



LAND SURVEYING • LAND USE PLANNING • CIVIL ENGINEERING

CONCEPTUAL STORMWATER SITE PLAN
FOR THE
**PRELIMINARY 9 LOT SHORT PLAT OF
SAFE HARBOR TRUST**
MONROE, WASHINGTON

January 13, 2020



EVERETT (ASPI)
5205 S. 2nd Avenue, Ste. A
Everett, WA 98203
425-252-1884

MONROE
125 East Main Street., Ste. 104
Monroe, WA 98272
360-794-7811

MOUNT VERNON
603 South First Street
Mount Vernon, WA 98273
360-336-9199

OAK HARBOR
840 SE 8th Avenue, Ste. 102
Oak Harbor, WA 98277
360-675-5973

PROJECT OVERVIEW

This Stormwater Site Plan has been prepared for the Preliminary Safe Harbor Trust 9-Lot Short Plat in Monroe, Washington. The project creates 9 lots from 2 existing parcels with 3 multi-family buildings and one shared access road. Currently, there are four non-residential structures with a driveway area that will be removed from the site. The 0.72-acre site is located at 16096 174th Drive SE, see Figure 1: Vicinity Map.

METHODOLOGY

The drainage design for the project has been prepared based on the requirements of the 2012 Department of Ecology Stormwater Management Manual (DOE Manual 2014 Amendment) as adopted by the City of Monroe (MMC 15.01.025). WWHM2012 as provided by DOE has been used for determining basin runoff and for sizing of the stormwater facilities. Based on the flow chart in Figure I-2.4.1 of the DOE Manual and the site parameters, the project is subject to Minimum Requirements 1-10.

The project site parameters are:

- The project is a new development with less than 35% existing impervious coverage.
- The project will create more than 2,000 sf of new plus replaced impervious area.
- The project will create over 5,000 sf of new plus replaced impervious area.
- The project will disturb more than 7,000 sf.
- The project does not convert $\frac{3}{4}$ acre of pasture to lawn.
- The project does not convert 2.5 acres of forest to pasture.

MR 1: PREPARATION OF STORMWATER SITE PLANS

DRAINAGE PLAN DESCRIPTION

Stormwater runoff from roofs and paved areas will be collected and conveyed to an infiltration trench located under the access drive.

WATER QUALITY MEASURES

Following is a list of the proposed construction water quality BMPs. See MR 3: Water Pollution Source Control for more information. The proposed BMPs are as follows:

- BMP C103, High Visibility Fence
- BMP C105, Construction Entrance
- BMP C107, Construction Road/Parking Area Stabilization
- BMP C120, Temporary and Permanent Seeding
- BMP C121, Mulching
- BMP C123, Plastic Covering
- BMP C125, Topsoiling/Composting
- BMP C140, Dust Control
- BMP C220, Storm Inlet Protection
- Temporary Infiltration Pond

INFILTRATION SIZING

Flow control will consist of an infiltration into the underlying soils using underground infiltration trenches. Permeable pavement is also proposed for the site, and as a result, there will be minimal surface runoff from the site.

CONVEYANCE CALCULATIONS

It is anticipated that pipe runs will be short, and that conveyance will not be an issue.

STORMWATER TREATMENT BMP'S

The roof runoff is considered clean and treatment is not required. Both on-site and off-site paved surfaces are proposed to be paved with permeable concrete or asphalt. For permit documents, the soils will be tested for CEC (Cation Exchange) values, and if the soils lack the required treatment ability, a sand layer will be added below the paving to provide the needed treatment.

PROTECTION OF WETLANDS

There are no wetlands on or adjacent to the site.

OPERATIONS AND MAINTENANCE

This will be provided with the permit documents after preliminary approval.

EXISTING CONDITIONS SUMMARY

DESCRIPTION

The site is located at 16096 174th Drive SE in Monroe, WA. There are 4 non-residential structures that exist on the 2-parcel, 0.72-acre site which are to be demolished. Apart from the

structures, the site is mostly lawn with a gravel driveway. The east side of the lot is the frontage to 174th Drive SE. To the south there is a duplex and manufactured home site. The west side of the lot is neighbor to two single-family residences, and to the north lies another manufactured home site. Highway 522 is in close proximity to the northwest of the site. The topography of the site lies between 49 feet and 52 feet with the lowest corner in the northwest. See Figure 2: Existing Site Map for more information.

