PRELIMINARY STORMWATER REPORT

GOERIG APARTMENTS

TAXLOT NOS.: 50630

PROPERTY ADDRESS: 1776 N. GOERIG ST, WOODLAND, WA 98674

June 24, 2022

REVISION LOG		
MARK	**DATE**	**DESCRIPTION**
A	6/24/2022	Issued for review.

PREPARED FOR:

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PRELIMINARY STORMWATER REPORT

GOERIG APARTMENTS

THE MATERIAL AND DATA IN THIS REPORT WERE PREPARED UNDER THE SUPERVISION AND DIRECTION OF THE UNDERSIGNED.

JOLMA DESIGN, LLC

Engineer's Statement of Completeness and Feasibility: *I, the undersigned, do hereby state that, to the best of my knowledge, all information required by City of Woodland 15.12 Stormwater Management Code is included in the Preliminary Stormwater Plan and that the proposed stormwater facilities are feasible.*

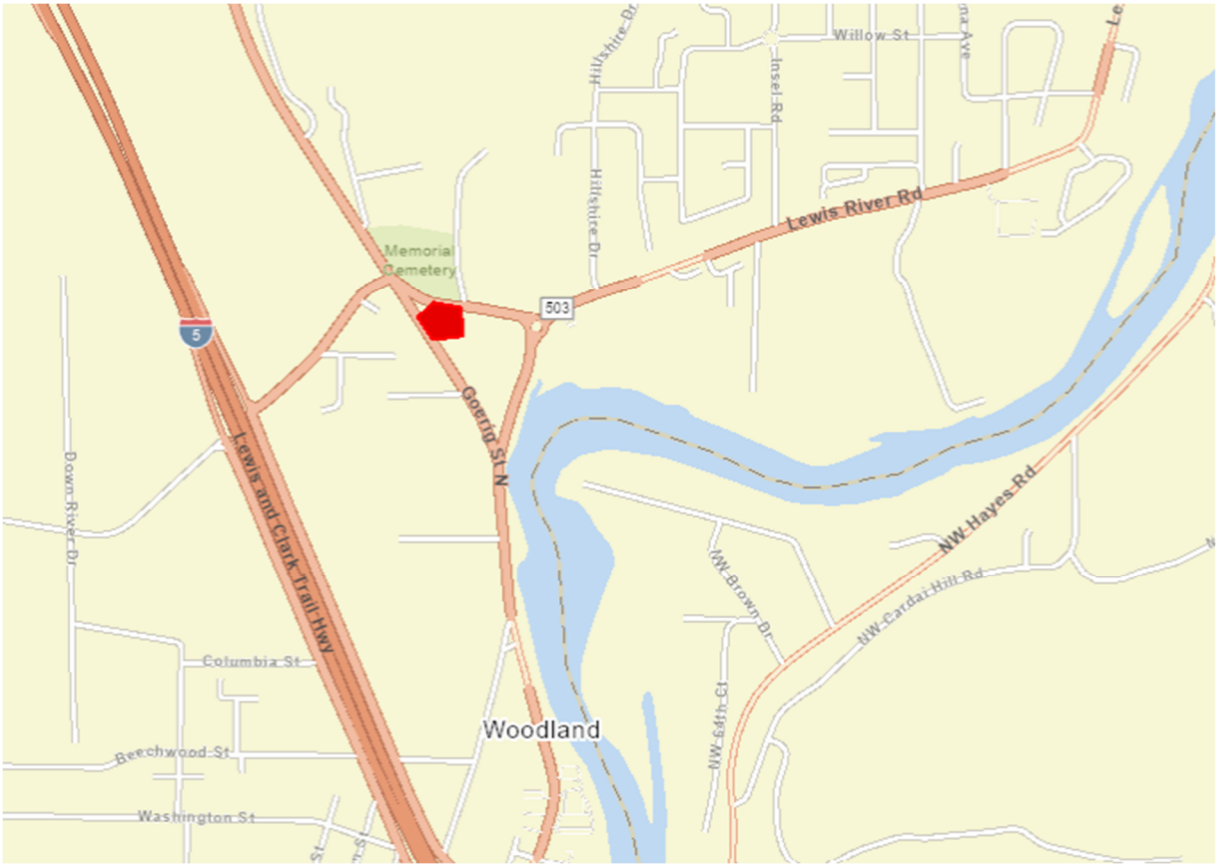
6/24/2022

DAVID G. SPENCER, PE

CIVIL ENGINEER

CONTENTS

A VICINITY MAPS



B PROJECT OVERVIEW

B.1 Site Information

B.1.1 *Site Location*

The project site is comprised of one existing tax lot totaling approximately 0.89 acres located at 1776 N. Goerig St, Woodland, WA 98674. The parcel number is 50630 and is legally described as Section 13, Township 5N, Range 1W, Willamette Meridian. The property is zoned as High Density Residential (HDR).

