Stormwater Site Plan Report

PREPARED FOR:

Everett School District
4730 Colby Avenue
Everett, WA 98201

PROJECT:

Everett School District
Longfellow Parking Improvements
Everett, WA
2160434.10

PREPARED BY:

Ryan Kelsey
Project Engineer

REVIEWED BY:

Douglas G. Tapp, PE
Principal

DATE:

January 2017

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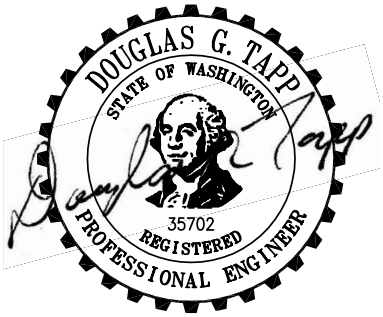

01/25/2017

I hereby state that this Stormwater Site Plan Report for Everett School District Longfellow Parking Improvements has been prepared by me or under my supervision, and meets the standard of care and expertise that is usual and customary in this community for professional engineers. I understand that the City of Everett does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

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1.0 Project Overview

1.1 Purpose and Scope

This Stormwater Site Plan Report has been written to support the Site Development Permit documents submitted for the Longfellow Building Parking Improvements for the Everett School District, located at 3715 Oakes Avenue, Everett, Washington. The project will meet Minimum Requirements 1 through 5 of the 2010 Department of Ecology (DOE) *Stormwater Management Manual for Western Washington (SMMWW)* (adopted by the City of Everett).

1.2 Existing Conditions Summary

The existing site is currently developed with two building structures and a parking area for the District's school buses. The existing site is approximately 2.56 acres. See Appendix A-2 for an Existing Conditions Map. The parking area surrounds the buildings toward the east and south, while Oakes Avenue and 37th Street border the buildings toward the west and north. Stormwater is collected and conveyed into catch basins located onsite before discharging to the city's combined storm sewer system located on 37th Street.

1.3 Developed Conditions Summary

The project consists of the demolition of the existing buildings, the construction of a new parking area, and replacement of a concrete walk along Oakes Avenue and 37th Street. The proposed development area of the site is approximately 1 acre, of which 81.5 percent is impervious surface. Stormwater runoff from the site will be conveyed in a watertight system, where it will outlet to an existing combined sewer mainline, north of the project site. Refer to Appendix A-3 for the Developed Conditions Map.

2.0 Minimum Requirements

The project is subjected to Minimum Requirements 1 through 5 of the City of Everett *Stormwater Management Manua*l, Volume I and Interim Policy 2-11 regarding stormwater control in the combined sewer area. The method by which the project meets the Minimum Requirements is discussed below.

2.1 Construction Stormwater Pollution Prevention Plan (SWPPP) Elements 1 through 12

1. Mark Clearing Limits – All areas to remain undisturbed during the construction of the project will be delineated prior to any site clearing or grading.

2. Construction Access – Construction access will be provided at 37th Street at the existing driveway entrance by a stabilized construction entrance per Best Management Practice (BMP) C105.

3. Control Flow Rates – Site will not need controlled flow rates during the demolition and construction of the parking improvements.

4. Sediment Controls – Silt fencing, sand bags, and storm drain inlet protection will prevent sediment from leaving the site.

5. Stabilize Soils – Disturbed areas not immediately worked shall be covered with plastic sheeting, mulch, or other BMP, as required in the *SMMWW*.

6. Protect Slopes – All soils on slopes shall be stabilized per Element 5 by covering exposed soils with plastic sheeting, mulch, or other BMP, as required by the *SMMWW*. Slopes will also be protected through the use of interceptor swales, check dams, and other BMPs to provide an alternative drainage path away from slopes.

7. Protect Drain Inlets – All catch basins in and adjacent to the construction area will be protected by storm drain inlet protection per BMP C220.

8. Stabilize Channels and Outlets – Site will not need stabilized channels or outlets during the demolition and construction of the parking improvements.

9. Control Pollutants – All pollutants and construction materials shall be handled in a manner to prevent stormwater contamination. Construction debris shall be handled and disposed of in a legal manner offsite. Construction BMPs shall be used to prevent or treat contamination of stormwater.

10. Control Dewatering – Site will not need dewatering during demolition or construction of the parking improvements.

11. Maintain BMPs – The Contractor shall be responsible for maintaining all BMPs.

12. Manage the Project – The Contractor shall be responsible for inspecting and maintaining temporary erosion and sedimentation control (TESC) facilities. The Construction SWPPP shall be retained onsite and shall be kept up to date. The Contractor will provide the name and contact information for the designated Certified Erosion and Sedimentation Control Lead (CESCL) to the City prior to beginning construction.

3.0 Analysis and Design of Runoff Control BMPs

Flow Control and Water quality is not required for this project, as it is within the combined sewer area in the city of Everett.

3.1 Onsite Stormwater Management

Onsite stormwater management BMPs have been evaluated based on Chapter 12 from Volume III of the City of Everett *Stormwater Management Manual*. Below is a BMP summary:

Surface Type	Area (acres)	List 2 Feasibility Review (**Bold Determined Feasible and Provided**)	Justification
Parking	0.67	~~1. Onsite Infiltration Areas~~ ~~2. Raingardens~~ ~~3. Downspout Dispersion Systems~~ ~~4. Concentrated Flow Dispersion~~ ~~5. Sheet Flow Dispersion~~	1. Onsite Infiltration Areas are not feasible due to low infiltration rate. Refer to geotechnical report for more information. 2. Raingardens are not feasible due to low infiltration rate. Refer to geotechnical report for more information. 3. Downspout Dispersion is not feasible due to inadequate vegetated flow path. 4. Concentrated Flow Dispersion is not feasible as there is not enough surface area to provide this BMP. This BMP would require 50 LF of vegetated flow path. Site constraints make this BMP infeasible. 5. Sheet Flow Dispersion is not feasible as there is not sufficient area adjacent to parking lot to provide the required vegetated flow path.

Surface Type	Area (acres)	List 2 Feasibility Review (**Bold Determined Feasible and Provided**)	Justification
Walk	0.11	~~1. Onsite Infiltration Areas~~ ~~2. Raingardens~~ ~~3. Downspout Dispersion Systems~~ ~~4. Concentrated Flow Dispersion~~ ~~5. Sheet Flow Dispersion~~	1. Onsite Infiltration Areas are not feasible due to low infiltration rate. Refer to geotechnical report for more information. 2. Raingardens are not feasible due to low infiltration rate. Refer to geotechnical report for more information. 3. Downspout Dispersion is not feasible due to inadequate vegetated flow path. 4. Concentrated Flow Dispersion is not feasible as there is not enough surface area to provide this BMP. This BMP would require 50 LF of vegetated flow path. Site constraints make this BMP infeasible. 5. Sheet Flow Dispersion is not feasible as there is not sufficient area adjacent to parking lot to provide the required vegetated flow path.

3.2 Runoff Treatment

Water quality treatment is not required by the City of Everett because site drains to a combined sewer system. Treatment from proposed pollution-generating impervious and pervious surfaces will occur at the sewage treatment plant.

3.3 Flow Control

This project proposes less impervious surface than the existing conditions, and therefore yields a calculated 0.023 cubic feet per second (cfs) decrease in the 100-year storm. Per Section 2.2.7 of Volume I of the City of Everett *Stormwater Management Manual*, because the 50-year storm is less than 0.1 cfs increase, flow control is not required. Refer to Appendix B for flow control calculations.

3.4 Conveyance System Analysis and Design

3.4.1 Onsite Conveyance System

As described above, the City of Everett requires that all storm and sewer utility lines are separated onsite. Therefore, the project site conveyance system consists of closed drainage pipe systems, which connect to a 12-inch combined sewer pipe on 37th Street. See Appendix A, Exhibit A-4 for the project Site Drainage Map.

The pipe system was checked for minimum velocity for the 25-year, 24-hour storm. All system components have a design velocity of at least 2 feet per second (fps) for the design storm. Pipe capacity was analyzed for capacity for both the 25-year and 100-year, 24-hour storm. The analysis indicates that no overtopping will occur during the 100-year, 24-hour storm event. Conveyance calculations can be found in Appendix B, Exhibit B-2.

3.4.2 Offsite Conveyance System

The downstream combined storm/sewer conveyance system has adequate capacity to support the proposed development, per communication with the City of Everett.

4.0 Analysis and Design of Required Source Control BMPs

This project does not fall under any of the specific business or manufacturing groups listed in the City of Everett *Stormwater Management Manual*. The pollutants of concern are oil and gas, and other fluid emissions from vehicles. This section will also address the construction practices dealing with pollutants other than sediments, and spill control measures.

4.1 Proposed Source Control

1. Warning signs (e.g., "Dump No Waste – Drains to Puget Sound") shall be stenciled or stamped on or adjacent to all storm drain inlets. Signs shall be repainted as needed.

2. Parking lots and drive aisles shall be swept periodically. Special care shall be taken not to flush water from the pavement surfaces into the storm drain system.

4.2 Construction Source Control

CONTROL OF POLLUTANTS OTHER THAN SEDIMENTS

Operation and maintenance activities and storage and disposal practices at the construction site will be conducted to minimize the potential for contamination of stormwater runoff.

Good housekeeping practices shall be maintained by the Contractor(s). Major equipment maintenance will be performed at a properly permitted location remote from the project site. The project site can be used for daily maintenance activities, such as periodic oil changes, to ensure proper operation of the equipment and to ensure that the equipment is environmentally safe. Heavy equipment that cannot leave the project site without being hauled on a trailer or truck can be worked on at the project site, provided that the work is performed in a designated Contractor's staging area and that environmentally safe procedures are adhered to. Waste oil and contaminated debris will be removed from the site and disposed of in accordance with applicable regulations.

There shall be no visible sheen from petroleum products allowed in waters of the state or stormwater runoff as a result of project activities.

All of the materials used in construction, as well as both mobile and stationary equipment, will be considered as potential waste generation materials. Potential waste, such as solvents, paints, batteries, strong acid and alkaline wastes, and paint removers, are all considered dangerous wastes and must be disposed of in accordance with the standards listed on the individual containers.

SPILL CONTROL AND COUNTERMEASURES PLAN (SPCC)
(SUGGESTED)

Spillable Materials and Location

Potential spillable substances onsite include gasoline, diesel fuel, and vehicle fluids (lubricating oil, hydraulic fluid, brake fluid, etc.). No petroleum products will be stored onsite. Any onsite vehicle and equipment fueling will occur in a single designated location in the construction staging area; this area will be located away from drainage courses and inside secondary containment.

Spill Prevention

The following spill prevention procedures will be used:

No vehicle maintenance other than emergency repair and daily maintenance activities will be performed on the project site. No fresh or used engine fluids will be stored on the project site.

1. Vehicle and equipment fueling will occur in a single designated location within the construction staging area; this area will be located away from drainage courses and inside secondary containment; and

2. Oil absorbent pads and drip pans will be placed under vehicles being fueled and under parked vehicles.

Spill Kit

A spill kit consisting of the following materials will be kept onsite. Any spill kit materials used will be replaced within 2 days.

- 3 - pairs of rubber gloves
- 3 - protective goggles or glasses (or face shields)
- 1 - set of spill response procedures (below)
- 12 - oil absorbent pads
- 1 - roll of visqueen
- 2 - rolls of duct tape for temporary patching of lines and tanks, etc.
- 1 - container of repair/auto putty for patching of lines and tanks, etc.
- 5 gallons - loose absorbent material (floor sweep, kitty litter, etc.)
- 2 - permanent markers for labeling contaminated materials
- 24 - heavy-duty garbage bags
- 100 feet - oil absorbent boom
- 2 - shovels
- 10 - copies of Spill Report Form (see below)

Spill Response Procedures

The following spill response procedures will be used, in order:

1. Hazard Assessment: Assess the source, extent, and quantity of the spill.

2. Securement and Personal Protection: If the spill cannot be safely and effectively controlled, evacuate the area and immediately notify outside response services (go to Step 5). If the spill can be safely and effectively controlled, secure the area and proceed immediately with spill control.

3. Containment and Elimination of Source: Contain the spill with absorbent materials, floating booms, or a soil berm around the affected area. Eliminate the source of the spill by closing valves, sealing leaks, providing containment, or deactivating pumps.

4. Cleanup: When containment is complete, use absorbent and other materials to clean up the spill.

5. Notification: Report all spills immediately. All notification will proceed according to the following protocols:

If necessary, the Contractor's ESC/Stormwater lead (or any employee if the ESC/Stormwater Lead is unavailable) should contact emergency agencies and/or spill response services:

Emergency Services: (fire and medical)	Fire Department: 911
Spill Response Contractor: (name and phone)	Contractor to provide:

All Contractor employees will notify the Contractor's designated ESC/Stormwater Lead:

Contractor's ESC Lead:	Contractor to provide:

The Contractor's ESC/Stormwater Lead will notify the City of Everett:

For all spills that produce a surface sheen:	National Response Center Hotline: (800) 424-8802 Washington Department of Ecology: (425) 649-7276
Any release that may be a threat to human health or the environment:	Ecology Toxics Cleanup Program: (360) 407-7170
Any spill to water that cannot be contained:	Washington State Emergency Management Division: (800) 258-5990

6. Removal and Disposal of Contaminated Materials: Remove all contaminated soil and place on a plastic liner, cover with plastic, and remove offsite within 24 hours. Properly dispose of contaminated soil at an approved disposal facility. Collect absorbent and other materials into a labeled container and properly dispose of at an approved disposal facility.

7. Follow-Up Reporting: Fill out a Spill Report Form (located in Appendix A, Exhibit A-6) within 2 working days and submit it to Contractor's ESC Lead.

SPCC Program Management

All Contractor employees will be trained in these spill control and response procedures, including spill source and receptor recognition, spill prevention techniques, spill response measures, and spill reporting protocol.

Should site conditions change, this SPCC will be updated as necessary.

5.0 Special Reports and Studies

"Subsurface Exploration and Geologic Engineering Report, Longfellow Building Site" by Associated Earth Sciences, Inc., dated January 19, 2017, is provided in Appendix C of this report.