SOILS DESCRIPTION

Per the NRSC soil survey, the site is underlain with Puget silty clay loam and Puyallup fine sandy loam. See Appendix B for full soil description and map. Based on previous work in the area and general knowledge of the local area, free draining, sandy, gravelly soils will be found approximately 4' below the surface grade.

EXISTING BASIN

The existing basin is the full site. As 100 percent infiltration is proposed, no existing basin calculations were performed.

OFFSITE ANALYSIS & MITIGATION

No runoff is proposed to leave the site.

UPSTREAM ANALYSIS

Due to the relative flatness of the area and considering all the surrounding lots are developed with their own storm systems, no significant upstream flow is anticipated to be a factor in the site design.

DOWNSTREAM ANALYSIS

No runoff is proposed to leave the site.

PROPOSED CONDITIONS SUMMARY

The 2-parcel site will be sub-divided into 9 lots consisting of 3 multi-family residences, and a shared access road which will connect to each building's driveway. Access will be from the existing site access location on the east side of the lots coming from 174th Drive SE. See Figure 3: Developed Conditions.

MR 2: CONSTRUCTION STORMWATER POLLUTION PREVENTION (SWPP)

This SWPPP Narrative has been prepared as part of the preliminary plat and is conceptual in nature. The project proposes less than 1 acre of land disturbing activities and will not require a Department of Ecology Construction Stormwater General Permit.

The construction site has the following characteristics:

Disturbed Area:	Approximately 0.96 ac.
Soil Type:	Puget silty clay loam, and Puyallup fine sandy loam (Runoff is slow and the hazard of water erosion is slight)
Average slope:	0.5-2%
Critical Areas:	None.

1. CONSTRUCTION STORMWATER POLLUTION PREVENTION ELEMENTS

A Construction Stormwater Management Plan will be prepared that addresses the 13 Required Elements summarized below:

Element #1: Mark Clearing Limits

The construction plans delineate the limits of the clearing for the site. These will be located in the field prior to clearing taking place.

Element #2: Establish Construction Access

Construction access will be taken from the existing access to 174th Drive SE. A stabilized construction entrance will be installed at that location.

Element #3: Control Flow Rates

Temporary infiltration ponds will be constructed by the contractor to allow construction runoff to infiltrate.

Element #4: Install Sediment Controls

Sediment controls and their installation will be delineated on the construction documents in the future.

Element #5: Stabilize Soils

In planting areas, the exposed soils will be stabilized BMP T5.13. In paved areas the soils will be stabilized by the placement of the rock base course. Temporary stockpiles will be mulched, seeded or covered with plastic.

Element #6: Protect Slopes

The site is flat and will not require slope protection.

Element #7: Protect Drain Inlets

There are no catch basin inlets along 174th Drive SE, but inlets will be protected along 162nd Street SE in vicinity to the project.

Element #8: Stabilize Channels and Outlets

No channels or outfalls are proposed.

Element #9: Control of Pollutants

All pollutants, including waste materials and demolition debris, that occur onsite shall be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well-organized, and free of debris.

Element #10: Control De-Watering

No dewatering is expected as no excavation to the water table is anticipated.

Element #11: Maintain BMPs

Notes for the maintenance of erosion control facilities will be included on the construction plans.

Element #12: Manage the Project

The project will be subject to seasonal work limitations, site inspection and monitoring as required by the City of Monroe. Erosion control monitoring and supervision will be managed by the contractor.

Element #13: Protect Low Impact Development

This will be addressed on the final construction documents after preliminary short plat.

MR 3: WATER POLLUTION SOURCE CONTROL

PERMANENT SOURCE CONTROL BMPs

Being a residential development source control will consist of maintained garbage facilities, maintenance of the storm drain system, and pavement sweeping.

MR 4: PRESERVATION OF NATURAL DRAINAGE

Infiltration of the storm water runoff from the developed site is proposed. This matches the existing conditions where there is essentially no surface discharge from the site. As such there is no downstream drainage that will be impacted by the discharge of surface water from the proposed development. By allowing the runoff to continue to infiltrate, the natural drainage will be preserved.