B.1.2 *Existing Conditions*

Existing conditions include an approximately 4,000 sf shop, a shed, and a gravel driveway. A sea wall extends across most of the site boundary to N. Goerig St. Existing access to site is from Scott Ave.

Table 1: Existing Site Conditions

Description			Location	Approximate Area (sf)	Remarks
Existing Roofs			Southwest corner of site	4,153	
Existing Access Road			Site-wide	5,129	
Impervious Subtotal				**9,282 sf (0.213 ac)**	
Landscaping/Lawn				21,196	
Pervious Subtotal				**29,486 sf (0.677 ac)**	
Project Site Total				**38,768 sf (0.89 ac)**	

B.2 Proposed Development

The project will add two 3-story apartment buildings. Building A will be a 27-unit building consisting of a mix of 1, 2, and 3-bedroom units, and Building B will consist of six 2-bedroom units.

There will be frontage half- street improvements along Scott Ave and N. Goerig St.

B.3 Stormwater Management Overview

This report and the associated stormwater management design applies to areas where right-of-way and onsite improvements are proposed (Project Site). The on-site stormwater is comprised of three catchment areas managed by three infiltration trenches and two stormfilter catch basins. The stormwater within the right-of-way is comprised of two catchment areas managed by two bioretention facilities.

The catchment runoff will be fully managed (treatment and detention) via a combination of infiltration trenches, stormfilters, and bioretention.

B.4 Stormwater Minimum Requirements

The project site is subject to the evaluation of Minimum Requirements (MR) numbers 1 through 9. Table 1 summarizes the proposed project site conditions; Table 2 includes information used to determine applicable stormwater minimum requirements.

Table 2: Post-Developed Project Site Conditions

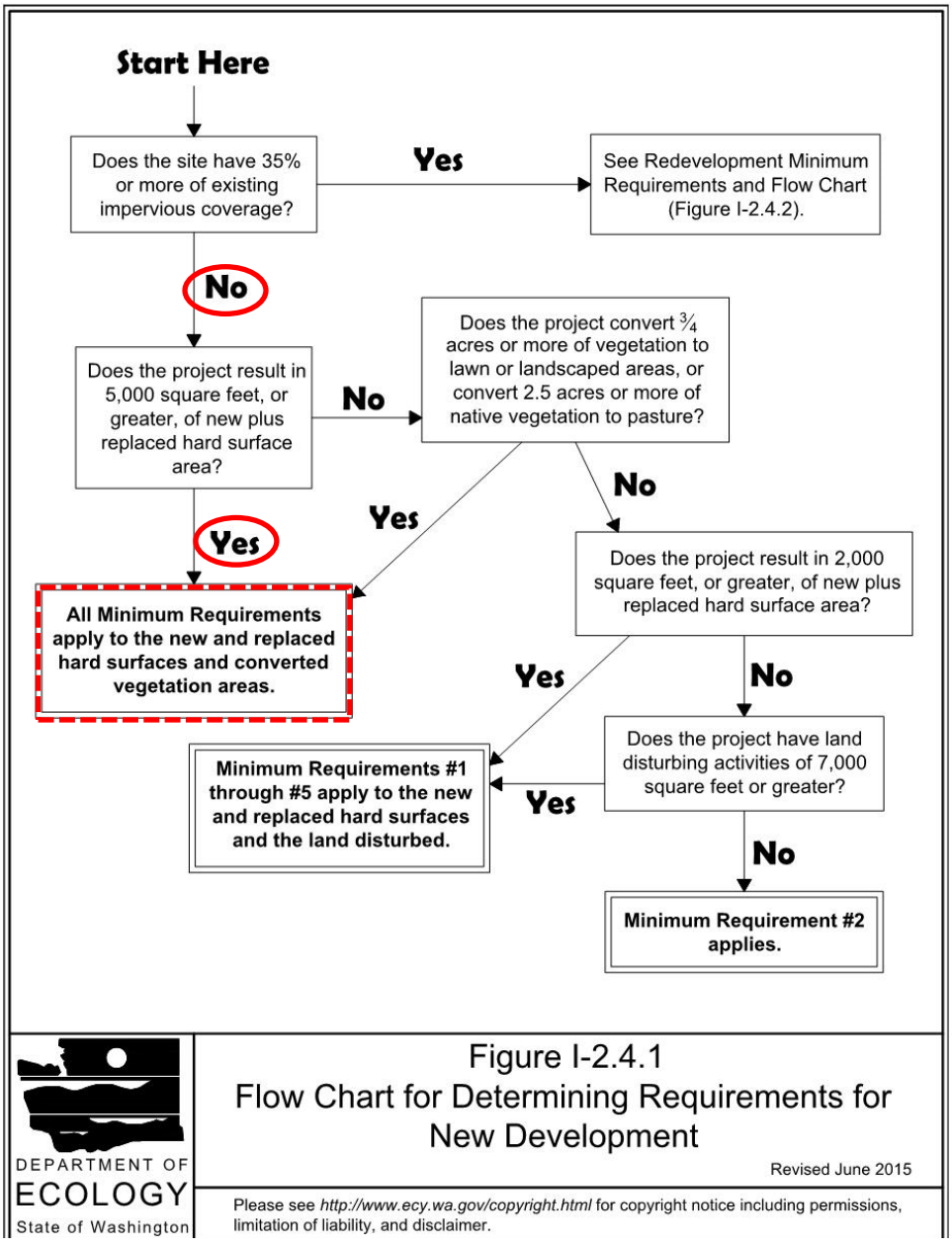
Surface Type	Area (sf)	Remarks
Roofs (Existing + New)	8,000	
Road & Drive Aisle, and Parking Areas	24,307	
Sidewalks	5,244	
Pervious (Perimeter & Interior Landscaping)	12,119	
Impervious Subtotal	**37,551 sf (0.86 ac)**	
Pervious Subtotal	**12,119 sf (0.28 ac)**	
Project Site Total	**49,670 sf (1.14 ac)**	