6.0 Other Permits

A National Pollution Discharge Elimination System (NPDES) Stormwater permit from the DOE is necessary because the proposed improvements will disturb more than 1 acre.

7.0 Miscellaneous Forms and Worksheets

The City of Everett Cost Estimate for Permit Fee Calculation will be provided to the City, if necessary, for the City's use to determine permit fees and bond amounts.

8.0 Maintenance and Operations Requirements

This section includes a list of specific permanent and construction BMPs and instructions for their maintenance. Maintenance guidelines for erosion control facilities should be onsite at all times during construction, and the checklists for permanent stormwater facilities shall be kept by those responsible for the maintenance of these facilities. A checklist shall be prepared and submitted to the City of Everett per the following schedule:

- Monthly from November through April.
- Once in late summer (September).
- After any major storm event.

The items for maintenance consideration are as follows:

Temporary Construction Erosion/Sedimentation Control BMPs

1. Filter Fabric Fence
2. Temporary Construction Entrance
3. Construction Fencing
4. Temporary Sediment Trap
5. Catch Basin Inlet Protection
6. Cover Measures
7. Dust Control

Permanent Stormwater Facilities, Grounds Maintenance, and Pest Control

1. Storm Drainage Pipes
2. Catch Basins
3. Parking Lot Cleaning
4. Vegetation Management
5. Pest Control

See Appendix D for Maintenance Guidelines.

9.0 Conclusion

This analysis is based on data and records either supplied to or obtained by AHBL, Inc. These documents are referenced within the text of the analysis. The analysis has been prepared utilizing procedures and practices within the standard accepted practices of the industry. We conclude that this project, as proposed, will not create any new problems within the existing downstream drainage system.

AHBL, Inc.

Ryan Kelsey
Project Engineer

RJK/CRP/LSK

January 2017

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Appendix A

Exhibits

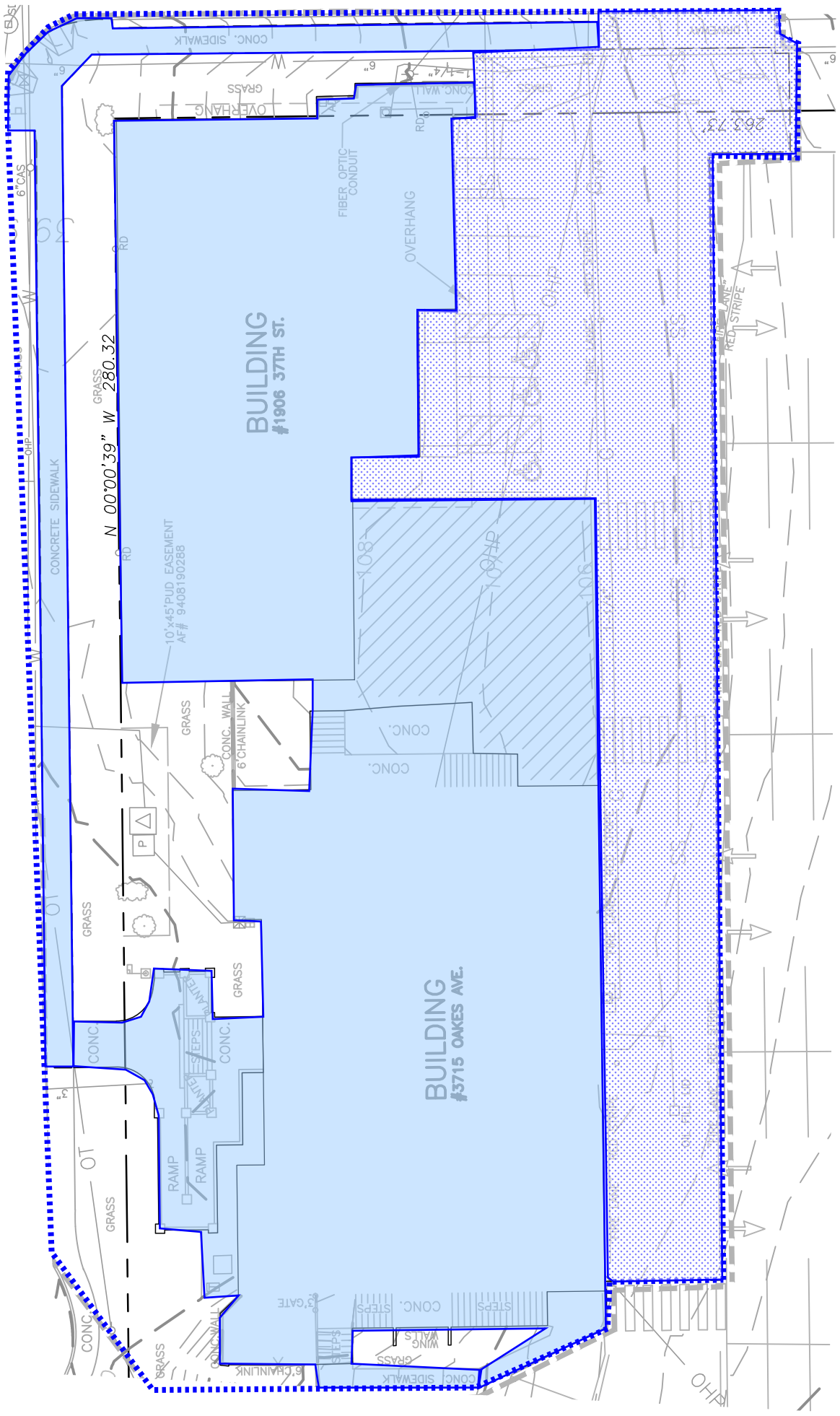
AHBL

1200 6th Avenue,
Suite 1620,
Seattle, WA 98101
206.267.2425 TEL
206.267.2429 FAX

LONGFELLOW PARKING IMPROVEMENT

VICINITY MAP

A-1



EXISTING SURFACE AREAS		
	Description	Area
	NPGHS	**0.56**
	PGHS	**0.25**
	SITE AREA	**1.00**

GRAPHIC SCALE

0 15 30 60

1" = 30 FEET

N

AHBL

1200 6th Avenue, #1620
Seattle, WA 98101
206.267.2425 TEL
206.267.2429 FAX
www.ahbl.com

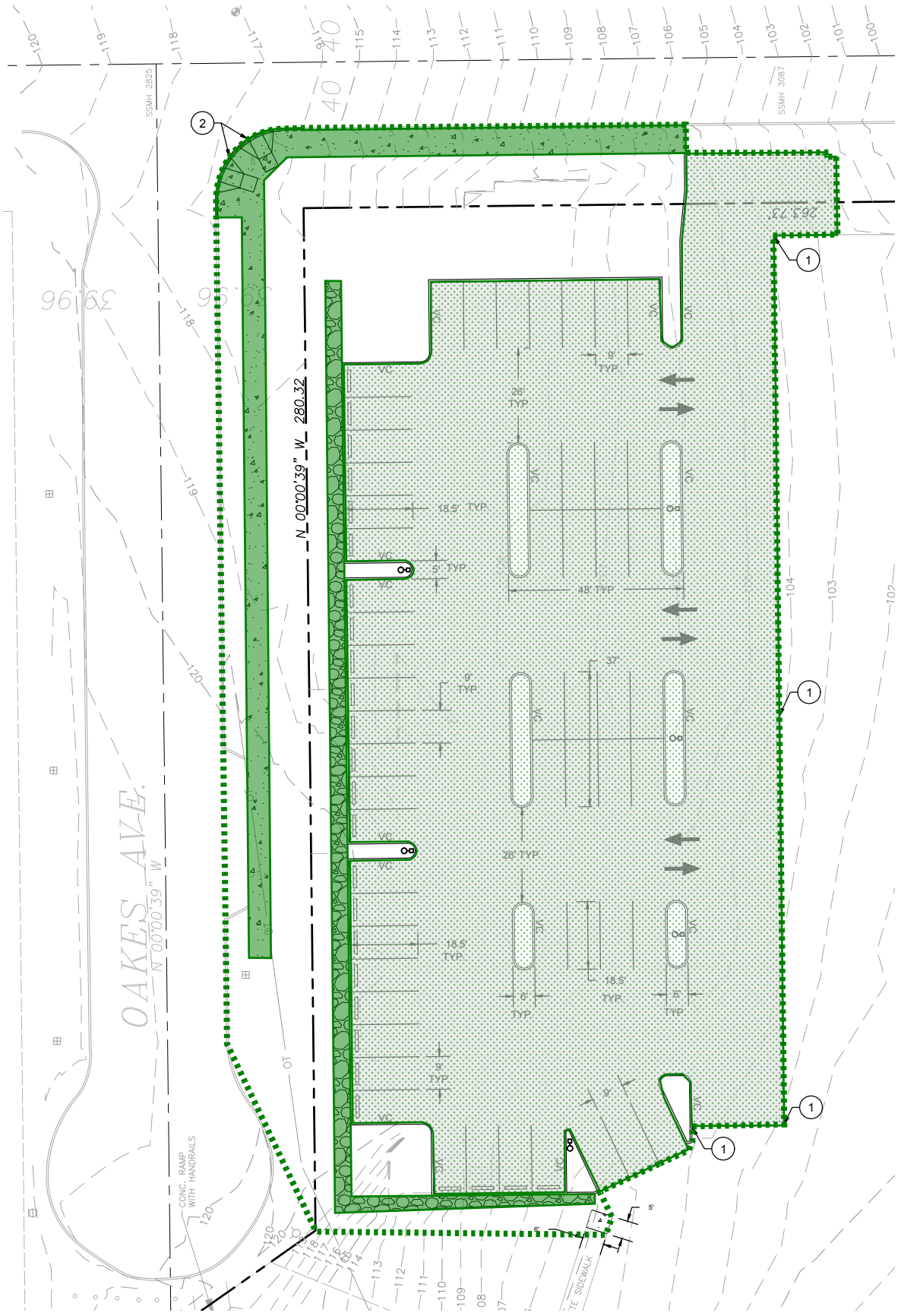
LONGFELLOW DEMO AND PARKING IMPROVEMENTS

EXISTING CONDITIONS EXHIBIT

JOB NO. **2160434**

DATE: **12/23/2016**

A-2



DEVELOPED SURFACE AREAS		
	Description	Area
	NPGHS	**0.1**
	PGHS	**0.7**
	SITE AREA	**1.0**

GRAPHIC SCALE

0 20 40 80

1" = 40 FEET

N

AHBL

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206.267.2425 TEL

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www.ahbl.com

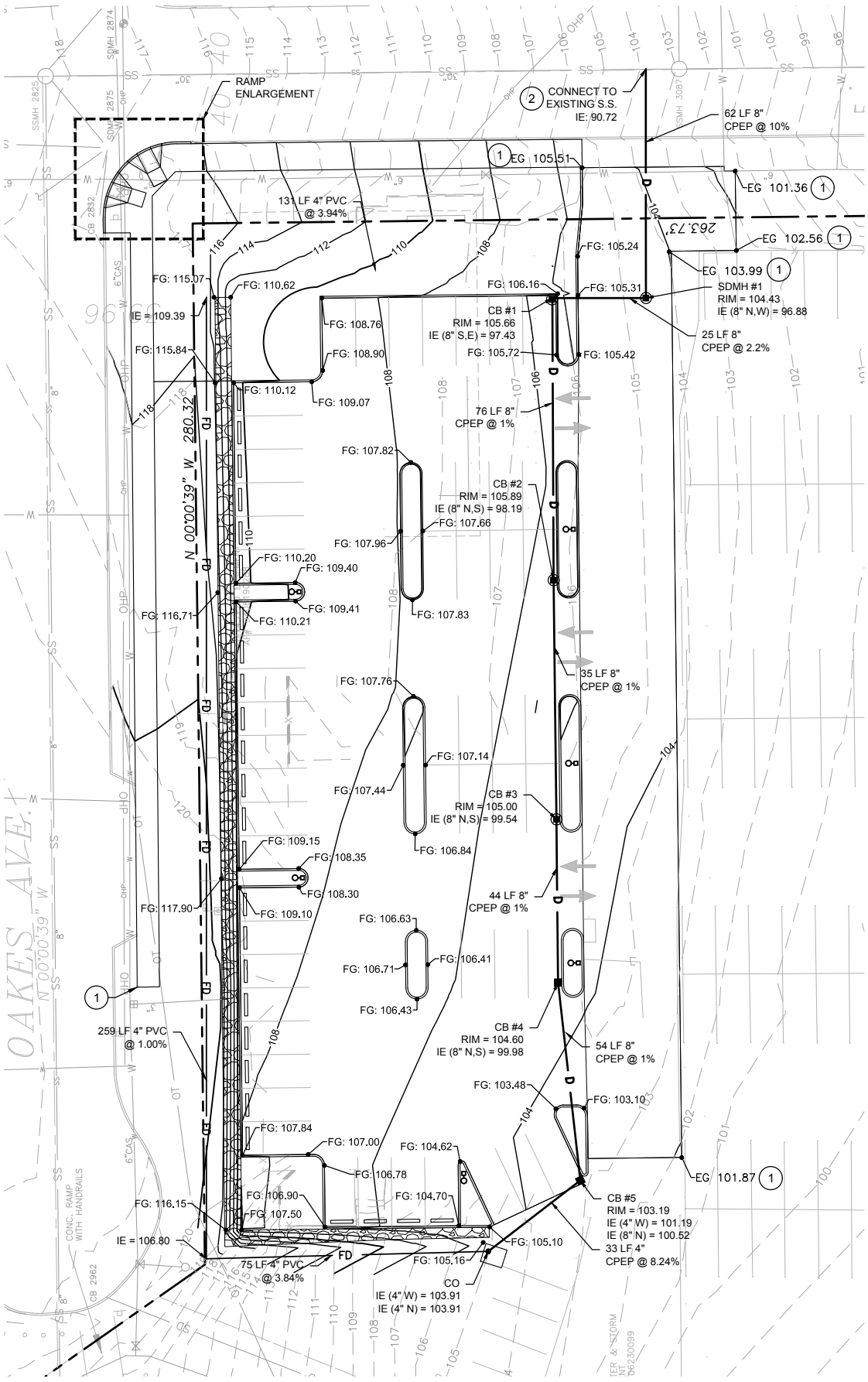
LONGFELLOW DEMO AND PARKING IMPROVEMENTS