MR 5: ON-SITE STORMWATER MANAGEMENT

The project proposes 100 percent infiltration of runoff, meeting the requirements of MRs #1-9. WWHM 2012 modeling parameters and results are shown in Appendix A. The project includes the construction of nine attached single-family residences (11,133 sf total), a combined driveway and access road (14,852 sf), and concrete sidewalk (2,999 sf). The total new plus replaced impervious surface is 31,918 sf. The following is a conceptual evaluation of the proposed onsite stormwater management BMPs for the site:

The project is not flow control exempt and triggers MRs #1-9. By following Figure I-2.5.1, the developer will need to choose between meeting the LID Performance Standard or following List #2 for each surface. Should the developer follow the List #2 option, the likely BMPs that will be used for each surface are as follows:

Lawn and Landscaped Areas

BMP T5.13 Post Construction Soil Quality and Depth will be implemented on disturbed and landscaped areas.

Roof Areas

BMP T5.10A Downspout Full Infiltration Systems

As the site is a previously developed, there is no option to use full dispersion, so downspout full infiltration systems are the preferred method of stormwater management for roof areas. Conceptual sizing is shown below.

Per Table 3.3 of the Drainage Manual, medium sand requires 30 lf of 2' wide infiltration trench per 1,000 sf of roof area. With three roof areas of varying size, the following calculations have been used in preliminary sizing:

Lots	Building Size (sf)	Required Trench Length (lf)	Proposed Trench Dimensions
1, 2, and 3	3,952	119	60' x 4'
4, 5, and 6	3,284	99	50' x 4'
7, 8, and 9	3,897	117	60' x 4'

Each trench location was chosen to be in the backside of the lots where there is the most open area. With full infiltration, the roof area has not been included in the developed basin WWHM2012 calculations.

Other Hard Surfaces

BMP T5.15 Permeable Pavement

As previously mentioned, full dispersion is not feasible due to the existing developed conditions of the site and surroundings. The remaining hard surface comprises of the shared driveway and repave of the existing access road to the updated road standards. Overall, this accounts for 14,852 sf of hard surface, with the existing driveway and road being 6,314 sf; a difference of 8,538 sf. The main access road to the site in its current condition Permeable pavement in accordance with BMP T5.15 will be the preferred method of stormwater management for the access road, parking areas and sidewalks for the site. An investigation of the site soils will need to be completed before final construction documents that include infiltration rates of the underlying soils which is a critical component of permeable pavement and downspout infiltration systems. The WWHM2012 model does not include permeable paving since it is being used in the List Approach.

MR 6: RUNOFF TREATMENT

With more than 5,000 sf (15,000 sf) of pollution generating hard surface the site requires runoff treatment. Basic treatment is required for the site and will be achieved with permeable paving. Both on-site and off-site paved surfaces are proposed to be paved with permeable concrete or asphalt. This will allow for stormwater to infiltrate through the surface layer to the underlying soils. Assuming the native underlying soils can remove pollutants through CEC (Cation Exchange), the water will be treated as it infiltrates, and no further treatment will be required. If the soils report determines the underlying soils are incapable of CEC, a sand layer with CEC properties will be added to treat the infiltrating water.

MR 7: FLOW CONTROL

The site has currently been sized as a single basin, but may be broken up into parts depending on project the extents at the final construction documents. Paved areas will either be permeable and infiltrate all runoff or will be graded to drain to a conveyance system which will flow to a flow control BMP.

The basin is modeled as 0.92 acres of forest and flat lawn in the predeveloped condition and consists of 0.06 acres of impervious sidewalk, 0.18 acres of pervious landscaping, and 0.34 acres of permeable paving in the developed condition. Roof area is fully infiltrated and is zeroed out in the developed condition.

See attached WWHM2012 Report under Appendix A.

MR 8: WETLANDS PROTECTION

There are no wetlands or other critical areas on or near the site.

MR 9: OPERATION AND MAINTENANCE

A full operations and Maintenance Manual will accompany the final drainage report.