Table 3: Project Site Parameters Used to Determine Applicable Minimum Requirements

Description	Value	Remarks
Project Site Area	49,670 sf (1.14 ac)	Includes on- and offsite areas where land-disturbing activity is proposed.
Existing Impervious Surface Area	0 sf	Existing impervious surface treated as new surface.
Existing Impervious Surface Coverage	0%	
New Impervious Surface Area	37,551 sf (0.86 ac)	
Replaced Impervious Area	0 sf	
New + Replaced Impervious Area	37,551 sf (0.86 ac)	
Converted Pervious: Native Vegetation Converted to Lawn or Landscape	0 sf	
Converted Pervious: Native Vegetation Converted to Pasture	0 sf	
Pollution-Generating Impervious Surface (PGIS)	24,307 sf	
Non-Pollution Generating Impervious Surface (NPGIS)	13,244 sf	
Pollution-Generating Pervious Surface	0	
Total Pollution-Generating Surface Area	24,307 sf	
Total Area Subject to Land-Disturbing Activities	49,670 sf (1.14 ac)	

Exhibit 1 was used to evaluate applicable minimum requirements based on site parameters.

Exhibit 1: New Development Flow Chart



C STORMWATER MINIMUM REQUIREMENTS

Following is a discussion regarding applicable Minimum Requirements and how each will be addressed.

C.1 MR #1—Preparation of Stormwater Site Plans

The project will add more than 2,000 sf of new impervious surface; therefore, a stormwater site plan following the City guidelines for "Large and Engineered Projects" is required. This Technical Information Report (TIR) along with pertinent drawings, exhibits, and technical documents associated with this project collectively comprise the Stormwater Site Plan.

C.2 MR #2—Construction Stormwater Pollution Prevention

A Construction Stormwater Pollution Prevention Plan (SWPPP) is required and will be submitted in the appendix of this report.

C.3 MR #3—Source Control of Pollution

New development shall comply with the requirements of Volume IV of the Stormwater management Manual for Western Washington (SMMWW). The source control Best Management Practices (BMPs) that may apply to this project are outlined below:

- S407—BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots
- S411—BMPs for Landscaping and Lawn/Vegetation Maintenance
- S417—BMPs for Maintenance of Stormwater Drainage and Treatment Facilities

Additional BMPs may be required depending on the specific activities taking place on site.