DEVELOPED CONDITIONS EXHIBIT

JOB NO. **2160434**

DATE: **01/24/2017**

A-3



0 20 40 80

1" = 40 FEET

N

AHBL
1200 6th Avenue, #1620
Seattle, WA 98101
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www.ahbl.com

LONGFELLOW DEMO AND PARKING IMPROVEMENTS

Site Drainage

JOB NO. 2160434

DATE: 01/23/2017

A-4

SPILL REPORT

DATE: _____ **TIME:** _____

1. Name of individual reporting spill: _____
2. Location of spill: _____
3. Type of material spilled: _____
4. Estimated quantity spilled: _____
5. Description of spill (odor, color, dimensions, etc.): _____
6. Source of spill: _____
7. Did material reach a sewer? Yes/No Sewer Type: Industrial Sanitary Storm
8. Did material soak into soil? Yes/No Estimated Quantity: _____
9. Did material leave property? Yes/No Estimated Quantity: _____
10. Property(ies)/stream(s) impacted? _____
11. Action taken (Description of initial containment/recover procedures): _____

(continued on back)

12. Weather conditions at site: _____
13. Party responsible for spill: _____
14. Name of individual preparing report: _____

OTHER INFORMATION/COMMENTS: _____

For all spills, complete this form and return to:

Contractor's ESC Lead: (name & phone)	Contractor to provide:

Appendix B

Exhibits

B-1

Conveyance Sizing Calculations

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.01000	ft/ft
Diameter	0.67	ft
Discharge	0.97	ft^3/s (100 year storm event)

Results

Normal Depth	0.38	ft
Flow Area	0.20	ft^2
Wetted Perimeter	1.14	ft
Hydraulic Radius	0.18	ft
Top Width	0.66	ft
Critical Depth	0.47	ft
Percent Full	56.4	%
Critical Slope	0.00537	ft/ft
Velocity	4.74	ft/s
Velocity Head	0.35	ft
Specific Energy	0.73	ft
Froude Number	1.50	
Maximum Discharge	1.71	ft^3/s
Discharge Full	1.59	ft^3/s
Slope Full	0.00371	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Upstream Depth	117.00	ft
Length	60.00	ft
Number Of Steps	0	

GVF Output Data

Downstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	38.83	%
Downstream Velocity	Infinity	ft/s

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.38	ft
Critical Depth	0.47	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00537	ft/ft

WWHM2012
PROJECT REPORT

Project Name: default[24]
Site Name: Longfellow
Site Address: 3715 Oakes AVE
City : Everett
Report Date: 12/23/2016
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.00
Version Date: 2016/02/25
Version : 4.2.12

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, Lawn, Mod	.18
Pervious Total	0.18

Impervious Land Use	acre
ROADS FLAT	0.25
ROOF TOPS FLAT	0.57
Impervious Total	0.82
Basin Total	1

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Lawn, Mod	.22
Pervious Total	0.22

Impervious Land Use	acre
SIDEWALKS FLAT	0.11
PARKING FLAT	0.67
Impervious Total	0.78
Basin Total	1

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.18
Total Impervious Area:0.82

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.22
Total Impervious Area:0.78

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.362858
5 year	0.499035
10 year	0.59988
25 year	0.739994
50 year	0.853951
100 year	0.976429

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.349149
5 year	0.482396
10 year	0.581421
25 year	0.719401

50 year	0.831905
100 year	0.953064

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

Year	Predeveloped	Mitigated
1949	0.386	0.376
1950	0.446	0.433
1951	0.407	0.388
1952	0.336	0.322
1953	0.446	0.429
1954	0.590	0.577
1955	0.420	0.407
1956	0.189	0.181
1957	0.344	0.335
1958	0.862	0.840
1959	0.330	0.315
1960	0.332	0.323
1961	1.146	1.123
1962	0.397	0.378
1963	0.489	0.477
1964	0.256	0.247
1965	0.284	0.271
1966	0.289	0.275
1967	0.701	0.668
1968	0.384	0.369
1969	0.786	0.772
1970	0.283	0.272
1971	0.414	0.401
1972	0.534	0.518
1973	0.430	0.415
1974	0.528	0.509
1975	0.417	0.404
1976	0.281	0.270
1977	0.279	0.267
1978	0.210	0.201
1979	0.495	0.481
1980	0.268	0.255
1981	0.283	0.271
1982	0.279	0.266
1983	0.395	0.383
1984	0.351	0.336
1985	0.498	0.474
1986	0.494	0.482
1987	0.422	0.406
1988	0.335	0.321
1989	0.361	0.350
1990	0.264	0.253
1991	0.334	0.318
1992	0.339	0.328
1993	0.260	0.250
1994	0.274	0.260
1995	0.257	0.245
1996	0.371	0.353
1997	0.445	0.437
1998	0.472	0.456

1999	0.211	0.203
2000	0.715	0.685
2001	0.251	0.239
2002	0.241	0.229
2003	0.324	0.308
2004	0.648	0.624
2005	0.296	0.284
2006	0.383	0.374
2007	0.375	0.364
2008	0.286	0.276
2009	0.303	0.291

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

Rank	Predeveloped	Mitigated
1	1.1463	1.1232
2	0.8619	0.8401
3	0.7862	0.7718
4	0.7146	0.6847
5	0.7014	0.6681
6	0.6475	0.6244
7	0.5904	0.5773
8	0.5337	0.5180
9	0.5282	0.5093
10	0.4975	0.4820
11	0.4952	0.4812
12	0.4945	0.4768
13	0.4895	0.4741
14	0.4720	0.4564
15	0.4465	0.4367
16	0.4463	0.4331
17	0.4446	0.4293
18	0.4305	0.4155
19	0.4216	0.4068
20	0.4199	0.4056
21	0.4169	0.4042
22	0.4143	0.4008
23	0.4074	0.3875
24	0.3974	0.3835
25	0.3952	0.3781
26	0.3865	0.3757
27	0.3840	0.3736
28	0.3829	0.3687
29	0.3746	0.3644
30	0.3709	0.3533
31	0.3606	0.3496
32	0.3510	0.3361
33	0.3437	0.3352
34	0.3391	0.3277
35	0.3355	0.3225
36	0.3347	0.3216
37	0.3341	0.3210
38	0.3319	0.3179
39	0.3296	0.3149
40	0.3238	0.3080
41	0.3035	0.2914

42	0.2964	0.2839
43	0.2889	0.2761
44	0.2862	0.2753
45	0.2845	0.2715
46	0.2834	0.2711
47	0.2827	0.2706
48	0.2809	0.2698
49	0.2792	0.2667
50	0.2789	0.2655
51	0.2738	0.2605
52	0.2679	0.2551
53	0.2639	0.2533
54	0.2601	0.2499
55	0.2575	0.2468
56	0.2560	0.2450
57	0.2513	0.2391
58	0.2407	0.2290
59	0.2114	0.2028
60	0.2097	0.2011
61	0.1889	0.1810

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.1814	1108	954	86	Pass
0.1882	974	820	84	Pass
0.1950	843	733	86	Pass
0.2018	760	654	86	Pass
0.2086	675	561	83	Pass
0.2154	592	491	82	Pass
0.2222	512	438	85	Pass
0.2290	472	394	83	Pass
0.2358	414	349	84	Pass
0.2426	366	318	86	Pass
0.2494	334	286	85	Pass
0.2562	297	262	88	Pass
0.2629	277	239	86	Pass
0.2697	255	219	85	Pass
0.2765	230	192	83	Pass
0.2833	208	179	86	Pass
0.2901	186	169	90	Pass
0.2969	176	154	87	Pass
0.3037	166	135	81	Pass
0.3105	148	126	85	Pass
0.3173	130	119	91	Pass
0.3241	123	107	86	Pass
0.3309	115	97	84	Pass
0.3377	107	86	80	Pass
0.3445	92	84	91	Pass
0.3513	87	78	89	Pass
0.3581	84	76	90	Pass
0.3648	80	74	92	Pass

0.3716	76	69	90	Pass
0.3784	73	67	91	Pass
0.3852	68	62	91	Pass
0.3920	67	56	83	Pass
0.3988	62	55	88	Pass
0.4056	57	51	89	Pass
0.4124	54	45	83	Pass
0.4192	50	40	80	Pass
0.4260	46	39	84	Pass
0.4328	42	37	88	Pass
0.4396	39	34	87	Pass
0.4464	37	32	86	Pass
0.4532	34	28	82	Pass
0.4599	33	26	78	Pass
0.4667	29	25	86	Pass
0.4735	26	22	84	Pass
0.4803	25	18	72	Pass
0.4871	24	16	66	Pass
0.4939	21	16	76	Pass
0.5007	16	15	93	Pass
0.5075	16	14	87	Pass
0.5143	15	12	80	Pass
0.5211	15	11	73	Pass
0.5279	13	11	84	Pass
0.5347	11	11	100	Pass
0.5415	11	10	90	Pass
0.5483	11	10	90	Pass
0.5551	11	10	90	Pass
0.5618	11	9	81	Pass
0.5686	10	9	90	Pass
0.5754	10	9	90	Pass
0.5822	10	8	80	Pass
0.5890	9	8	88	Pass
0.5958	8	7	87	Pass
0.6026	8	7	87	Pass
0.6094	8	7	87	Pass
0.6162	8	7	87	Pass
0.6230	8	7	87	Pass
0.6298	7	6	85	Pass
0.6366	7	6	85	Pass
0.6434	7	6	85	Pass
0.6502	6	6	100	Pass
0.6569	6	6	100	Pass
0.6637	6	6	100	Pass
0.6705	6	5	83	Pass
0.6773	6	5	83	Pass
0.6841	6	5	83	Pass
0.6909	6	4	66	Pass
0.6977	6	4	66	Pass
0.7045	5	4	80	Pass
0.7113	5	4	80	Pass
0.7181	4	4	100	Pass
0.7249	4	4	100	Pass
0.7317	4	4	100	Pass
0.7385	4	4	100	Pass
0.7453	4	4	100	Pass
0.7521	4	4	100	Pass

0.7588	4	4	100	Pass
0.7656	4	4	100	Pass
0.7724	4	3	75	Pass
0.7792	4	3	75	Pass
0.7860	4	3	75	Pass
0.7928	3	3	100	Pass
0.7996	3	3	100	Pass
0.8064	3	3	100	Pass
0.8132	3	3	100	Pass
0.8200	3	3	100	Pass
0.8268	3	3	100	Pass
0.8336	3	3	100	Pass
0.8404	3	3	100	Pass
0.8472	3	2	66	Pass
0.8540	3	2	66	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

LID Report

LID Technique	Used for Treatment?	Total Volumn Needs Treatment (ac-ft)	Volumn Through Facility (ac-ft)	Infiltration Volumn (ac-ft.)	Cumulative Volumn Infiltration Credit	Percent Water Quality	Percent Comment Volumn Infiltrated	Treated
Total Volume Infiltrated		0.00	0.00	0.00	0.00	0.00	0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

Appendix C

Geotechnical Report

associated earth sciences incorporated

January 19, 2017
Project No. KE160668A

Botesch, Nash and Hall Architects, PS
2727 Oaks Avenue, Suite 100
Everett, Washington 98201

Attention: Mr. Andy Hall

Subject: Subsurface Exploration and
Geotechnical Engineering Report
Longfellow Building Site
3715 Oaks Avenue
Everett, Washington

Dear Mr. Hall:

As requested, Associated Earth Sciences, Inc. (AESI) has completed an investigation of subsurface conditions for the referenced project. This report was completed based on our proposal dated December 16, 2016. This report has been completed in accordance with local standards of practice in the field of geotechnical engineering. No other warranty, express or implied, is made.

SITE AND PROJECT DESCRIPTION

The subject site includes the existing Longfellow Building, located at 3715 Oaks Avenue in Everett, Washington (Figure 1). The subject site includes the Longfellow Building, a nearby Annex Building, and associated parking areas. We understand that the existing Longfellow Building, along with the nearby Annex Building, will be demolished. Following demolition, the basement walls of the existing structures will be replaced with rockery walls and the buildings' footprints turned into additional surface parking. To satisfy a City of Everett project requirement we have been requested to provide a geotechnical study for the project and a feasibility study for the potential of infiltration of stormwater.

SUBSURFACE EXPLORATION

Our field study included drilling one exploration boring. The exploration boring location is shown on the attached Figure 2. The various types of sediments, as well as the depths where characteristics of the sediments changed, are indicated on the attached exploration log. The depths indicated on the log where conditions changed may represent gradational variations between sediment types in the field. If changes occurred between sample intervals in our boring, they were interpreted.

The conclusions and recommendations presented in this report are based on the exploration boring completed for this study. The location and depth of the exploration were completed within site and budgetary constraints. Because of the nature of exploratory work below ground, extrapolation of subsurface conditions beyond the field exploration is necessary.

Exploration Boring

The exploration boring was completed by advancing a hollow-stem auger with a subcontracted track-mounted drill rig. During the drilling process, samples were obtained at generally 2.5- to 5-foot-depth intervals. The boring was continuously observed and logged by an engineer from our firm. The attached exploration log is based on the field log, drilling action, and inspection of the secured samples.

Disturbed, but representative samples were obtained by using the Standard Penetration Test procedure in accordance with *American Society for Testing and Materials* (ASTM) D-1586. This test and sampling method consists of driving a standard 2-inch, outside-diameter, split-barrel sampler a distance of 18 inches into the soil with a 140-pound hammer free-falling a distance of 30 inches. The number of blows for each 6-inch interval is recorded, and the number of blows required to drive the sampler the final 12 inches is known as the Standard Penetration Resistance ("N") or blow count. If a total of 50 blows are recorded within one 6-inch interval, the blow count is recorded as 50 blows for the corresponding number of inches of penetration. The resistance, or N-value, provides a measure of the relative density of granular soils or the relative consistency of cohesive soils; these values are plotted on the attached boring logs.