FIGURE 1: VICINITY MAP



FIGURE 2: EXISTING CONDITIONS

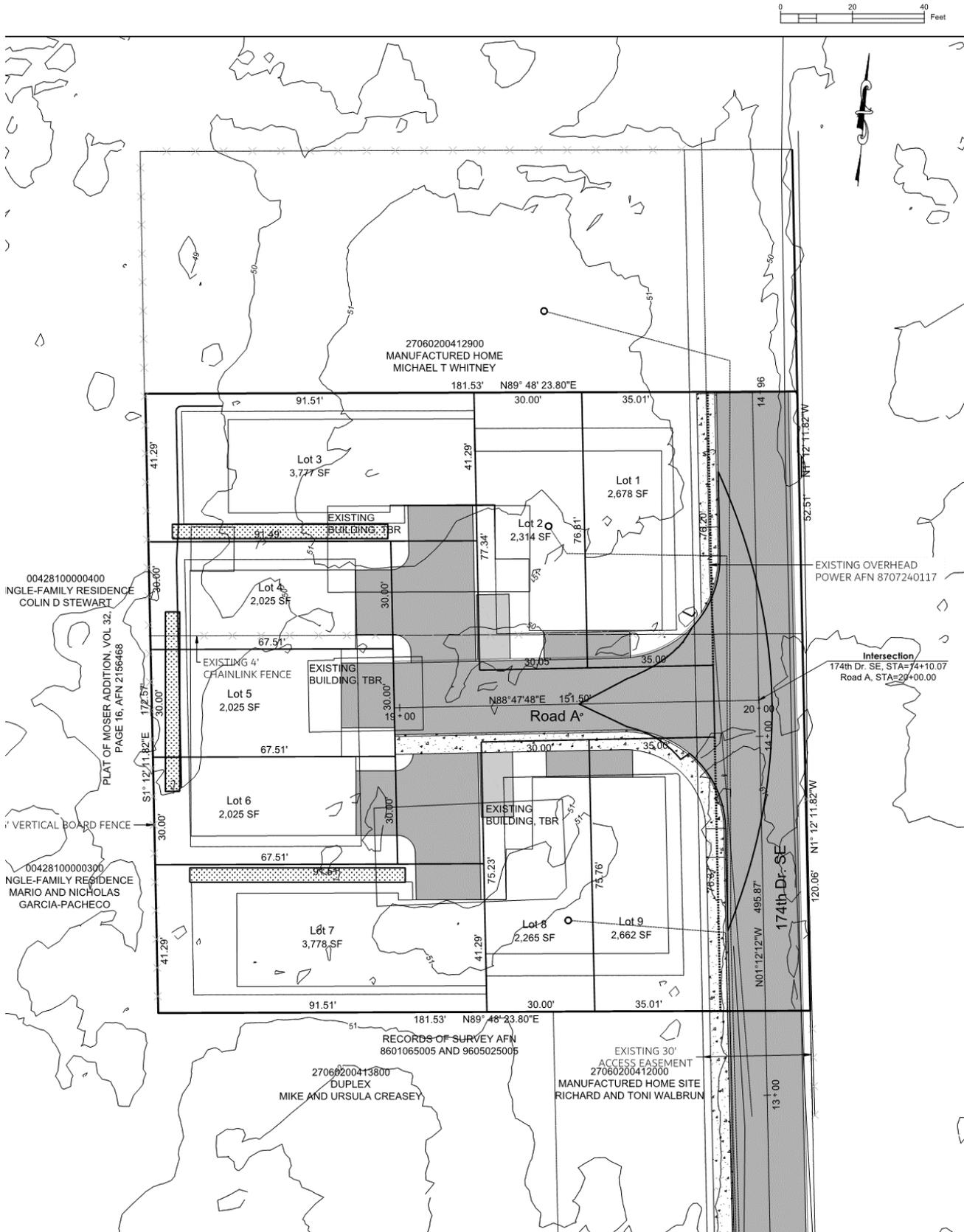


FIGURE 3: DEVELOPED SITE

APPENDIX A: WWHM2012 REPORT

**WWHM2012
PROJECT REPORT**

Project Name: 19-319
Site Name:
Site Address:
City :
Report Date: 1/13/2020
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.20
Version Date: 2018/10/10
Version : 4.2.16