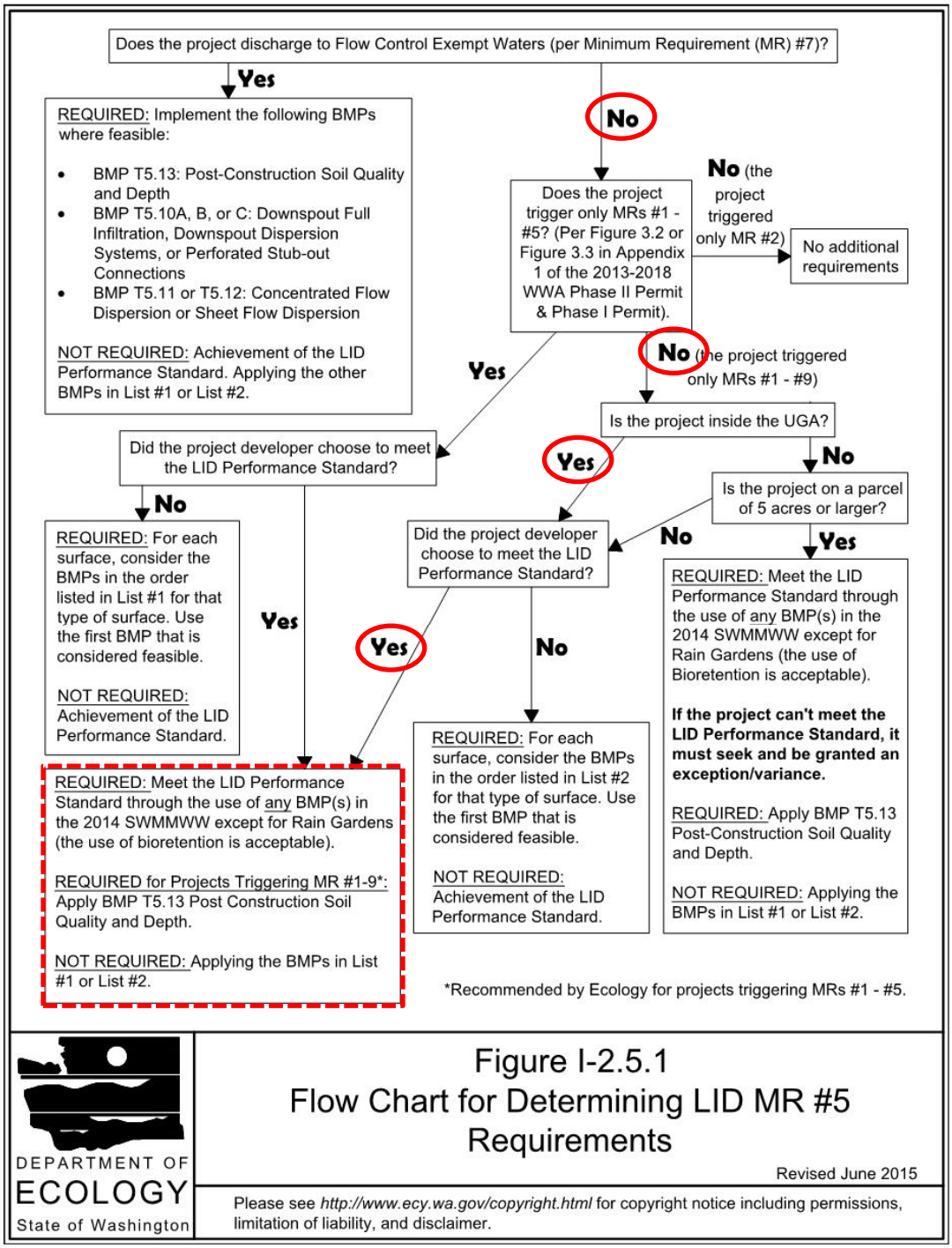
C.4 MR #4—Preservation of Natural Drainage System and Outfalls

Natural drainage patterns will be maintained to the extent practicable. The entire project site generally flows toward the southeast and after development, stormwater will be routed to that same location.

C.5 MR #5—Onsite Stormwater Management BMPs

Because the project will add more than 2,000 sf of new impervious surface, it is subject to MR #5, which requires the use of onsite stormwater management BMPs.

Exhibit 2: Flow Chart for Determining MR #5 Requirements



C.6 MR #6—Runoff Treatment

The project will add more than 5,000 sf of new pollution-generating hard surface area within a threshold discharge area and is therefore subject to MR #6. Runoff from PGIS areas will be treated within the stormfilter catch basins (on-site) and bioretention (off-site). PGIS runoff and runoff from other surfaces that mixes with PGIS runoff will be treated.

C.7 MR #7—Flow Control

More than 10,000 sf of new effective impervious surface is proposed; therefore, the project must comply with MR #7. Infiltration trenches and bioretention will be used to comply with the flow control standard. Infiltration testing was performed, and results used to determine the design infiltration rate for soils. See attached infiltration test results, MGSFlood calculations, and additional details in Appendixes A and B.

C.8 MR #8—Wetlands Protection

The project does not propose any discharge of stormwater directly or indirectly into a wetland; therefore, MR #8 does not apply.

C.9 MR #9—Operation and Maintenance

All stormwater systems will be privately owned, operated, and maintained. Final Operation and Maintenance guidelines are submitted in Appendix C of this report within the SWPPP.

D MGSFLOOD METHODOLOGY

The Washington State Department of Ecology (DOE) requires flow control BMPs be designed using a calibrated continuous simulation hydrologic model based on the Environmental Protection Agency's HSPF (Hydrologic Simulation Program-Fortran) program. DOE has approved three continuous runoff models: Western Washington Hydrology Model (WWHM); KCRTS (King County Runoff Time Series); and MGSFlood, a program used by the Washington State Department of Transportation. JD elected to use MGSFlood because of its faster processing time, particularly with complex hydrologic models. The purpose of this section is to provide an overview of the methodology used to develop the Project Site MGSFlood hydrologic model.

D.1 General Information

The project site is located at 1776 N Goerig St. Based upon coordinates the Mean Annual Precipitation (MAP) was computed as 48.7 inches. The project site is within one threshold discharge area with a single point of compliance (POC).

D.2 Scenario

D.2.1 *Predeveloped*

The Project Site was modeled as a single 1.14-acre flat, forested subbasin (PD-1) with Soil Group (SG) 3 soils. See MGSFlood modeling results in Appendix A.