The samples obtained from the split-barrel sampler were classified in the field and representative portions placed in watertight containers. The samples were then transported to our laboratory for further visual classification, as necessary.

Monitoring Well

Exploration boring EB-1W was completed as a 2-inch-diameter monitoring well with 10 feet of machine-slotted Schedule 40 polyvinyl chloride (PVC) well screen and a flush-mount monument. The sand pack materials consisted of 10/20 Colorado Silica Sand. The well was sealed with a combination of bentonite chips and bentonite grout. Well construction details are presented on

the boring log in the Appendix. Hand water level data was collected after well development was completed on January 17, 2017. There was no water level measured in the well.

Laboratory Test Results

Grain-size analysis tests were completed on two samples selected from the exploration boring. Results are included in the Appendix.

SUBSURFACE CONDITIONS

Subsurface conditions were inferred from the field exploration accomplished for this study. As shown on the boring log, the exploration encountered approximately 4 feet of fill overlying medium dense grading to very dense silty to very silty fine to medium sand, with silt interbeds, interpreted as deposits placed prior to the Fraser Glaciation and subsequently compacted by the weight of the overlying glacial ice. The pre-Fraser-age deposits extended beyond the depth explored of 31.5 feet below the ground surface. This medium dense to very dense material is generally considered suitable for support of light to heavily loaded foundations or new paved surfaces when in an intact, undisturbed condition. This material is highly moisture-sensitive and susceptible to disturbance when wet.

Review of the regional geologic map titled *Geologic Map of the Everett 7.5-minute Quadrangle, Snohomish County, Washington* (J.P. Minard, 1985) indicates that the area of the subject site is underlain by Vashon lodgement till, with Vashon advance outwash and pre-Fraser-age "transitional beds" mapped downslope to the east of the subject site. Our interpretation of the sediments encountered at the subject site is in general agreement with pre-Fraser-age sediments mapped nearby.

We did not encounter ground water in our exploration boring, nor did we encounter ground water during our initial measurement on January 17, 2017. We expect ground water seepage across much of the site to be limited to interflow. Interflow occurs when surface water percolates down through the surficial weathered or higher-permeability sediments and becomes perched atop underlying, lower-permeability sediments. It should be noted that the occurrence and level of ground water seepage at the site may vary in response to such factors as changes in season, precipitation, and site use.

CONCLUSIONS AND RECOMMENDATIONS

We encountered fill material in our exploration boring, and anticipate that, due to previous construction activities, pockets of existing fill may be encountered during the excavation for the proposed parking lot and associated improvements. Fill thicknesses can vary significantly over short distances, particularly in the vicinity of the pre-existing building foundations, buried utilities,

and landscape areas. Existing fill is not suitable for support of new foundations, and warrants remedial preparation where it occurs below paving and similar lightly loaded structures. Structural fill or native pre-Fraser-age deposits are suitable for support of shallow foundations or new paved surfaces with proper preparation.

The site is underlain at shallow depths by medium dense to very dense, interbedded, glacially-overridden pre-Fraser-age sediments. These sediments are not a suitable infiltration receptor, in part, due to the grain-size analysis test results indicating fines contents ranging from 38 to 57 percent of the fraction passing the No. 10 sieve. Since the pre-Fraser sediments are glacially overridden, estimating an infiltration rate based on correlation with grain-size distribution is not appropriate. The 2016 *City of Everett Stormwater Management Manual* references the 2014 edition of the Washington State Department of Ecology *Stormwater Management Manual for Western Washington*, which considers an initial infiltration rate less than 0.3 inches per hour to be "infeasible for on-site stormwater management." We consider the elevated fines content of the sediment, coupled with the density and interbedding of the pre-Fraser-age sediments encountered in our explorations and our previous experience with sites exhibiting similar soil conditions, to preclude the use of infiltration for the handling of stormwater runoff at the subject site, in our opinion.

Site Preparation

Subsequent to demolition activities, any existing vegetation and topsoil should be removed from all areas where new paving is planned and any remaining tree roots should be grubbed. Existing paving, structures, and buried utilities should be identified and moved if they conflict with planned construction locations. If any depressions beneath planned paving are present following site preparation, the depressions should be backfilled with structural fill.

Once demolition and stripping activities are complete, we recommend that any loose fill soils be addressed. Loose fill soils could be found and should be removed. The subgrade for the parking lot pavement is expected to consist of moisture-sensitive soils. The soils will be easily disturbed by equipment and vehicle traffic. We recommend that no wheeled traffic be allowed on wet subgrades and that tracked traffic be kept to a minimum. Excessive traffic over exposed subgrades will cause disturbance of otherwise suitable soils that will require overexcavation and replacement. At all locations onsite, care should be taken to limit traffic on wet soils. We recommend that haul routes be designated onsite where it will be necessary to excavate to final grade so that any soils that are disturbed by site traffic are in areas that will be removed as part of the planned earthwork operation. If it is necessary to operate equipment or trucks over areas of planned pavement subgrade, we recommend that a temporary construction surface be considered.

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction. Temporary, unsupported cut slopes in the pre-Fraser-age sediments can be made at angles of 1H:1V (Horizontal:Vertical) or flatter. If ground or surface water is present when the temporary excavation slopes are exposed, flatter slope angles or

temporary shoring will be required. As is typical with earthwork operations, some sloughing and raveling may occur, and cut slopes may have to be adjusted in the field. In addition, WISHA/OSHA regulations should be followed at all times. All permanent slopes composed of structural fill or native soils should be planned at 2H:1V or flatter and provided with erosion protection immediately after construction.

Structural Fill

All references to structural fill in this report refer to subgrade preparation, fill type and placement, and compaction of materials, as discussed in this section. If a percentage of compaction is specified under another section of this report, the value given in that section should be used.

After stripping, planned excavation, and any required overexcavation have been performed to the satisfaction of the geotechnical engineer, the upper 12 inches of exposed ground in areas to receive fill should be recompacted to 90 percent of the modified Proctor maximum density using ASTM D-1557 as the standard. If the subgrade contains silty soils and too much moisture, adequate recompaction may be difficult or impossible to obtain and should probably not be attempted. In lieu of recompaction, the area to receive fill should be blanketed with washed rock or quarry spalls to act as a capillary break between the new fill and the wet subgrade. Where the exposed ground remains soft and further overexcavation is impractical, placement of an engineering stabilization fabric may be necessary to prevent contamination of the free-draining layer by silt migration from below.

After recompaction of the exposed ground is tested and approved, or a free-draining rock course is laid, structural fill may be placed to attain desired grades. Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts, with each lift being compacted to 95 percent of the modified Proctor maximum density using ASTM D-1557 as the standard. In the case of roadway and utility trench filling, the backfill should be placed and compacted in accordance with current City of Everett codes and standards. The top of the compacted fill should extend horizontally outward a minimum distance of 3 feet beyond the locations of the roadway edges before sloping down at an angle of 2H:1V.

The contractor should note that any proposed fill soils must be evaluated by AESI prior to their use in fills. This would require that we have a sample of the material 72 hours in advance to perform a Proctor test and determine its field compaction standard. Soils in which the amount of fine-grained material (smaller than the No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture-sensitive. Use of moisture-sensitive soil in structural fills should be limited to favorable dry weather conditions. The native and existing fill soils present onsite contained variable amounts of silt and are considered moisture-sensitive. In addition, construction equipment traversing the site when the soils are wet can cause considerable disturbance. If fill is placed during wet weather or if proper compaction cannot be obtained, a select import material consisting of a clean, free-draining gravel and/or sand should be used. Free-draining fill consists of non-organic soil with the amount of fine-grained

material limited to 5 percent by weight when measured on the minus No. 4 sieve fraction with at least 25 percent retained on the No. 4 sieve.

A representative from our firm should inspect the stripped subgrade and be present during placement of structural fill to observe the work and perform a representative number of in-place density tests. In this way, the adequacy of the earthwork may be evaluated as filling progresses, and any problem areas may be corrected at that time. It is important to understand that taking random compaction tests on a part-time basis will not assure uniformity or acceptable performance of a fill. As such, we are available to aid in developing a suitable monitoring and testing program.

CLOSURE

We recommend that we review project plans prior to construction to verify that our recommendations have been correctly interpreted and incorporated into the project. We also recommend that we be retained to observe fill placement to ensure that installation materials and procedures are consistent with our recommendations, and that subsurface conditions are consistent with those assumed for completion of this report.

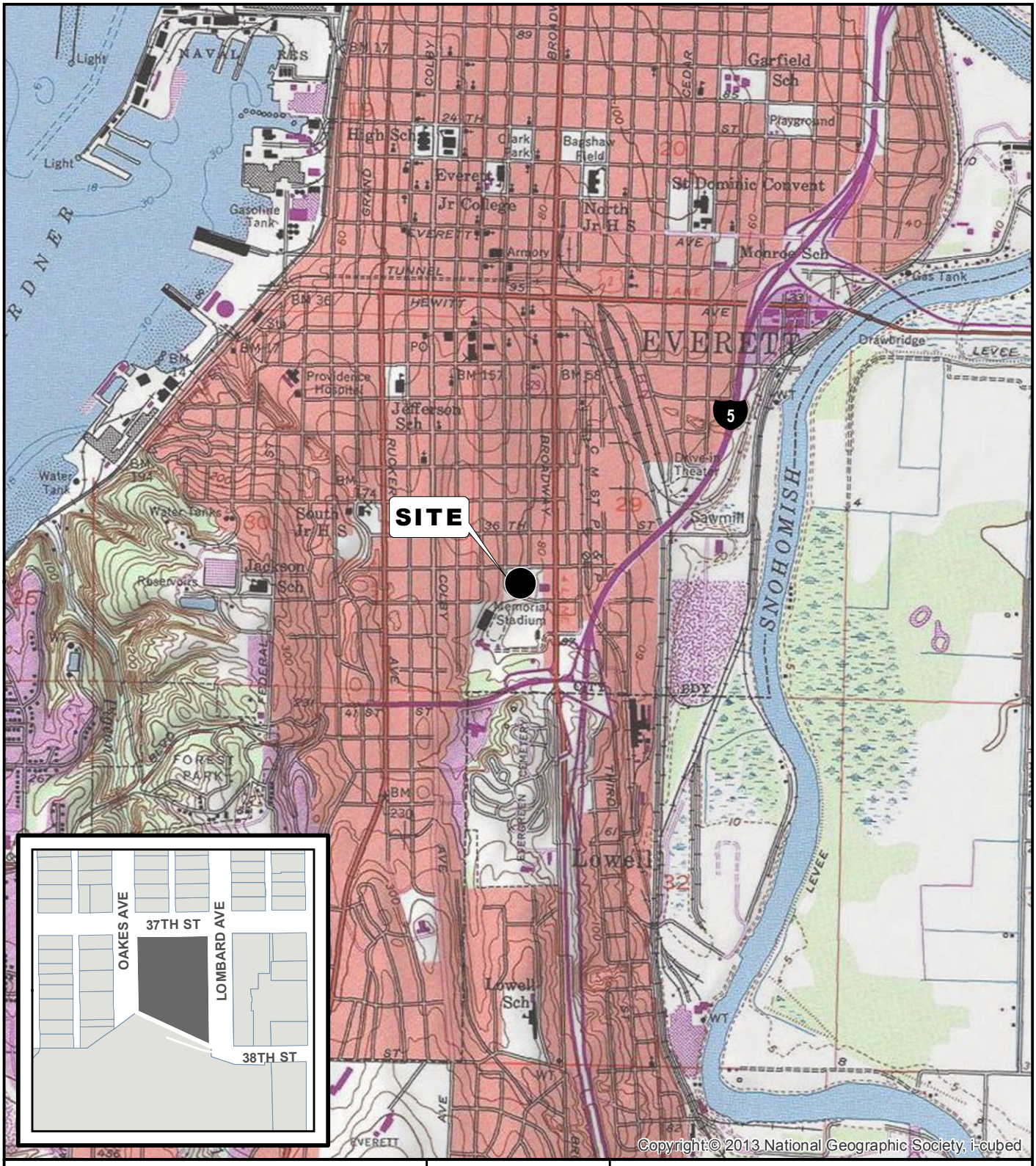
We appreciate the opportunity to be of continued service. If you have any questions, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Jeffrey P. Laub, L.G., L.E.G.
Senior Project Engineering Geologist

Kurt D. Merriman, P.E.
Senior Principal Engineer

Attachments:
Figure 1: Vicinity Map
Figure 2: Site and Exploration Plan
Appendix: Exploration Log
Laboratory Testing



