seismic design value at 0.2 second; S_{DS}(g)	0.846	0.854
Numeric seismic design value at 1.0 second; S_{M1}(g)	0.492	0.551[3]

1. Note: In general accordance with Chapter 20 of ASCE 7-10 and 7-16, the Site Class is based on the average characteristics of the upper 100 feet of the subsurface profile.

2. Note: ASCE 7-10 and 7-16 require a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope of our services does not include the required 100 foot soil profile determination. Test probes extended to a maximum depth of 12 feet, and this seismic site class definition considers that similar soil continues below the maximum depth of the subsurface exploration. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.

3. Note: In accordance with ASCE 11.4.8, a ground motion hazard analysis is not required for the following cases:
   - Structures on Site Class E sites with S_S greater than or equal to 1.0, provided the site coefficient Fa is taken as equal to that of Site Class C.
   - Structures on Site Class D sites with S_1 greater than or equal to 0.2, provided that the value of the seismic response coefficient Cs is determined by Eq. 12.8-2 for values of $T \leq 1.5Ts$ and taken as equal to 1.5 times the value computed in accordance with either Eq. 12.8-3 for $T_L \geq T > 1.5T_s$ or Eq. 12.8-4 for $T > TL$.
   - Structures on Site Class E sites with S_1 greater than or equal to 0.2, provided that T is less than or equal to T_s and the equivalent static force procedure is used for design.

The above exceptions do not apply to seismically isolated structures, structures with damping systems or structures designed using the response history procedures of Chapter 16.

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations from a seismic event. Liquefaction mainly affects geologically recent deposits of fine-grained sands that are below the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction, thus reducing or eliminating the soil's strength.

RGI reviewed the results of the field and laboratory testing and assessed the potential for liquefaction of the site's soil during an earthquake. Since the site is underlain by glacial till, RGI considers that the possibility of liquefaction during an earthquake is minimal.

4.6 GEOLOGIC HAZARD AREAS

Regulated geologically hazardous areas include erosion, landslide, earthquake, or other geological hazards. Based on the definition in the Kirkland Zoning Code and City of Kirkland GIS mapping, portions of the site meet the criteria of a landslide hazard area. In order to discuss all of the aspect of the Kirkland Code, the code section and our response to each item is provided in the following section or referenced to the appropriate section of this report.

KZC 85.15.1. A topographic survey of the subject property, or the portion of the subject property specified by the Planning Official, with two (2) foot contour intervals. This mapping shall contain the following information:

a. Delineation of areas containing slopes 15 percent or greater, and identification of slopes 40 percent or greater.
b. Wetlands, streams and lakes on or adjacent to the subject property.
c. The location of storm drainage facilities on the subject property.
d. Existing vegetation, including size and type of significant trees.

Response: The general site topography slopes from east to west, with a total grade change of 34 feet with an elevation of approximately 400 feet along 112th Avenue Northeast to an elevation of approximately 366 feet at the west property line. This overall grade change it equivalent to the slope of 12 percent. There is a steeper grade change in the middle of the site which separates the east and west portions of the site.

The areas of greater than 15 percent and greater than 40 percent slope areas are shown on Figure 2. This area will be regraded to a flat grade less than 15 percent and a retaining wall will be constructed as part of the first home construction as shown on Figure 2.

No wetlands, streams, or lakes are on or adjacent to the property. No storm drainage facilities are located on the slope. The site is wooded with mature trees which show no signs of slope movement.

KZC 85.15.2. A geotechnical investigation, prepared by a geotechnical engineer licensed in Washington State or engineering geologist licensed in Washington State, to determine if a landslide hazard area or seismic hazard area exists on the subject property.

Response: The slope on the central portion of the is mapped as Moderate Susceptibility on the City of Kirkland Landslide Susceptibility Map with small areas mapped as high due to the small area with over 40 percent slope. The majority of the mapped area is less than 15 percent with a small area as shown on Figure 2 with greater than 15 percent slopes and the small area of greater than 40 percent slopes. The greater than 40 percent slope area is general 10 feet in height or less and appears to have been modified to create a flat yard area for the existing house including a small wall. Based on the topography and the subsurface conditions, the potential for landslides on the site in the current condition is low.

The site is mapped as moderate or mixed liquefaction potential on the City of Kirkland Liquefaction Potential Map. Based on the subsurface conditions, in our opinion the potential for liquefaction is low.

KZC 85.15.3. A geotechnical report, prepared by a geotechnical engineer licensed in Washington State or engineering geologist licensed in Washington State, showing and including the following information:

a. A description of how the proposed development will or will not affect slope stability, surface and subsurface drainage, erosion, and seismic hazards on the subject property and other potentially impacted properties.
b. Evidence, if any, of holocene or recent landsliding, sloughing, or soil creep.
c. The location of springs, seeps, or any other surface expression of groundwater, and the location of surface water or evidence of seasonal runoff or groundwater.
d. Identification of existing fill areas.
e. Soil description in accordance with the Unified Soil Classification Systems.
f. Depth to groundwater and estimates of potential seasonal fluctuations, if applicable to the project.
g. Subsurface exploration logs that assess geologic hazards at the site, meaning that soil descriptions on the logs shall be in accordance with the Unified Soil Classification System. In addition, the logs shall also identify each of the geologic units encountered (e.g., fill, Vashon lodgement till, Vashon advance outwash).

h. If the subject property is located within 100 feet of a high landslide hazard area, then a current LiDAR-based shaded relief map of the project area and a discussion of the licensed geotechnical professional interpretation of this mapping must be provided.

i. Results of a quantitative slope stability analysis for any project involving development within a horizontal distance "H" of a high landslide hazard area where "H" is equal to the height of the slope within the high landslide hazard area or 50 feet, whichever is greater. The evaluation of slope stability under seismic conditions shall be based on a horizontal ground acceleration equal to one-half of the peak horizontal ground acceleration with a two (2) percent in 50-year probability of exceedance as defined in the current version of the International Building Code.

j. A discussion of the presence or absence of site features potentially indicative of historic landslide activity or increased risk of future landslide activity. Such features include, but are not limited to, tree trunk deformation, emergent seepage, landslide scarps, tension cracks, reversed slope benches, hummocky topography, vegetation patterns, and area stormwater management practices.

k. Estimate of the magnitude of seismically induced settlement that could occur during a seismic event for any project involving development within a seismic hazard area. Estimation of the magnitude of seismically induced settlement shall be based on a peak horizontal ground acceleration based on a seismic event with a two (2) percent in 50-year probability of exceedance as defined in the current version of the International Building Code. This requirement may be waived if it can be demonstrated that construction methods will mitigate the risk of seismically induced settlement such that there will be no significant impacts to life, health, safety and property.

l. A summary or abstract of the geotechnical report for the property where the development activity is proposed. The abstract shall at a minimum include the type of hazard, extent of the hazard, hazard analysis and geologic conditions.

m. The geotechnical report shall state that the project can be undertaken safely as long as the measures/recommendations of the geotechnical report are incorporated into the project plans.

Response: The central portion of the site where the slope is located will be modified to create a level yard area including a retaining wall for grade changes. The finished grades will be less than 15 percent in this area. This construction will remove the landslide potential area on the site.

There is no indication of landsliding, sloughing or soil creep. No springs, seeps, or any surface expression of groundwater were observed. No surface water was observed. No significant fill soils were observed at the site in our explorations. The soils encountered are interpreted to be Vashon-age advance outwash deposits. Soils at the site are predominantly silty gravelly sand (SM). Groundwater was not encountered on the eastern