D.2.2 *Postdeveloped*

The primary objective of the preliminary hydrologic model was to demonstrate postdeveloped stormwater runoff can be feasibly managed. The Project Site was modeled to reflect the postdeveloped condition as accurately as possible. Appendix A contains detailed MGSFlood model parameters (subcatchment areas, storm facility dimensions, etc.) and analysis results. Exhibit 3 illustrates the postdeveloped schematic objects used in the model.

Exhibit 3: Postdeveloped MGSFlood Schematic

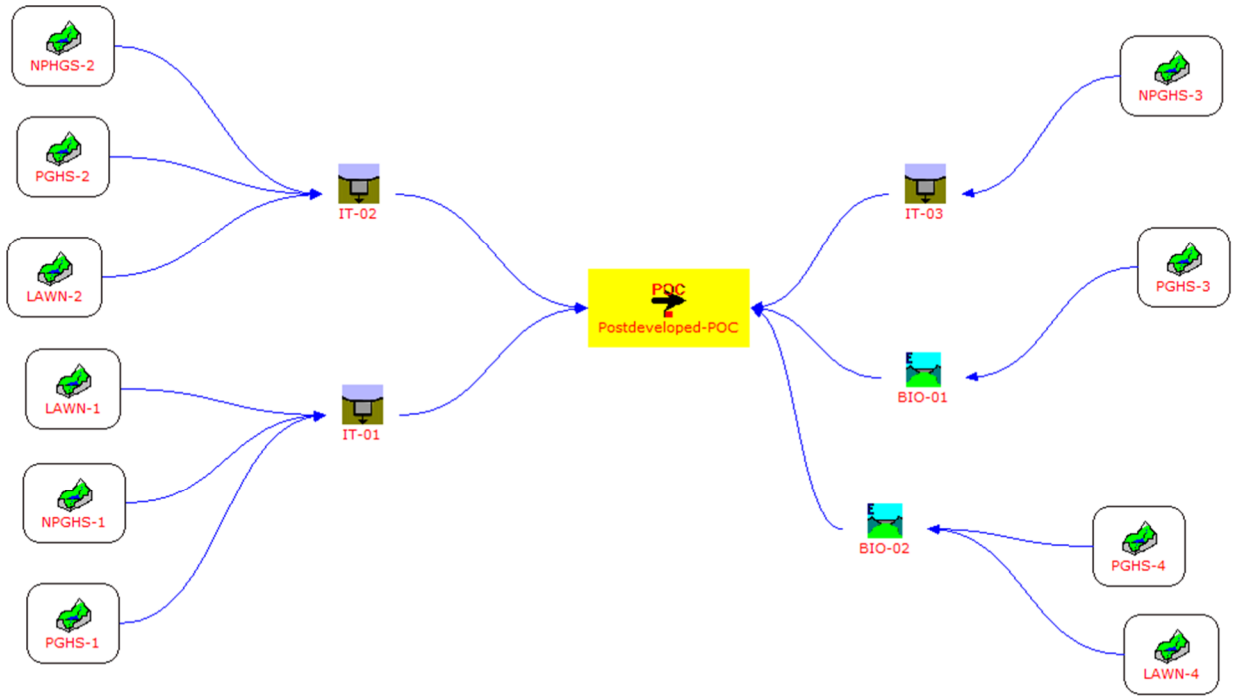


Table 3: WWHM Mitigated Scenario Methodology

Mark	Element Type	Area Modeled/ Managed	Modeled As	Discharge Point	Area (ac)	Remarks
NPGHS-1 On-site	Subbasin	Sidewalk	Impervious Flat	IT-01	0.0664	
NPGHS-2 On-site	Subbasin	Roof, Sidewalk	Impervious Flat	IT-02	0.0396	
NPGHS-3 On-site	Subbasin	Roof	Impervious Flat	IT-03	0.1442	
PGHS-1 On-site	Subbasin	Parking Lot	Pavement/ Flat	IT-01	0.2369	

Mark	Element Type	Area Modeled/ Managed	Modeled As	Discharge Point	Area (ac)	Remarks
PGHS-2 On-site	Subbasin	Parking Lot	Pavement/ Flat	IT-02	0.1383	
PGHS-3 On-site	Subbasin	Scott Ave	Pavement/ Flat	BIO-01	0.1465	
PGHS-4 On-site	Subbasin	Goerig St	Pavement/ Flat	BIO-02	0.1076	
LAWN-1 On-site	Subbasin	Landscape	SG3 Lawn, Flat	IT-01	0.0607	
LAWN-2 On-site	Subbasin	Landscape	SG3 Lawn, Flat	IT-02	0.0622	
LAWN-3 On-site	Subbasin	Landscape	SG3 Lawn, Flat	IT-03	0.0844	
LAWN-4 On-site	Subbasin	Landscape	SG3 Lawn, Flat	BIO-02	0.0455	
				TOTAL AREA REPRESENTED	**1.14**	