DATA SOURCES / REFERENCES:
USGS: 24K SERIES TOPOGRAPHIC MAPS
SNOHOMISH CO: STREETS, CITY LIMITS, PARCELS 2016

LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE

N

0 1000 2000
FEET

NOTE: BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION

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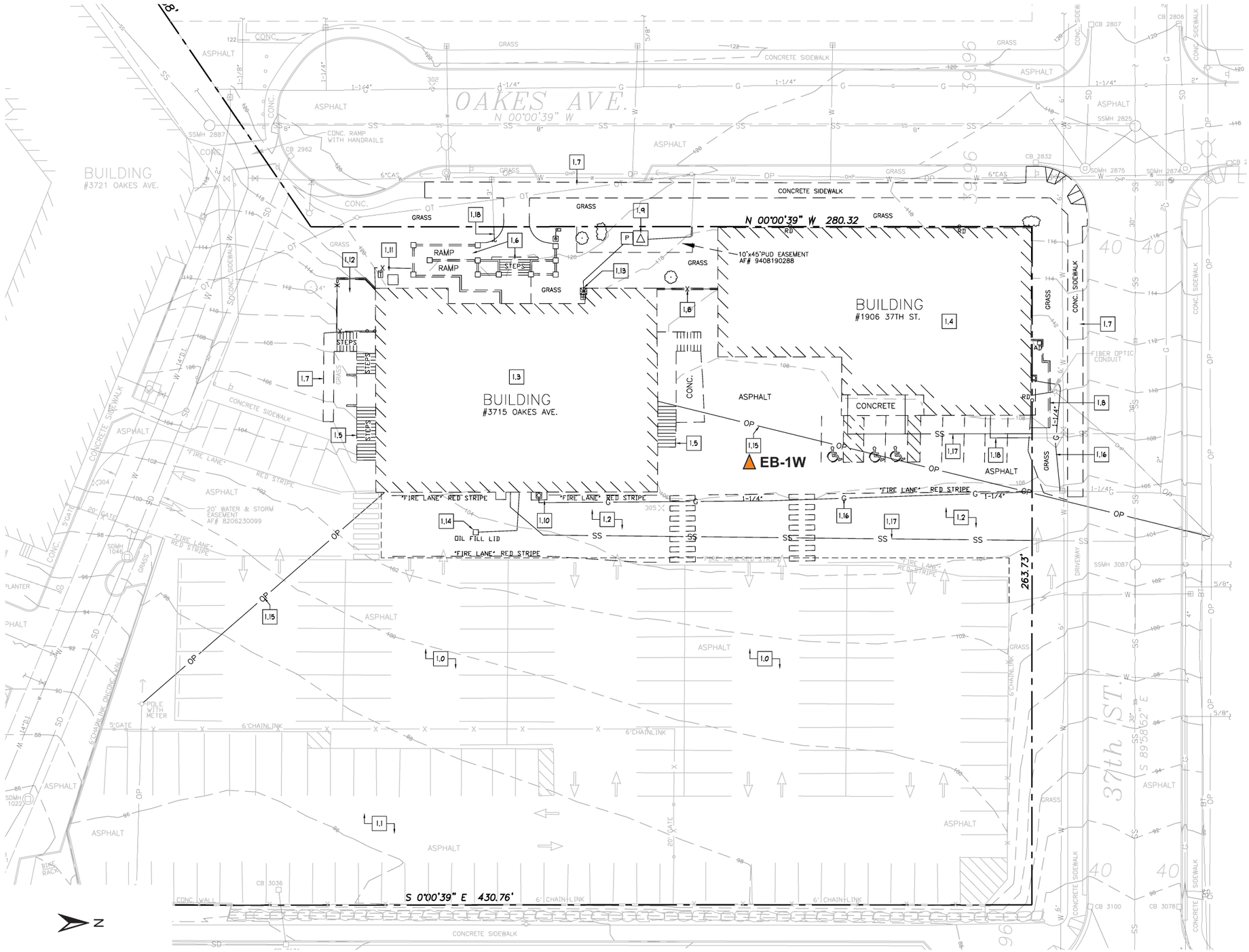
VICINITY MAP

LONGFELLOW BUILDING SITE
EVERETT, WASHINGTON

PROJ NO.	DATE:	FIGURE:
KE160668A	1/17	1

Document Path: G:\GIS_Projects\aTemplates\aVM_Template\VM_MXD\160668 Fig1 VM_Longfellow.mxd



LEGEND:

▲ **EB** MONITORING WELL

CONTOUR INTERVAL = 2'

NOTE: LOCATION AND DISTANCES SHOWN ARE APPROXIMATE.

NOTES:

1. BASE MAP REFERENCE: BNH ARCHITECTS, LONGFELLOW BUILDING, DEMO SITE PLAN, SHEET ADS1.0, 11/28/16.

BLACK AND WHITE REPRODUCTION OF THIS COLOR ORIGINAL MAY REDUCE ITS EFFECTIVENESS AND LEAD TO INCORRECT INTERPRETATION.

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SITE AND EXPLORATION PLAN

LONGFELLOW BUILDING SITE
EVERETT, WASHINGTON

PROJ NO.	DATE:	FIGURE:
KE160668A	1/17	2

160668 Longfellow Rockery \ 160668 F2 Site-Explr.cdr

APPENDIX

Coarse-Grained Soils - More than 50% [1] Retained on No. 200 Sieve	Gravels - More than 50% [1] of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines [5]	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥12% Fines [5]	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50% [1] or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines [5]	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥12% Fines [5]	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50% [1] or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

	Density	SPT [2] blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50
	Consistency	**SPT [2] blows/foot**
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

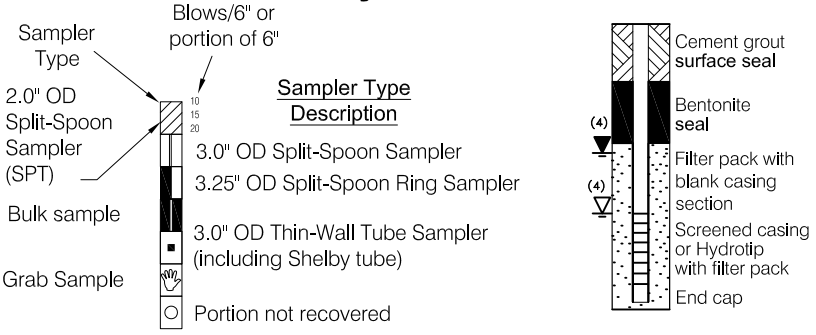
[3] Estimated Percentage

Component	Percentage by Weight
Trace	<5
Some	5 to <12
Modifier (silty, sandy, gravelly)	12 to <30
Very *modifier* (silty, sandy, gravelly)	30 to <50

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols



(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of ground water
▼ ATD = At time of drilling
▽ Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 12%

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

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Geologic & Monitoring Well Construction Log

Project Number	Well Number	Sheet
KE160668A	EB-1W	1 of 1

Project Name: Longfellow Building Site
Location: Everett, WA
Elevation (Top of Well Casing):
Surface Elevation (ft):
Water Level Elevation:
Date Start/Finish: 1/5/17,1/5/17
Drilling/Equipment: EDI / Trailer Mounted Rig
Hole Diameter (in): 8 inches
Hammer Weight/Drop: 140# / 30"

Depth (ft)	WELL CONSTRUCTION	ST	Blows/ 6"	DESCRIPTION
	Flush mount monument			**Asphalt - 12 inches**
	Bentonite grout 0 to 3 feet			**Fill**
			2 3 7	Medium dense, moist, tan, gravelly, fine to medium SAND, trace to some silt (SP-SM). Gravelly drill action at 4 feet.
5			12 16 19	**Pre-Fraser Deposits** Dense, moist, tannish gray, very silty, fine to medium SAND, some gravel grading coarser near bottom of sampler (SM).
	Bentonite chips 3 to 17 feet		11 17 20	Dense, moist, tannish gray, gravelly, very silty, fine to medium SAND; unsorted (SM).
10	2-inch I.D. PVC casing with threaded connections 0 to 20 feet		11 12 14	Medium dense, moist,tannish gray, fine to medium SAND, trace to some silt; contains fine sandy silt interbeds (SP-SM).
			12 11 11	Medium dense, moist, tannish gray, silty, fine to coarse SAND, some gravel; unsorted; contains thin interbeds of fine and medium sand (SM).
15				
	10x20 silica sand 17 to 31.5 feet		10 15 19	Medium dense, moist, tannish gray, silty, fine to medium SAND, some gravel; micaceous; thinly laminated layers of fine sand and silt near sampler tip (SM).
20				
			18 36 48	Very dense, moist, tannish gray, silty, fine to medium SAND, some gravel; micaceous (SM).
	2-inch I.D. PVC well screen, 0.010-inch machine slot width, 20 to 30 feet			
25			12 14 25	Dense, moist, tannish gray, fine to medium SAND, trace to some silt; micaceous (SP-SM).
	Slip end cap			
30			10 16 22	Contains thin beds / clasts of silt. Possible ground water observed in top of sampler.
	Well tag #BIZ 531			Boring terminated at 31.5 feet. Well completed at 30 feet on 1/5/17. No ground water encountered.
35				

Sampler Type (ST):

- 2" OD Split Spoon Sampler (SPT)
- 3" OD Split Spoon Sampler (D & M)
- Grab Sample
- No Recovery
- Ring Sample
- Shelby Tube Sample
- M - Moisture
- Water Level ()
- Water Level at time of drilling (ATD)

Logged by: AWR
Approved by: JHS

NWWELL- B 160668.GPJ BORING.GDT 1/16/17

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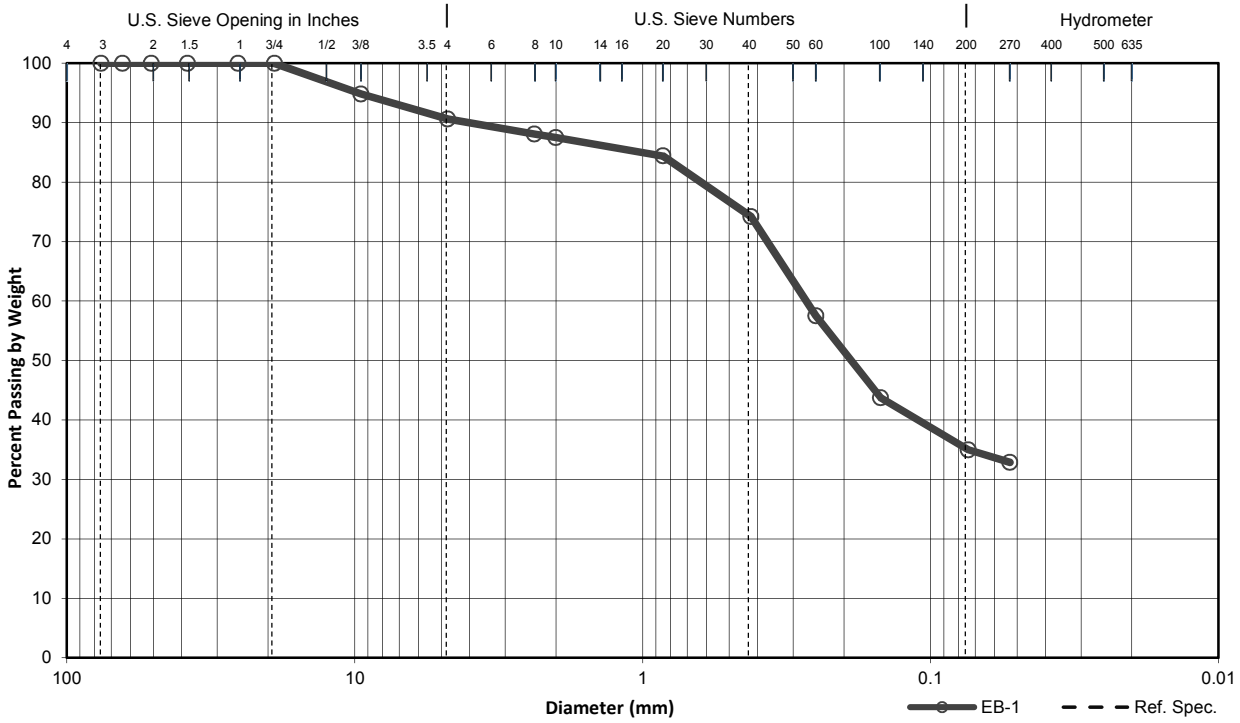
GRAIN SIZE ANALYSIS - MECHANICAL ASTM D422

Project Name	Project Number	Date Sampled	Date Tested	Tested By
Longfellow Bldg.	**KE160668A**	**01/05/2016**	**01/10/2016**	**BP**

Sample Source	Sample No.	Depth (ft)	Soil Description
Onsite	**EB-1**	**5**	**very silty SAND, some gravel (SM)**

Total Sample Dry Wt. (g)	Moisture Content (%)	D_{10} (mm)	Reference Specification
447.8	**7**	**<0.01**	



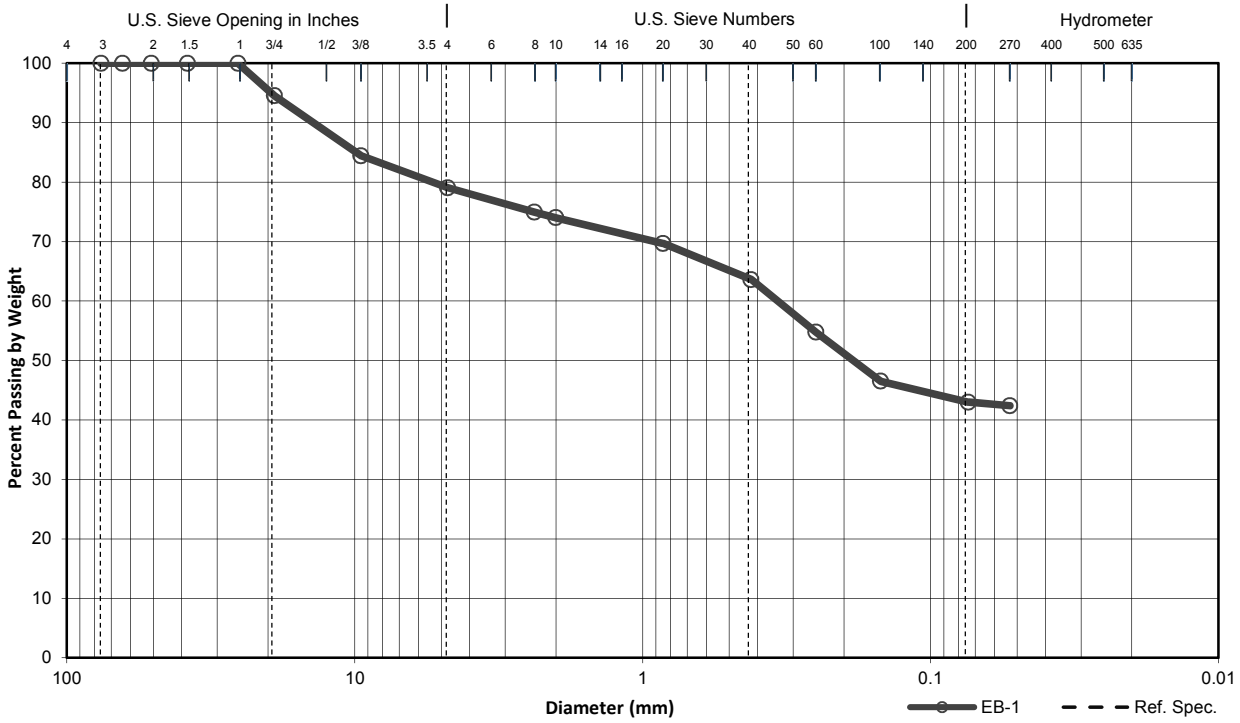
Cobb.	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Sieve No.	Diam. (mm)	Cum. Wt. Ret. (g)	% Ret. by Wt.	% Passing by Wt.	% Specs. Pass. by Wt.	
					Min	Max
3	76.1		0.0	100.0		
2.5	64		0.0	100.0		
2	50.8		0.0	100.0		
1.5	38.1		0.0	100.0		
1	25.4		0.0	100.0		
3/4	19		0.0	100.0		
3/8	9.51	23.1	5.2	94.8		
#4	4.76	42.0	9.4	90.6		
#8	2.38	53.2	11.9	88.1		
#10	2	56.0	12.5	87.5		
#20	0.85	69.8	15.6	84.4		
#40	0.42	115.6	25.8	74.2		
#60	0.25	190.2	42.5	57.5		
#100	0.149	252.0	56.3	43.7		
#200	0.074	291.2	65.0	35.0		
#270	0.053	300.6	67.1	32.9		

associated earth sciences incorporated

GRAIN SIZE ANALYSIS - MECHANICAL ASTM D422

Project Name	Project Number	Date Sampled	Date Tested	Tested By
Longfellow Bldg.	**KE160668A**	**01/05/2016**	**01/10/2016**	**BP**
Sample Source	Sample No.	Depth (ft)	Soil Description	
Onsite	**EB-1**	**7.5**	**gravelly, very silty SAND (SM)**	
Total Sample Dry Wt. (g)	Moisture Content (%)	D_{10} (mm)	Reference Specification	
495.8	**9**	**<0.01**		