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

<u>Pervious Land Use</u>	<u>acre</u>
A B, Forest, Flat	.1
C, Lawn, Flat	.82

Pervious Total 0.92

<u>Impervious Land Use</u>	<u>acre</u>
Impervious Total	0

Basin Total 0.92

Element Flows To:		
Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Lawn, Flat	.18
Pervious Total	0.18
<u>Impervious Land Use</u>	<u>acre</u>
SIDEWALKS FLAT	0.06
Impervious Total	0.06
Basin Total	0.24

Element Flows To:
 Surface Interflow Groundwater

Name : Permeable Pavement 1
 Pavement Area: 0.3444 ac.
 Pavement Length: 750.00 ft.
 Pavement Width: 20.00 ft.
 Pavement slope 1: 0 To 1
 Pavement thickness: 0.33
 Pour Space of Pavement: 0.3
 Material thickness of second layer: 0.33
 Pour Space of material for second layer: 0.3
 Material thickness of third layer: 0
 Pour Space of material for third layer: 0
 Infiltration On
 Infiltration rate: 3.7
 Infiltration safety factor: 1
 Total Volume Infiltrated (ac-ft.): 62.648
 Total Volume Through Riser (ac-ft.): 0
 Total Volume Through Facility (ac-ft.): 62.648
 Percent Infiltrated: 100
 Total Precip Applied to Facility: 0
 Total Evap From Facility: 3.615

Element Flows To:
 Outlet 1 Outlet 2

Permeable Pavement Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.344	0.000	0.000	0.000
0.0056	0.344	0.000	0.000	1.284
0.0111	0.344	0.001	0.000	1.284
0.0167	0.344	0.001	0.000	1.284
0.0222	0.344	0.002	0.000	1.284

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0.0278	0.344	0.002	0.000	1.284
0.0333	0.344	0.003	0.000	1.284
0.0389	0.344	0.004	0.000	1.284
0.0444	0.344	0.004	0.000	1.284
0.0500	0.344	0.005	0.000	1.284
0.0556	0.344	0.005	0.000	1.284
0.0611	0.344	0.006	0.000	1.284
0.0667	0.344	0.006	0.000	1.284
0.0722	0.344	0.007	0.000	1.284
0.0778	0.344	0.008	0.000	1.284
0.0833	0.344	0.008	0.000	1.284
0.0889	0.344	0.009	0.000	1.284
0.0944	0.344	0.009	0.000	1.284
0.1000	0.344	0.010	0.000	1.284
0.1056	0.344	0.010	0.000	1.284
0.1111	0.344	0.011	0.000	1.284
0.1167	0.344	0.012	0.000	1.284
0.1222	0.344	0.012	0.000	1.284
0.1278	0.344	0.013	0.000	1.284
0.1333	0.344	0.013	0.000	1.284
0.1389	0.344	0.014	0.000	1.284
0.1444	0.344	0.014	0.000	1.284
0.1500	0.344	0.015	0.000	1.284
0.1556	0.344	0.016	0.000	1.284
0.1611	0.344	0.016	0.000	1.284
0.1667	0.344	0.017	0.000	1.284
0.1722	0.344	0.017	0.000	1.284
0.1778	0.344	0.018	0.000	1.284
0.1833	0.344	0.018	0.000	1.284
0.1889	0.344	0.019	0.000	1.284
0.1944	0.344	0.020	0.000	1.284
0.2000	0.344	0.020	0.000	1.284
0.2056	0.344	0.021	0.000	1.284
0.2111	0.344	0.021	0.000	1.284
0.2167	0.344	0.022	0.000	1.284
0.2222	0.344	0.023	0.000	1.284
0.2278	0.344	0.023	0.000	1.284
0.2333	0.344	0.024	0.000	1.284
0.2389	0.344	0.024	0.000	1.284
0.2444	0.344	0.025	0.000	1.284
0.2500	0.344	0.025	0.000	1.284
0.2556	0.344	0.026	0.000	1.284
0.2611	0.344	0.027	0.000	1.284
0.2667	0.344	0.027	0.000	1.284
0.2722	0.344	0.028	0.000	1.284
0.2778	0.344	0.028	0.000	1.284
0.2833	0.344	0.029	0.000	1.284
0.2889	0.344	0.029	0.000	1.284
0.2944	0.344	0.030	0.000	1.284
0.3000	0.344	0.031	0.000	1.284
0.3056	0.344	0.031	0.000	1.284
0.3111	0.344	0.032	0.000	1.284
0.3167	0.344	0.032	0.000	1.284
0.3222	0.344	0.033	0.000	1.284
0.3278	0.344	0.033	0.000	1.284
0.3333	0.344	0.034	0.000	1.284
0.3389	0.344	0.035	0.000	1.284