FIGURES & DRAWINGS

APPENDIX A

MGSFLOOD RESULTS

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.55
Program License Number: 202010005
Project Simulation Performed on: 05/23/2022 3:48 PM
Report Generation Date: 05/23/2022 3:48 PM

Input File Name: 22046_Analysis.fld
Project Name: GoerigApartments
Analysis Title: 22046_Analysis
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 5

Extended Precipitation Time Series Selected
Climatic Region Number: 26

Full Period of Record Available used for Routing
Precipitation Station : 97004805 Vancouver 48 in_5min 10/01/1939-10/01/2060
Evaporation Station : 971048 Vancouver 48 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 2
HSPF Parameter Region Name : Clark County

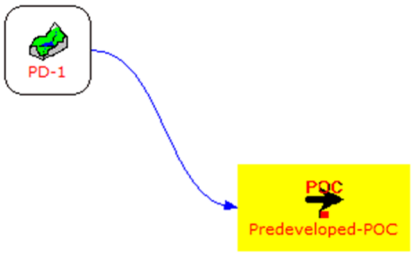
********** Default HSPF Parameters Used (Not Modified by User) **********

********** WATERSHED DEFINITION **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	1.140	1.131
Area of Links that Include Precip/Evap (acres)	0.000	0.009
Total (acres)	1.140	1.140