Cobb.	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

Sieve No.	Diam. (mm)	Cum. Wt. Ret. (g)	% Ret. by Wt.	% Passing by Wt.	% Specs. Pass. by Wt.	
					Min	Max
3	76.1		0.0	100.0		
2.5	64		0.0	100.0		
2	50.8		0.0	100.0		
1.5	38.1		0.0	100.0		
1	25.4		0.0	100.0		
3/4	19	27.1	5.5	94.5		
3/8	9.51	77.1	15.6	84.4		
#4	4.76	103.8	20.9	79.1		
#8	2.38	124.0	25.0	75.0		
#10	2	128.7	26.0	74.0		
#20	0.85	150.3	30.3	69.7		
#40	0.42	180.4	36.4	63.6		
#60	0.25	224.3	45.2	54.8		
#100	0.149	265.1	53.5	46.5		
#200	0.074	282.5	57.0	43.0		
#270	0.053	285.6	57.6	42.4		

Kirkland Office | 911 Fifth Avenue | Kirkland, WA 98033 P | 425.827.7701 F| 425.827.5424
Everett Office | 2911 ½ Hewitt Avenue, Suite 2 | Everett, WA 98201 P | 425.259.0522 F | 425.252.3408
Tacoma Office | 1552 Commerce Street, Suite 102 | Tacoma, WA 98402 P | 253.722.2992 F | 253.722.2993
www.aesgeo.com

Appendix D

Maintenance and Operations Guidelines

- Construction Erosion Control Maintenance
- Permanent BMP Checklists

Construction Erosion Control Maintenance

Volume II – Construction Stormwater Pollution Prevention

Figures

Tables

Chapter 3 - Standards and Specifications for Best Management Practices

3.1 Introduction

BMPs are defined as schedules of activities, prohibitions of practices, maintenance procedures, and structural and/or managerial practices, that when used singly or in combination, prevent or reduce the release of pollutants to waters of Washington. This chapter contains standards and specifications for temporary BMPs to be used as applicable during the construction phase of a project.

Chapter 3.2 contains the standards and specifications for source control BMPs.

Chapter 3.3 contains the standards and specifications for runoff conveyance and treatment BMPs.

The standards for each individual BMP are divided into four sections:

1. Purpose
2. Conditions of Use
3. Design and Installation Specifications
4. Maintenance Standards.

Note that the "conditions of use" always refers to site conditions. As site conditions change, BMPs must be changed to remain in compliance.

Information on stream bank stabilization is available in the *Integrated Streambank Protection Guidelines*, Washington State Department of Fish and Wildlife (WDFW), 2003.

The standards and specifications in this chapter are not intended to limit any innovative or creative effort to effectively control erosion and sedimentation. In those instances where appropriate BMPs are not in this chapter, experimental management practices can be considered. Minor modifications to standard practices may also be employed. However, such practices must be approved by the City before they may be used. All experimental management practices and modified standard practices are required to achieve the same or better performance than the BMPs listed in this chapter.

3.2 Source Control Best Management Practices

3.2.1 BMP C101: Preserving Natural Vegetation

Purpose

The purpose of preserving natural vegetation is to reduce erosion wherever practicable. Limiting site disturbance is the single most effective method for reducing erosion. For example, conifers can hold up to about 50 percent of all rain that falls during a storm. Up to 20 to 30 percent of this rain may never reach the ground but is taken up by the tree or evaporates. Another benefit is that the rain held in the tree can be released slowly to the ground after the storm.

Conditions of Use

1. Natural vegetation should be preserved on steep slopes, near perennial and intermittent watercourses or swales, and on building sites in wooded areas.
2. As required by the City.

Maintenance Standards

1. Inspect the area frequently to make sure flagging remains in place and the area remains undisturbed.

3.2.3 BMP C103: High Visibility Plastic Fence

Purpose

Fencing is intended to: (1) restrict clearing to approved limits; (2) prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed; (3) limit construction traffic to designated construction entrances or roads; and (4) protect areas where marking with survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits plastic fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared
- As necessary to control vehicle access to and on the site.

Design and Installation Specifications

1. High visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least 4 feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every 6 inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high visibility orange. The fence tensile strength shall be 360 pounds/feet using the American Society for Testing and Materials (ASTM) D4595 testing method.
2. Fences shall not be wired or stapled to trees.

Maintenance Standards

1. If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

3.2.4 BMP C105: Stabilized Construction Entrance

Purpose

Construction entrances are stabilized to reduce the amount of sediment transported onto paved roads by vehicles or equipment by constructing a stabilized pad of quarry spalls at entrances to construction sites.

Conditions of Use

Construction entrances shall be stabilized wherever traffic will be leaving a construction site and traveling on paved roads or other paved areas within 1,000 feet of the site.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized entrances not shown in the initial C-SWPPP. It is difficult to determine exactly where access to these projects will take place; additional materials will enable the contractor to install them where needed.

Design and Installation Specifications

See DCSS Drawing #201 for details. Note: the 100 foot minimum length of the entrance shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100 feet).

1. A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the following standards:
    a. Grab Tensile Strength (ASTM D4751): 200 psi minimum
    b. Grab Tensile Elongation (ASTM D4632): 30 percent maximum
    c. Mullen Burst Strength (ASTM D3786-80a): 400 psi minimum
    d. AOS (ASTM D4751): 20 to 45 (U.S. standard sieve size).
2. Hog fuel (wood-based mulch) may be substituted for or combined with quarry spalls in areas that will not be used for permanent roads. Hog fuel is generally less effective at stabilizing construction entrances and should be used only at sites where the amount of traffic is very limited. Hog fuel is not recommended for entrance stabilization in urban areas. The effectiveness of hog fuel is highly variable and it generally requires more maintenance than quarry spalls. The inspector may at any time require the use of quarry spalls if the hog fuel is not preventing sediment from being tracked onto pavement or if the hog fuel is being carried onto pavement. Hog fuel is prohibited in permanent roadbeds because organics in the subgrade soils cause degradation of the subgrade support over time.
3. Fencing (see BMP C103) shall be installed as necessary to restrict traffic to the construction entrance.
4. Whenever possible, the entrance shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.

Maintenance Standards

1. Quarry spalls (or hog fuel) shall be added if the pad is no longer in accordance with the specifications.
2. If the entrance is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include an increase in the dimensions of the entrance or the installation of a wheel wash.
3. Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment collected by sweeping shall be removed or stabilized on site. The pavement shall not be cleaned by washing down the street, except when sweeping is ineffective and there is a threat to public safety. If it is necessary to wash the streets, the construction of a small sump shall be considered. The sediment would then be washed into the sump where it can be controlled.
4. Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.
5. If vehicles are entering or exiting the site at points other than the construction entrance(s), fencing (see BMP C103) shall be installed to control traffic.
6. Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.

3.2.5 BMP C106: Wheel Wash

Purpose

Wheel washes reduce the amount of sediment transported onto paved roads by motor vehicles.

Conditions of Use

When a stabilized construction entrance (see BMP C105) is not preventing sediment from being tracked onto pavement.

Wheel washing is generally an effective BMP when installed with careful attention to topography. For example, a wheel wash can be detrimental if installed at the top of a slope abutting a right-of-way where the water from the dripping truck can run unimpeded into the street.

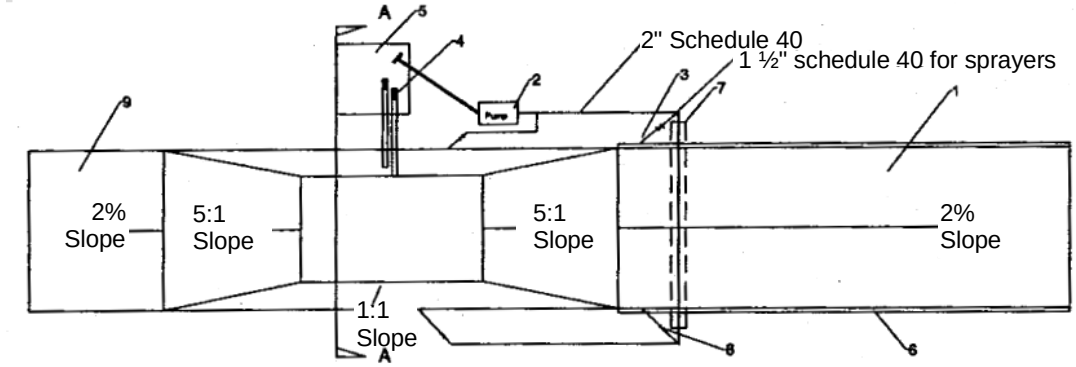
Pressure washing combined with an adequately sized and surfaced pad with direct drainage to a large 10 x 10-foot sump can be very effective.

Design and Installation Specifications

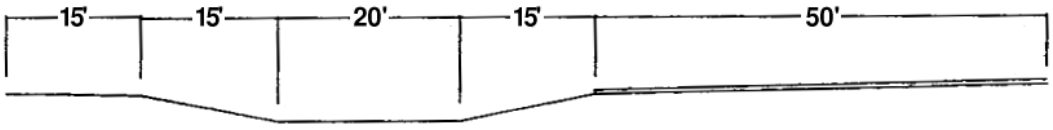
1. Applicable details are shown in Figure 3.1. A minimum of 6 inches of asphalt treated base over crushed base material or 8 inches over a good subgrade is recommended to pave the wheel wash.
2. Use a low clearance truck to test the wheel wash before paving. Either a belly dump or lowboy will work well to test clearance.
3. Keep the water level from 12 to 14 inches deep to avoid damage to truck hubs and filling the truck tongues with water.
4. Midpoint spray nozzles are only needed in extremely muddy conditions.
5. Wheel wash systems should be designed with a small grade change, 6 to 12 inches for a 10-foot-wide pond, to allow sediment to flow to the low side of pond to help prevent re-suspension of sediment. A drainpipe with a 2- to 3-foot riser should be installed on the low side of the pond to allow for easy cleaning and refilling. Polymers may be used to promote coagulation and flocculation in a closed-loop system.

Maintenance Standards

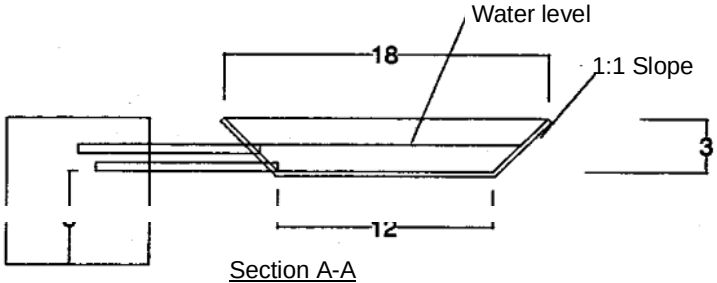
1. The wheel wash should start out the day with fresh water.
2. The washwater should be changed a minimum of once per day. On large earthwork jobs where more than 10 to 20 trucks per hour are expected, the washwater will need to be changed more often.
3. Wheel wash or tire bath wastewater shall be controlled by pumping back on site to an approved infiltration facility, or otherwise must be prevented from discharging into systems tributary to state surface waters. Options include discharge to the sanitary sewer, or discharge to an approved offsite treatment system. For discharges to the sanitary sewer, permits must be obtained from the City's Industrial Pretreatment Program at (425) 257-8874.



Wheel Wash Plan



Elevation View



Section A-A
N.T.S.

Notes:
1. Asphalt construction entrance 6 in. asphalt treated base.
2. 3-inch trash pump with floats on the suction hose.
3. Midpoint spray nozzles, if needed.
4. 6-inch sewer pipe with butterfly valves. Bottom one is a drain. Locate top pipe's invert 1 foot above bottom of wheel wash.
5. 8 foot x 8 foot sump with 5 feet of catch. Build so can be cleaned with trackhoe.
6. Asphalt curb on the low road side to direct water back to pond.
7. 6-inch sleeve under road.
8. Ball valves.
9. 15 foot asphalt treated base apron to protect ground from splashing water.

Figure 3.1 Wheel Wash

3.2.6 BMP C107: Construction Road/Parking Area Stabilization

Purpose

Stabilizing subdivision roads, parking areas and other onsite vehicle transportation routes immediately after grading reduces erosion caused by construction traffic or runoff.