0.3444	0.344	0.035	0.000	1.284
0.3500	0.344	0.036	0.000	1.284
0.3556	0.344	0.036	0.000	1.284
0.3611	0.344	0.037	0.000	1.284
0.3667	0.344	0.037	0.000	1.284
0.3722	0.344	0.038	0.000	1.284
0.3778	0.344	0.039	0.000	1.284
0.3833	0.344	0.039	0.000	1.284
0.3889	0.344	0.040	0.000	1.284
0.3944	0.344	0.040	0.000	1.284
0.4000	0.344	0.041	0.000	1.284
0.4056	0.344	0.041	0.000	1.284
0.4111	0.344	0.042	0.000	1.284
0.4167	0.344	0.043	0.000	1.284
0.4222	0.344	0.043	0.000	1.284
0.4278	0.344	0.044	0.000	1.284
0.4333	0.344	0.044	0.000	1.284
0.4389	0.344	0.045	0.000	1.284
0.4444	0.344	0.045	0.000	1.284
0.4500	0.344	0.046	0.000	1.284
0.4556	0.344	0.047	0.000	1.284
0.4611	0.344	0.047	0.000	1.284
0.4667	0.344	0.048	0.000	1.284
0.4722	0.344	0.048	0.000	1.284
0.4778	0.344	0.049	0.000	1.284
0.4833	0.344	0.049	0.000	1.284
0.4889	0.344	0.050	0.000	1.284
0.4944	0.344	0.051	0.000	1.284
0.5000	0.344	0.051	0.000	1.284

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1

Total Pervious Area:0.92

Total Impervious Area:0

Mitigated Landuse Totals for POC #1

Total Pervious Area:0.18

Total Impervious Area:0.06

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.128404
5 year	0.232332
10 year	0.316757
25 year	0.440839
50 year	0.545776
100 year	0.661346

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.057252
5 year	0.090078
10 year	0.115882
25 year	0.153354
50 year	0.184967
100 year	0.219889

Stream Protection Duration

Annual Peaks for Predeveloped and Mitigated. POC #1

<u>Year</u>	<u>Predeveloped</u>	<u>Mitigated</u>
1949	0.200	0.078
1950	0.231	0.087
1951	0.084	0.040
1952	0.129	0.055
1953	0.164	0.075
1954	0.316	0.118
1955	0.215	0.081
1956	0.073	0.029
1957	0.196	0.071
1958	0.530	0.188
1959	0.099	0.049
1960	0.166	0.065
1961	0.783	0.264
1962	0.144	0.057
1963	0.290	0.103
1964	0.113	0.041
1965	0.032	0.028
1966	0.053	0.038
1967	0.112	0.071
1968	0.130	0.058
1969	0.533	0.181
1970	0.088	0.040
1971	0.180	0.074
1972	0.263	0.101
1973	0.155	0.071
1974	0.221	0.093
1975	0.181	0.075
1976	0.085	0.040
1977	0.043	0.033
1978	0.060	0.027
1979	0.290	0.102
1980	0.100	0.043
1981	0.088	0.040
1982	0.080	0.036
1983	0.181	0.073
1984	0.123	0.056
1985	0.167	0.065
1986	0.253	0.096
1987	0.155	0.071
1988	0.089	0.050
1989	0.161	0.065
1990	0.068	0.039
1991	0.062	0.034

1992	0.140	0.058
1993	0.069	0.038
1994	0.069	0.034
1995	0.070	0.036
1996	0.160	0.062
1997	0.322	0.105
1998	0.227	0.089
1999	0.044	0.028
2000	0.202	0.111
2001	0.025	0.024
2002	0.037	0.023
2003	0.037	0.030
2004	0.223	0.105
2005	0.080	0.043
2006	0.216	0.078
2007	0.177	0.070
2008	0.128	0.051
2009	0.085	0.045