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1



---------- Subbasin : PD-1 ----------

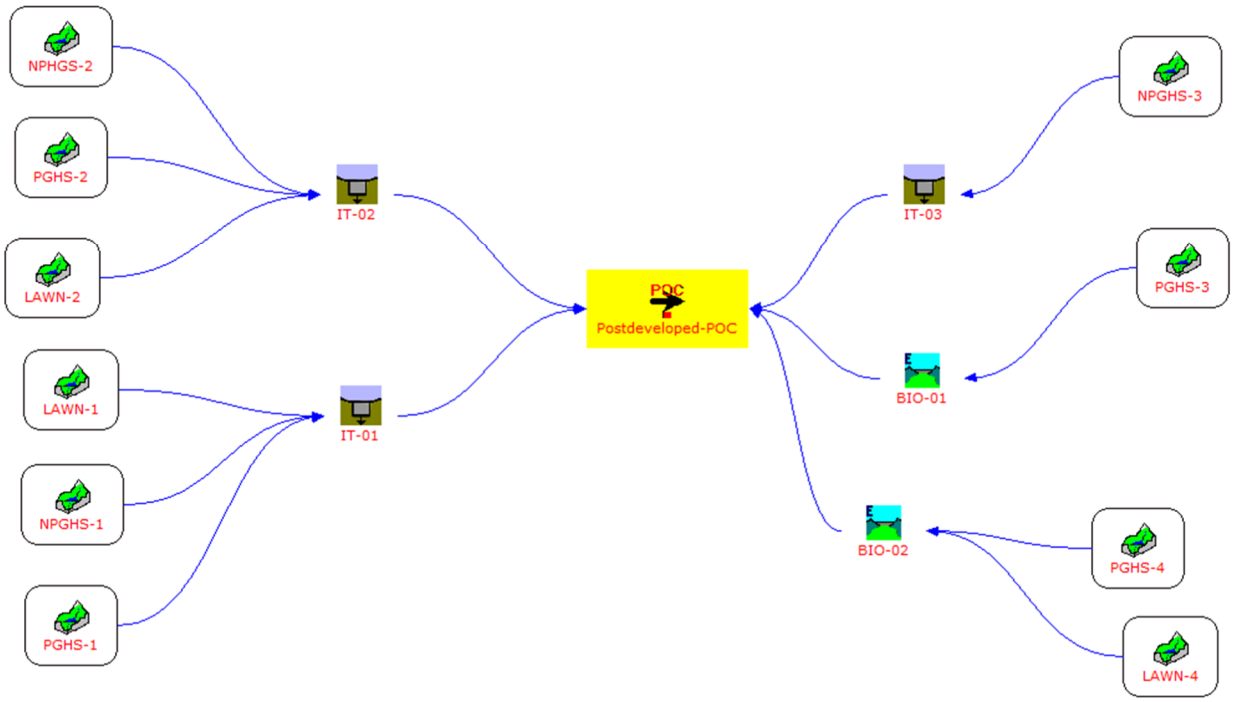
-------Area (Acres) --------

Clark Co. SG3, Forest 1.140

Subbasin Total 1.140

----------SCENARIO: POSTDEVELOPED

Number of Subbasins: 11



---------- Subbasin : PGHS-1 ----------

-------Area (Acres) --------

Impervious Flat 0.237

Subbasin Total 0.237

---------- Subbasin : NPGHS-1 ----------

-------Area (Acres) --------

Impervious Flat 0.066

Subbasin Total 0.066

---------- Subbasin : PGHS-2 ----------

	-------Area (Acres) --------
Impervious Flat	0.138
Subbasin Total	0.138

---------- Subbasin : NPHGS-2 ----------

	-------Area (Acres) --------
Impervious Flat	0.038
Subbasin Total	0.038

---------- Subbasin : NPGHS-3 ----------

	-------Area (Acres) --------
Impervious Flat	0.141
Subbasin Total	0.141

---------- Subbasin : LAWN-1 ----------

	-------Area (Acres) --------
Clark Co. SG3, Lawn,	0.061
Subbasin Total	0.061

---------- Subbasin : LAWN-2 ----------

	-------Area (Acres) --------
Clark Co. SG3, Lawn,	0.062
Subbasin Total	0.062

---------- Subbasin : PGHS-3 ----------

	-------Area (Acres) --------
Impervious Flat	0.147
Subbasin Total	0.147

---------- Subbasin : PGHS-4 ----------

	-------Area (Acres) --------
Impervious Flat	0.108
Subbasin Total	0.108

---------- Subbasin : LAWN-4 ----------

	-------Area (Acres) --------
Clark Co. SG3, Lawn,	0.046
Subbasin Total	0.046

---------- Subbasin : LAWN-3 ----------

	-------Area (Acres) --------
Clark Co. SG3, Lawn,	0.087
Subbasin Total	0.087

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 1

Link Name: Predeveloped-POC
Link Type: Copy
Downstream Link: None

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 6

Link Name: Postdeveloped-POC
Link Type: Copy
Downstream Link: None

Link Name: IT-01
Link Type: Infiltration Trench
Downstream Link Name: Postdeveloped-POC

Trench Type	:	Trench at Toe of Embankment
Trench Length (ft)	:	45.00
Trench Width (ft)	:	5.00
Trench Depth (ft)	:	3.00
Trench Bottom Elev (ft)	:	100.00
Trench Rockfill Porosity (%)	:	30.00

Constant Infiltration Option Used
Infiltration Rate (in/hr): 20.00

Link Name: IT-02
Link Type: Infiltration Trench
Downstream Link Name: Postdeveloped-POC

Trench Type	:	Trench at Toe of Embankment

Trench Length (ft) : 27.00
Trench Width (ft) : 5.00
Trench Depth (ft) : 3.00
Trench Bottom Elev (ft) : 100.00
Trench Rockfill Porosity (%) : 30.00

Constant Infiltration Option Used
Infiltration Rate (in/hr): 20.00

Link Name: IT-03
Link Type: Infiltration Trench
Downstream Link Name: Postdeveloped-POC

Trench Type : Trench at Toe of Embankment
Trench Length (ft) : 30.00
Trench Width (ft) : 3.00
Trench Depth (ft) : 3.00
Trench Bottom Elev (ft) : 100.00
Trench Rockfill Porosity (%) : 30.00

Constant Infiltration Option Used
Infiltration Rate (in/hr): 20.00

Link Name: BIO-01
Link Type: Ecology Bioretention Facility
Downstream Link Name: Postdeveloped-POC

Floor Elevation (ft) : 100.00
Riser Crest Elevation (ft) : 100.50
Storage Depth (ft) : 0.50
Bottom Length (ft) : 65.0
Bottom Width (ft) : 3.0
Bottom Slope (ft/ft) : 0.000
Side Slopes (ft/ft) : L1= 0.00 L2= 0.00 W1= 0.00 W2= 0.00
Bottom Area (sq-ft) : 195.
Area at Riser Crest El (sq-ft) : 195.
(acres) : 0.004
Volume at Riser Crest (cu-ft) : 98.
(ac-ft) : 0.002

Infiltration on Bottom and Sideslopes Selected

Soil Properties

Layer No	Soil Name	Thickness (ft)
1	ASTM 100	0.250
2	SMMWW 12 in/hr (Ecol	1.500
3	GRAVEL	2.000

KSat Safety Factor: None
Native Soil Infiltration Rate (in/hr) : 20.00

Underdrain Not Present

Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 6.00
Common Length (ft) : 0.000
Riser Crest Elevation : 100.50 ft

Hydraulic Structure Geometry

Number of Devices: 0

Link Name: BIO-02
Link Type: Ecology Bioretention Facility
Downstream Link Name: Postdeveloped-POC

Floor Elevation (ft) : 100.00
Riser Crest Elevation (ft) : 100.50
Storage Depth (ft) : 0.50
Bottom Length (ft) : 65.0
Bottom Width (ft) : 3.0
Bottom Slope (ft/ft) : 0.000
Side Slopes (ft/ft) : L1= 0.00 L2= 0.00 W1= 0.00 W2= 0.00
Bottom Area (sq-ft) : 195.
Area at Riser Crest El (sq-ft) : 195.
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Volume at Riser Crest (cu-ft) : 98.
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KSat Safety Factor: None
Native Soil Infiltration Rate (in/hr) : 20.00

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Riser Geometry
Riser Structure Type : Circular
Riser Diameter (in) : 6.00
Common Length (ft) : 0.000
Riser Crest Elevation : 100.50 ft