Conditions of Use

- Roads or parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.
- Fencing (see BMP C103) shall be installed, if necessary, to limit the access of vehicles to only those roads and parking areas that are stabilized.

Design and Installation Specifications

1. On areas that will receive asphalt as part of the project, install the first lift as soon as possible.
2. A 6-inch depth of 2- to 4-inch crushed rock, gravel base, or crushed surfacing base course shall be applied immediately after grading or utility installation. A 4-inch course of asphalt treated base may also be used, or the road/parking area may be paved. It may also be possible to use cement or calcium chloride for soil stabilization. If cement or cement kiln dust is used for road base stabilization, pH monitoring and BMPs are necessary to evaluate and minimize the effects on stormwater. If the area will not be used for permanent roads, parking areas, or structures, a 6-inch depth of hog fuel may also be used, but this is likely to require more maintenance. Whenever possible, construction roads and parking areas shall be placed on a firm, compacted subgrade.
3. Temporary road gradients shall not exceed 15 percent. Roadways shall be carefully graded to drain. Drainage ditches shall be provided on each side of the roadway in the case of a crowned section, or on one side in the case of a super-elevated section. Drainage ditches shall be directed to a sediment control BMP.
4. Rather than relying on ditches, it may also be possible to grade the road so that runoff sheet-flows into a heavily vegetated area with a well-developed topsoil. Landscaped areas are not adequate. If this area has at least 50 feet of vegetation, then it is generally preferable to use the vegetation to treat runoff, rather than a sediment pond or trap. The 50 feet shall not include wetlands. If runoff is allowed to sheetflow through adjacent vegetated areas, it is vital to design the roadways and parking areas so that no concentrated runoff is created.
5. Storm drain inlets shall be protected to prevent sediment-laden water entering the stormwater drainage system (see BMP C220).

Maintenance Standards

1. Inspect stabilized areas regularly, especially after large storm events
2. Crushed rock, gravel base, hog fuel, etc. shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded
3. Following construction, these areas shall be restored to preconstruction condition or better to prevent future erosion.

2. Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
3. Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
4. Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
5. Encourage the use of alternate, paved routes, if available.
6. Restrict use by tracked vehicles and heavy trucks to prevent damage to road surface and base.
7. Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
8. Pave unpaved permanent roads and other trafficked areas.
9. Use vacuum street sweepers.
10. Remove mud and other dirt promptly so it does not dry and then turn into dust.
11. Limit dust-causing work on windy days.

Contact the Puget Sound Air Pollution Control Agency (PSAPCA) for guidance and training on other dust control measures. Compliance with PSACP constitutes compliance with this BMP.

Maintenance Standards

Re-spray area as necessary to keep dust to a minimum.

3.2.17 BMP C150: Materials on Hand

Purpose

Quantities of erosion prevention and sediment control materials shall be kept on the project site at all times to be used for emergency situations such as unexpected heavy summer rains. Having these materials on site reduces the time needed to implement BMPs when inspections indicate that existing BMPs are not meeting the C-SWPPP requirements.

Conditions of Use

1. Materials shall be stockpiled and readily available before any site clearing, grubbing, or earthwork begins.
2. If storage space at the project site is at a premium, the contractor shall maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

Design and Installation Specifications

Depending on the project type, size, complexity, and length, materials and quantities will vary. A good minimum that will cover numerous situations includes the materials in the table at the end of this section.

Maintenance Standards

1. All materials with the exception of the quarry spalls, steel T-posts, and gravel should be kept covered and out of both sun and rain.
2. Materials shall be restocked as needed.

Material	Measure	Quantity
Clear Plastic, 6 mil	100 foot roll	1-2
Drainpipe, 6 or 8 inch diameter	25 foot section	4-6
Sandbags, filled	each	25-50
Straw Bales for mulching	approx. 50# each	10-20
Quarry Spalls	ton	2-4
Washed Gravel	cubic yard	2-4
Geotextile Fabric	100 foot roll	1-2
Catch Basin Inserts	each	2-4
Steel T-Posts	each	12-24

3.2.18 BMP C151: Concrete Handling

Purpose

Concrete work can generate process water and slurry that contain fine particles and high pH, both of which can violate water quality standards in the receiving water. This BMP is intended to minimize and eliminate concrete process water and slurry from entering waters of the state.

Conditions of Use

For use any time concrete is used, these management practices shall be utilized. Concrete construction projects include, but are not limited to, the following:

1. Curbs
2. Sidewalks
3. Roads
4. Bridges
5. Foundations
6. Floors
7. Runways.

Design and Installation Specifications

1. Concrete truck chutes, pumps, and internals shall be washed out only into formed areas awaiting installation of concrete or asphalt.
2. Unused concrete remaining in the truck and pump shall be returned to the originating batch plant for recycling, as feasible.
3. Hand tools including, but not limited to, screeds, shovels, rakes, floats, and trowels shall be washed off only into formed areas awaiting installation of concrete or asphalt.
4. Equipment that cannot be easily moved, such as concrete pavers, shall only be washed in areas that do not directly drain to natural or constructed stormwater conveyances.
5. Wash down from areas such as concrete aggregate driveways shall not drain directly to natural or constructed stormwater conveyances.

6. When no formed areas are available, washwater and leftover product shall be contained in a lined container or a hole dug on site. Contained concrete shall be disposed of in a manner that does not violate groundwater or surface water quality standards.

Maintenance Standards

Containers shall be checked for holes in the liner daily during concrete pours and repaired the same day.

3.2.19 BMP C152: Saw-cutting and Surfacing Pollution Prevention

Purpose

Sawcutting and surfacing operations generate slurry and process water that contains fine particles and high pH (concrete cutting), both of which can violate the water quality standards in the receiving water. This BMP is intended to minimize and eliminate process water and slurry from entering waters of the state.

Conditions of Use

Anytime saw-cutting or surfacing operations take place, these management practices shall be utilized. Sawcutting and surfacing operations include, but are not limited to, the following:

1. Sawing
2. Coring
3. Grinding
4. Roughening
5. Hydro-demolition
6. Bridge and road surfacing.

Design and Installation Specifications

1. Slurry and cuttings shall be vacuumed during cutting and surfacing operations.
2. Slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight.
3. Slurry and cuttings shall not drain to any natural or constructed drainage conveyance.
4. Collected slurry and cuttings shall be disposed of in a manner that does not violate groundwater or surface water quality standards.
5. Process water that is generated during hydro-demolition, surface roughening or similar operations shall not drain to any natural or constructed drainage conveyance and shall be disposed of in a manner that does not violate groundwater or surface water quality standards.
6. Cleaning waste material and demolition debris shall be handled and disposed of in a manner that does not cause contamination of water. If the area is swept with a pick-up sweeper, the material must be hauled out of the area to an appropriate site.

Maintenance Standards

Continually monitor operations to determine whether slurry, cuttings, or process water could enter waters of the state. If inspections show that a violation of water quality standards could occur, stop operations and immediately implement preventive measures such as berms, barriers, secondary containment, and vacuum trucks.

3.2.20 BMP C153: Material Delivery, Storage and Containment

Purpose

Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials onsite, storing materials in a designated area, and installing secondary containment.

Conditions of Use

These procedures are suitable for use at all construction sites with delivery and storage of the following materials:

- Petroleum products such as fuel, oil and grease
- Soil stabilizers and binders (e.g., Polyacrylamide)
- Fertilizers, pesticides and herbicides
- Detergents
- Asphalt and concrete compounds
- Hazardous chemicals such as acids, lime, adhesives, paints, solvents and curing compounds
- Any other material that may be detrimental if released to the environment.

Design and Installation Specifications

The following steps shall be taken to minimize risk:

1. Temporary storage area shall be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
2. Material safety data sheets shall be supplied for all materials stored. Chemicals shall be kept in their original labeled containers.
3. Hazardous material storage on site shall be minimized.
4. Hazardous materials should be handled as infrequently as possible.
5. During the wet weather season (October 1 to April 30), storage of materials in a covered area shall be considered.
6. Materials should be stored in secondary containments, such as earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
7. Chemicals, drums, or bagged materials shall not be stored directly on the ground. Place these items on a pallet and, when possible, in secondary containment.
8. If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.

Material Storage Areas and Secondary Containment Practices:

1. Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.

2. Temporary secondary containment facilities shall provide for a spill containment volume able to contain precipitation from a 25-year, 24-hour storm event, plus 10 percent of the total enclosed container volume of all containers, or 110 percent of the capacity of the largest container within its boundary, whichever is greater.
3. Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
4. Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be non-hazardous.
5. Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
6. During the wet weather season (October 1 to April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
7. Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill cleanup material (spill kit).
8. The spill kit shall include, at a minimum:
    a. 1 water resistant nylon bag
    b. 3 oil absorbent socks 3 inches x 4 feet
    c. 2 oil absorbent socks 3 inches x 10 feet
    d. 12 oil absorbent pads 17 inches x 19 inches
    e. 1 pair splash resistant goggles
    f. 3 pair nitrile gloves
    g. 10 disposable bags with ties
    h. Instructions.

3.2.21 BMP C160: Certified Erosion and Sediment Control Lead

Purpose

The project applicant designates at least one person as the responsible representative in charge of ESC, and water quality protection. The designated person shall be the CESCL who is responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements.

Conditions of Use

A CESCL shall be made available on projects disturbing ground 1 acre or larger and that discharge stormwater to surface waters of the state.

The CESCL shall:

- Have a current certificate proving attendance in an ESC training course that meets the minimum ESC training and certification requirements established by Ecology

OR

- Be a Certified Professional in Erosion and Sediment Control (CPESC); for additional information go to: <www.cpesc.net>.

Ecology will maintain a list of ESC training and certification providers at: <**www.ecy.wa.gov/programs/wq/stormwater**>.

Certification shall remain valid for 3 years.

Specifications

1. The CESCL shall have authority to act on behalf of the contractor or developer and shall be available, on call, 24 hours per day throughout the period of construction.
2. The C-SWPPP shall include the name, telephone number, fax number, and address of the designated CESCL.
3. A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region.

Duties and responsibilities of the CESCL shall include, but are not limited to the following:

1. Maintaining permit file on site at all times which includes the C-SWPPP and any associated permits and plans.
2. Directing BMP installation, inspection, maintenance, modification, and removal.
3. Updating all project drawings and the C-SWPPP with changes made.
4. Keeping daily records and inspection reports. Inspection reports should include:
    a. Inspection date/time.
    b. Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection.
    c. Locations of BMPs inspected
    d. Locations of BMPs that need maintenance
    e. Locations of BMPs that failed to operate as designed or intended, and
    f. Locations of where additional or different BMPs are required.
    g. Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
    h. Any water quality monitoring performed during inspection.
    i. General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
5. Facilitating, participating in, and taking corrective actions resulting from inspections performed by outside agencies or the owner.

3.2.22 BMP C161: Payment of Erosion Control Work

Purpose

As with any construction operation, the contractor should be paid for erosion control work. Payment for erosion control must be addressed during project development and design. Method of payment should be identified in the C-SWPPP.

Conditions of Use

Erosion control work should never be "incidental" to the contract as it is extremely difficult for the contractor to bid the work. Work that is incidental to the contract is work where no separate measurement or payment is made. The cost for incidental work is included in payments made for applicable bid items in the schedule of unit prices. For example, any erosion control work associated with an item called "clearing and grubbing" is bid and paid for as part of that item, not separately.

Effective means for payment of erosion control work include:

- Temporary erosion and sediment control lump sum
- Temporary ESC force account
- Unit prices
- Lump sum.

3.2.23 BMP C162: Scheduling

Purpose

Sequencing a construction project reduces the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.

Conditions of Use

The construction sequence schedule is an orderly listing of all major land-disturbing activities together with the necessary erosion and sedimentation control measures planned for the project. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.

Following a specified work schedule that coordinates the timing of land-disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction. The removal of surface ground cover leaves a site vulnerable to accelerated erosion. Construction procedures that limit land clearing, provide timely installation of erosion and sedimentation controls, and restore protective cover quickly can significantly reduce the erosion potential of a site.

Design Considerations

- Avoid rainy periods
- Schedule projects to disturb only small portions of the site at any one time. Complete grading as soon as possible. Immediately stabilize the disturbed portion before grading the next portion. Practice staged seeding in order to revegetate cut and fill slopes as the work progresses.

3.3 Runoff Conveyance and Treatment Best Management Practices

3.3.1 BMP C200: Interceptor Dike and Swale

Purpose

Provide a ridge of compacted soil, or a ridge with an upslope swale, at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. Use the dike and/or swale to intercept the runoff from unprotected areas and direct it to areas where erosion can be controlled. This can prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.

3. Clean energy dissipater if sediment builds up.

3.3.11 BMP C220: Storm Drain Inlet Protection

Purpose is to prevent coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

Conditions of Use

For use where storm drain inlets are to be made operational before permanent stabilization of the disturbed drainage area. Protection should be provided for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless the runoff that enters the catch basin will be conveyed to a sediment pond or trap. Inlet protection may be used anywhere to protect the drainage system. It is likely that the drainage system will still require cleaning.

Table 3.9 lists several options for inlet protection. All of the methods for storm drain inlet protection are prone to plugging and require a high frequency of maintenance. Drainage areas should be limited to 1 acre or less. Emergency overflows may be required where stormwater ponding would cause a hazard. If an emergency overflow is provided, additional end-of-pipe treatment may be required.

Table 3.9 Storm Drain Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/Earthen Surfaces	Conditions of Use
Drop Inlet Protection			
Excavated drop inlet protection	Yes, temporary flooding will occur	Earthen	Applicable for heavy flows. Easy to maintain. Large area Requirement: 30 x 30-feet/acre
Block and gravel drop inlet protection	Yes	Paved or Earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and wire drop inlet protection	No		Applicable for heavy concentrated flows. Will pond. Can withstand traffic.
Catch basin filters	Yes	Paved or Earthen	Frequent maintenance required.
Curb Inlet Protection			
Curb inlet protection with a wooden weir	Small capacity overflow	Paved	Used for sturdy, more compact installation.
Block and gravel curb inlet protection	Yes	Paved	Sturdy, but limited filtration.
Culvert Inlet Protection			
Culvert inlet sediment trap			18 month expected life.