Stream Protection Duration

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.7831	0.2636
2	0.5327	0.1882
3	0.5300	0.1807
4	0.3224	0.1177
5	0.3159	0.1106
6	0.2896	0.1053
7	0.2895	0.1049
8	0.2627	0.1031
9	0.2528	0.1019
10	0.2305	0.1010
11	0.2271	0.0965
12	0.2227	0.0932
13	0.2209	0.0892
14	0.2158	0.0873
15	0.2154	0.0808
16	0.2022	0.0781
17	0.2001	0.0781
18	0.1963	0.0750
19	0.1814	0.0746
20	0.1812	0.0741
21	0.1797	0.0735
22	0.1768	0.0710
23	0.1666	0.0709
24	0.1655	0.0708
25	0.1638	0.0705
26	0.1607	0.0703
27	0.1602	0.0654
28	0.1554	0.0654
29	0.1553	0.0646
30	0.1443	0.0616
31	0.1396	0.0581
32	0.1300	0.0578
33	0.1294	0.0572
34	0.1278	0.0556

35	0.1232	0.0552
36	0.1127	0.0513
37	0.1115	0.0496
38	0.1004	0.0487
39	0.0986	0.0446
40	0.0889	0.0434
41	0.0876	0.0434
42	0.0876	0.0406
43	0.0848	0.0404
44	0.0848	0.0404
45	0.0844	0.0403
46	0.0804	0.0395
47	0.0795	0.0389
48	0.0726	0.0383
49	0.0699	0.0376
50	0.0692	0.0358
51	0.0689	0.0357
52	0.0677	0.0345
53	0.0617	0.0344
54	0.0597	0.0329
55	0.0532	0.0297
56	0.0442	0.0292
57	0.0427	0.0282
58	0.0374	0.0279
59	0.0372	0.0274
60	0.0325	0.0242
61	0.0251	0.0229

Stream Protection Duration

POC #1

The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0642	597	77	12	Pass
0.0691	485	63	12	Pass
0.0739	411	53	12	Pass
0.0788	341	39	11	Pass
0.0837	275	33	12	Pass
0.0885	237	29	12	Pass
0.0934	212	21	9	Pass
0.0983	190	17	8	Pass
0.1031	174	10	5	Pass
0.1080	163	6	3	Pass
0.1128	147	5	3	Pass
0.1177	130	5	3	Pass
0.1226	119	4	3	Pass
0.1274	110	4	3	Pass
0.1323	102	4	3	Pass
0.1372	98	4	4	Pass
0.1420	92	4	4	Pass
0.1469	85	4	4	Pass
0.1518	79	4	5	Pass
0.1566	74	4	5	Pass
0.1615	67	4	5	Pass

SAFE HARBOR TRUST 9-LOT SHORT PLAT

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0.1664	60	4	6	Pass
0.1712	56	4	7	Pass
0.1761	53	4	7	Pass
0.1809	49	4	8	Pass
0.1858	46	3	6	Pass
0.1907	45	2	4	Pass
0.1955	42	2	4	Pass
0.2004	38	2	5	Pass
0.2053	34	2	5	Pass
0.2101	34	2	5	Pass
0.2150	32	1	3	Pass
0.2199	30	1	3	Pass
0.2247	27	1	3	Pass
0.2296	26	1	3	Pass
0.2345	24	1	4	Pass
0.2393	23	1	4	Pass
0.2442	22	1	4	Pass
0.2490	21	1	4	Pass
0.2539	19	1	5	Pass
0.2588	16	1	6	Pass
0.2636	13	1	7	Pass
0.2685	12	0	0	Pass
0.2734	10	0	0	Pass
0.2782	10	0	0	Pass
0.2831	8	0	0	Pass
0.2880	8	0	0	Pass
0.2928	6	0	0	Pass
0.2977	6	0	0	Pass
0.3026	6	0	0	Pass
0.3074	6	0	0	Pass
0.3123	6	0	0	Pass
0.3171	5	0	0	Pass
0.3220	5	0	0	Pass
0.3269	4	0	0	Pass
0.3317	4	0	0	Pass
0.3366	4	0	0	Pass
0.3415	4	0	0	Pass
0.3463	4	0	0	Pass
0.3512	4	0	0	Pass
0.3561	4	0	0	Pass
0.3609	4	0	0	Pass
0.3658	4	0	0	Pass
0.3707	4	0	0	Pass
0.3755	4	0	0	Pass
0.3804	4	0	0	Pass
0.3853	4	0	0	Pass
0.3901	4	0	0	Pass
0.3950	4	0	0	Pass
0.3998	4	0	0	Pass
0.4047	4	0	0	Pass
0.4096	4	0	0	Pass
0.4144	4	0	0	Pass
0.4193	4	0	0	Pass
0.4242	4	0	0	Pass
0.4290	4	0	0	Pass
0.4339	4	0	0	Pass
0.4388	4	0	0	Pass