Design and Installation Specifications

1. *Excavated Drop Inlet Protection* – An excavated impoundment around the storm drain. Sediment settles out of the stormwater prior to entering the storm drain.
    a. Depth 1 to 2 feet as measured from the crest of the inlet structure
    b. Side slopes of excavation no steeper than 2:1

c. Minimum volume of excavation 3.5 cubic yards

d. Shape basin to fit site with longest dimension oriented toward the longest inflow area

e. Install provisions for draining to prevent standing water problems

f. Clear the area of all debris

g. Grade the approach to the inlet uniformly

h. Drill weep holes into the side of the inlet

i. Protect weep holes with screen wire and washed aggregate

j. Seal weep holes when removing structure and stabilizing area

k. It may be necessary to build a temporary dike to the down slope side of the structure to prevent bypass flow.

2. *Block and Gravel Filter* – A barrier formed around the storm drain inlet with standard concrete blocks and gravel. See also DCSS Drawing # 209.

   a. Height 1 to 2 feet above inlet

   b. Recess the first row 2 inches into the ground for stability

   c. Support subsequent courses by placing a 2 x 4 through the block opening

   d. Do not use mortar

   e. Lay some blocks in the bottom row on their side for dewatering the pool

   f. Place hardware cloth or comparable wire mesh with one-half-inch openings over all block openings

   g. Place gravel just below the top of blocks on slopes of 2:1 or flatter

   h. An alternative design is a gravel donut

   i. Inlet slope of 3:1

   j. Outlet slope of 2:1

   k. 1-foot wide level stone area between the structure and the inlet

   l. Inlet slope stones 3 inches in diameter or larger

   m. Outlet slope use gravel one-half to three-fourths inches at a minimum thickness of 1 foot.

3. *Gravel and Wire Mesh Filter* – A gravel barrier placed over the top of the inlet. This structure does not provide an overflow. See DCSS Drawing # 210.

   a. Hardware cloth or comparable wire mesh with one-half-inch openings

   b. Coarse aggregate

   c. Height 1 foot or more, 18 inches wider than inlet on all sides

   d. Place wire mesh over the drop inlet so that the wire extends a minimum of 1 foot beyond each side of the inlet structure

   e. If more than one strip of mesh is necessary, overlap the strips

   f. Place coarse aggregate over the wire mesh

g. The depth of the gravel should be at least 12 inches over the entire inlet opening and extend at least 18 inches on all sides.

4. *Curb Inlet Protection with Wooden Weir* – Barrier formed around a curb inlet with a wooden frame and gravel.
    a. Wire mesh with one-half-inch openings
    b. Extra strength filter cloth
    c. Construct a frame
    d. Attach the wire and filter fabric to the frame
    e. Pile coarse washed aggregate against wire/fabric
    f. Place weight on frame anchors.
5. *Block and Gravel Curb Inlet Protection* – Barrier formed around an inlet with concrete blocks and gravel. See DCSS Drawing # 211.
    a. Wire mesh with one-half-inch openings.
    b. Place two concrete blocks on their sides abutting the curb at either side of the inlet opening. These are spacer blocks.
    c. Place a 2 x 4 stud through the outer holes of each spacer block to align the front blocks.
    d. Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
    e. Place wire mesh over the outside vertical face.
    f. Pile coarse aggregate against the wire to the top of the barrier.
6. *Inlet Fabric Fence Filter* – DCSS Drawing # 212 provides an illustration of the use of filter fabric as an inlet protection option.

Maintenance Standards

1. Catch basin filters should be inspected frequently, especially after storm events. If the insert becomes clogged, it should be cleaned or replaced.
2. For systems using stone filters: If the stone filter becomes clogged with sediment, the stones must be pulled away from the inlet and cleaned or replaced. Since cleaning of gravel at a construction site may be difficult, an alternative approach would be to use the clogged stone as fill and put fresh stone around the inlet.
3. Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.

3.3.12 BMP C230: Straw Bale Barrier

Purpose

1. To decrease the velocity of sheet flows and intercept and detain small amounts of sediment from disturbed areas of limited extent, preventing sediment from leaving the site. See Figure 3.3.
2. Below disturbed areas subject to sheet and rill erosion.
3. Straw bales are among the most used and **least effective BMPs**. The best use of a straw bale is hand spread on the site.

treated solely by a barrier, rather than by a sediment pond, is when the area draining to the barrier is small.

- Brush barriers should only be installed on contours.

Design and Installation Specifications

1. Height 2 feet (minimum) to 5 feet (maximum).
2. Width 5 feet at base (minimum) to 15 feet (maximum).
3. Filter fabric (geotextile) may be anchored over the brush berm to enhance the filtration ability of the barrier. Ten-ounce burlap is an adequate alternative to filter fabric.
4. Chipped site vegetation, composted mulch, or wood-based mulch (hog fuel) can be used to construct brush barriers.
5. A 100 percent biodegradable installation can be constructed using 10-ounce burlap held in place by wooden stakes.

Maintenance Standards

1. There shall be no signs of erosion or concentrated runoff under or around the barrier. If concentrated flows are bypassing the barrier, it must be expanded or augmented by toed-in filter fabric.
2. The dimensions of the barrier must be maintained.

3.3.14 BMP C233: Silt Fence

Purpose

Use of a silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow. See DCSS Drawing # 214.

Conditions of Use

- Silt fence may be used downslope of all disturbed areas.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to a sediment pond. The only circumstance in which overland flow can be treated solely by a silt fence, rather than by a sediment pond, is when the area draining to the fence is 1 acre or less and flow rates are less than 0.5 cubic feet per second.
- Silt fences should not be constructed in streams or used in V-shaped ditches. They are not an adequate method of silt control for anything deeper than sheet or overland flow.

Design and Installation Specifications

1. Drainage area of 1 acre or less or in combination with sediment basin in a larger site.
2. Maximum slope steepness (normal [perpendicular] to fence line) 1:1.
3. Maximum sheet or overland flow path length to the fence of 100 feet.
4. No flows greater than 0.5 cubic feet per second shall be directed toward a silt fence.
5. The geotextile used shall meet the following standards. All geotextile properties listed below are minimum average roll values (i.e., the test result for any sampled roll in a lot shall meet or exceed the values shown in Table 3.10).

Table 3.10 Geotextile Standards for Silt Fences

Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for film woven (#30 sieve). 0.30 mm maximum for all other geotextile types (#50 sieve). 0.15 mm minimum for all fabric types (#100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec^{-1} minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. Minimum for extra strength fabric. 100 lbs minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

6. Standard strength fabrics shall be supported with wire mesh, chicken wire, 2 x 2-inch wire, safety fence, or jute mesh to increase the strength of the fabric. Silt fence materials are available that have synthetic mesh backing attached.
7. Filter fabric material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F.
8. 100 percent biodegradable silt fence is available that is strong, long lasting, and can be left in place after the project is completed, if permitted by local regulations.
9. The contractor shall install and maintain temporary silt fences at the locations shown in the plans. The silt fences shall be constructed in the areas of clearing, grading, or drainage prior to starting those activities. A silt fence shall not be considered temporary if the silt fence must function beyond the life of the contract. The silt fence shall prevent soil carried by runoff water from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
10. The minimum height of the top of silt fence shall be 2 feet and the maximum height shall be 2.5 feet above the original ground surface.
11. The geotextile shall be sewn together at the point of manufacture, or at an approved location as determined by the engineer, to form geotextile lengths as required. All sewn seams shall be located at a support post. Alternatively, two sections of silt fence can be overlapped, provided the contractor can demonstrate, to the satisfaction of the engineer, that the overlap is long enough and that the adjacent fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.
12. The geotextile shall be attached on the up-slope side of the posts and support system with staples, wire, or in accordance with the manufacturer's recommendations. The geotextile shall be attached to the posts in a manner that reduces the potential for geotextile tearing at the staples, wire, or other connection device. Silt fence back-up support for the geotextile in the form of a wire or plastic mesh is dependent on the properties of the geotextile selected for use. If wire or plastic back-up mesh is used, the mesh shall be fastened securely to the up-slope of the posts with the geotextile being up-slope of the mesh back-up support.
13. The geotextile at the bottom of the fence shall be buried in a trench to a minimum depth of 4 inches below the ground surface. The trench shall be backfilled and the soil tamped in place over the buried portion of the geotextile, such that no flow can pass beneath the fence and scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the trench a minimum of 3 inches.

14. The fence posts shall be placed or driven a minimum of 18 inches. A minimum depth of 12 inches is allowed if topsoil or other soft subgrade soil is not present and a minimum depth of 18 inches cannot be reached. Fence post depths shall be increased by 6 inches if the fence is located on slopes of 3:1 or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading.
15. Silt fences shall be located on contour as much as possible, except at the ends of the fence, where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.
16. If the fence must cross contours, with the exception of the ends of the fence, gravel check dams placed perpendicular to the back of the fence shall be used to minimize concentrated flow and erosion along the back of the fence. The gravel check dams shall be approximately 1-foot deep at the back of the fence. It shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence. The gravel check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. The gravel check dams shall be located every 10 feet along the fence where the fence must cross contours. The slope of the fence line where contours must be crossed shall not be steeper than 3:1.
17. Wood, steel or equivalent posts shall be used. Wood posts shall have minimum dimensions of 2 inches by 2 inches by 3 feet minimum length, and shall be free of defects such as knots, splits, or gouges. Steel posts shall consist of either size No. 6 reinforcement bar or larger, ASTM A 120 steel pipe with a minimum diameter of 1-inch, U, T, L, or C shape steel posts with a minimum weight of 1.35 pounds/feet or other steel posts having equivalent strength and bending resistance to the post sizes listed. The spacing of the support posts shall be a maximum of 6 feet.
18. Fence back-up support, if used, shall consist of steel wire with a maximum mesh spacing of 2 inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 pounds grab tensile strength. The polymeric mesh must be as resistant to ultraviolet radiation as the geotextile it supports.
19. The base of both end posts must be at least 2 to 4 inches above the top of the silt fence fabric on the middle posts for ditch checks to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.
20. Install posts 3 to 4 feet apart in critical retention areas and 6 feet apart in standard applications.

Maintenance Standards

1. Any damage shall be repaired immediately.
2. If concentrated flows are evident uphill of the fence, they must be intercepted and conveyed to a sediment pond.
3. It is important to check the uphill side of the fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence or remove the trapped sediment.
4. Sediment deposits shall either be removed when the deposit reaches approximately one-third the height of the silt fence, or a second silt fence shall be installed.
5. If the filter fabric (geotextile) has deteriorated due to ultraviolet breakdown, it shall be replaced.

Permanent BMP Checklists

Appendix F – Maintenance Checklists

INSTRUCTIONS FOR USE OF MAINTENANCE CHECKLISTS

The following pages contain maintenance needs for most of the components that may be part of a drainage system. Those components that are applicable to a particular project must be contained within the project's Maintenance Plan (see Volume I, Chapter 3.2.6H). The property owner shall plan to complete a checklist for all system components on the following schedule:

(M) Monthly from October through April.
(A) Once in late summer (preferably September).
(S) After any major storm (use 1 inch in 24 hours as a guideline).

Photocopies of these pages shall be used and checked off for the problems looked for each time an inspection is completed. Comments on problems found and actions taken shall be noted. Some items do not need to be looked at every time an inspection is done. The suggested frequency at the left of each item shall be used as a guideline for inspections.

The "checked" sheets shall be kept by the property owner and made available to the City upon request.

The facility-specific maintenance standards contained in this appendix are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceedance of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

Maintenance checklists are provided for the following types of facilities/structures:

Catch Basins

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Maintenance Activities and Conditions That Should Exist**
A	General					"Dump no pollutants" Stencil or stamp not visible	Stencil or stamp should be visible and easily read	Warning signs (e.g., "Dump No Waste-Drains to Stream") shall be painted or embossed on or adjacent to all storm drain inlets.
M,S	General					Trash and Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10 percent.	No trash or debris located immediately in front of catch basin or on grate opening.
M	General					Trash and Debris	Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
M	General					Trash and Debris	Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.	Inlet and outlet pipes free of trash or debris.
M	General					Trash and Debris	Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
M	General					Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
A	General					Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than one-fourth inch (intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Maintenance Activities and Conditions That Should Exist**
A	General					Structure Damage to Frame and/or Top Slab	Frame not sitting flush on top slab, i.e., separation of more than three-fourth inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
A	General					Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
A	General					Fractures or Cracks in Basin Walls/ Bottom	Grout fillet has separated or cracked wider than one-half-inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is re-grouted and secure at basin wall.
A	General					Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
M	General					Vegetation	Vegetation growing across and blocking more than 10 percent of the basin opening.	No vegetation blocking opening to basin.
M	General					Vegetation	Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.	No vegetation or root growth present.
M	General					Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. (Coordinate removal/cleanup with the City of Everett Surface Water Management 425-257-8885 and/or DOE Spill Response 800-424-8802.)
A	Catch Basin Cover					Cover Not in Place	Cover is missing or only partially in place.	Any open catch basin requires maintenance. Catch basin cover is closed
A	Catch Basin Cover					Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half-inch of thread.	Mechanism opens with proper tools.

		Date						
Frequency	**Drainage System Feature**	✓	✓	✓	✓	**Problem**	**Conditions to Check For**	**Maintenance Activities and Conditions That Should Exist**
A	Catch Basin Cover					Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
A	Ladder					Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
	Grates					Grate opening Unsafe	Grate with opening wider than seven-eighths of an inch.	Grate opening meets design standards.
M,S	Grates					Trash and Debris	Trash and debris that is blocking more than 20 percent of grate surface inletting capacity.	Grate free of trash and debris.
A	Grates					Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

If you are unsure whether a problem exists, please contact a professional engineer.

Key:

(M) Monthly from October through April.
(A) Once in late summer (preferably September)
(S) After any major storm (use 1 inch in 24 hours as a guideline).