0.4436	4	0	0	Pass
0.4485	4	0	0	Pass
0.4534	4	0	0	Pass
0.4582	4	0	0	Pass
0.4631	4	0	0	Pass
0.4679	4	0	0	Pass
0.4728	4	0	0	Pass
0.4777	4	0	0	Pass
0.4825	4	0	0	Pass
0.4874	4	0	0	Pass
0.4923	4	0	0	Pass
0.4971	4	0	0	Pass
0.5020	4	0	0	Pass
0.5069	4	0	0	Pass
0.5117	4	0	0	Pass
0.5166	4	0	0	Pass
0.5215	4	0	0	Pass
0.5263	4	0	0	Pass
0.5312	3	0	0	Pass
0.5360	2	0	0	Pass
0.5409	2	0	0	Pass
0.5458	2	0	0	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 Quality Percent	Used for Comment	Total Volume Needs	Volume Through	Infiltration Volume	Cumulative Volume	Percent Volume	Water
Water Quality Treated		Treatment (ac-ft)	Facility (ac-ft)	(ac-ft.)	Infiltration Credit	Infiltrated	
Total Volume Infiltrated 0%	No Treat. Credit	0.00	0.00	0.00		0.00	0.00
Compliance with LID Standard 8 Duration Analysis Result = Passed							

PerlnD and Implnd Changes

No changes have been made.

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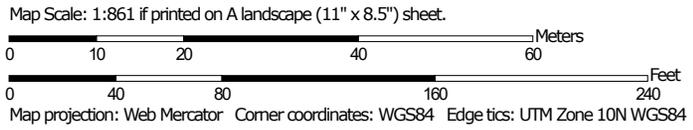
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APPENDIX B: SOIL DATA

Soil Map—Snohomish County Area, Washington



Soil Map may not be valid at this scale.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Snohomish County Area, Washington

Survey Area Data: Version 21, Sep 16, 2019

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

Date(s) aerial images were photographed: Sep 26, 2018—Oct 16, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
13	Custer fine sandy loam	2.5	65.7%
55	Puget silty clay loam	1.0	25.3%
66	Sultan silt loam	0.3	9.0%
Totals for Area of Interest		3.9	100.0%

Snohomish County Area, Washington

13—Custer fine sandy loam

Map Unit Setting

National map unit symbol: 2hy0

Elevation: 0 to 150 feet

Mean annual precipitation: 32 to 50 inches

Mean annual air temperature: 48 to 50 degrees F

Frost-free period: 150 to 200 days

Farmland classification: Prime farmland if irrigated and drained

Map Unit Composition

Custer, undrained, and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Custer, Undrained

Setting

Landform: Outwash plains

Parent material: Glacial outwash

Typical profile

H1 - 0 to 9 inches: fine sandy loam

H2 - 9 to 35 inches: sand

H3 - 35 to 60 inches: sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification

Natural drainage class: Poorly drained

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high (0.20 to 0.57 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: None

Frequency of ponding: None

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: C/D

Forage suitability group: Wet Soils (G002XN102WA)

Hydric soil rating: Yes

Minor Components

Custer, drained

Percent of map unit: 5 percent

Landform: Depressions

Hydric soil rating: Yes

Indianola

Percent of map unit: 5 percent

Hydric soil rating: No

Norma, undrained

Percent of map unit: 5 percent

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Snohomish County Area, Washington

Survey Area Data: Version 21, Sep 16, 2019