Hydraulic Structure Geometry

Number of Devices: 0

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 1

********** **Subbasin: PD-1** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	3.762E-02
5-Year	6.314E-02
10-Year	9.605E-02
25-Year	0.144
50-Year	0.178
100-Year	0.235
200-Year	0.339
500-Year	0.477

********** Link: Predeveloped-POC ********** Link Inflow
Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	3.762E-02
5-Year	6.314E-02
10-Year	9.605E-02
25-Year	0.144
50-Year	0.178
100-Year	0.235
200-Year	0.339
500-Year	0.477

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 11
Number of Links: 6

********** **Subbasin: PGHS-1** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.127
5-Year	0.178
10-Year	0.202
25-Year	0.248
50-Year	0.330
100-Year	0.376
200-Year	0.407
500-Year	0.448

********** **Subbasin: NPGHS-1** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	3.550E-02
5-Year	4.981E-02
10-Year	5.658E-02
25-Year	6.951E-02
50-Year	9.243E-02
100-Year	0.105
200-Year	0.114
500-Year	0.125

********** **Subbasin: PGHS-2** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	7.395E-02
5-Year	0.104
10-Year	0.118
25-Year	0.145
50-Year	0.193
100-Year	0.219
200-Year	0.237
500-Year	0.261

********** **Subbasin: NPHGS-2** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	2.037E-02
5-Year	2.858E-02
10-Year	3.246E-02
25-Year	3.989E-02
50-Year	5.303E-02
100-Year	6.041E-02
200-Year	6.540E-02
500-Year	7.201E-02

********** **Subbasin: NPGHS-3** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)

2-Year	7.561E-02
5-Year	0.106
10-Year	0.120
25-Year	0.148
50-Year	0.197
100-Year	0.224
200-Year	0.243
500-Year	0.267

********** **Subbasin: LAWN-1** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	5.500E-03
5-Year	1.134E-02
10-Year	1.474E-02
25-Year	1.938E-02
50-Year	2.591E-02
100-Year	2.865E-02
200-Year	3.218E-02
500-Year	3.685E-02

********** **Subbasin: LAWN-2** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	5.654E-03
5-Year	1.166E-02
10-Year	1.515E-02
25-Year	1.993E-02
50-Year	2.664E-02
100-Year	2.945E-02
200-Year	3.308E-02
500-Year	3.789E-02

********** **Subbasin: PGHS-3** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	7.833E-02
5-Year	0.110
10-Year	0.125
25-Year	0.153
50-Year	0.204
100-Year	0.232
200-Year	0.251
500-Year	0.277

********** **Subbasin: PGHS-4** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	5.753E-02
5-Year	8.071E-02
10-Year	9.168E-02
25-Year	0.113
50-Year	0.150
100-Year	0.171
200-Year	0.185
500-Year	0.203

********** **Subbasin: LAWN-4** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	4.122E-03
5-Year	8.501E-03
10-Year	1.105E-02
25-Year	1.453E-02
50-Year	1.942E-02
100-Year	2.147E-02
200-Year	2.412E-02
500-Year	2.763E-02

********** **Subbasin: LAWN-3** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	7.901E-03
5-Year	1.629E-02
10-Year	2.117E-02
25-Year	2.785E-02
50-Year	3.722E-02
100-Year	4.115E-02
200-Year	4.623E-02
500-Year	5.294E-02

********** Link: Postdeveloped-POC ********** Link Inflow Frequency Stats

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)

2-Year	9.526E-06
5-Year	2.099E-05
10-Year	3.051E-05
25-Year	4.128E-05
50-Year	6.187E-02
100-Year	0.266
200-Year	0.289
500-Year	0.318

********** Link: IT-01 ********** Link Inflow Frequency Stats

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.169
5-Year	0.234
10-Year	0.263
25-Year	0.342
50-Year	0.424
100-Year	0.495
200-Year	0.523
500-Year	0.560

********** Link: IT-01 ********** Link Outflow 1 Frequency Stats

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	2.652E-06
5-Year	5.856E-06
10-Year	8.378E-06
25-Year	1.179E-05
50-Year	1.176E-02
100-Year	0.109
200-Year	0.119
500-Year	0.133

********** Link: IT-02 ********** Link Inflow Frequency Stats

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.101
5-Year	0.137
10-Year	0.158
25-Year	0.202
50-Year	0.248
100-Year	0.295
200-Year	0.305

500-Year	0.319

********** Link: IT-02 ********** Link Outflow 1 Frequency Stats

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	2.444E-06
5-Year	5.700E-06
10-Year	8.275E-06
25-Year	1.103E-05
50-Year	5.561E-03
100-Year	5.322E-02
200-Year	6.273E-02
500-Year	7.530E-02

********** Link: IT-03 ********** Link Inflow Frequency Stats

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	8.221E-02
5-Year	0.115
10-Year	0.137
25-Year	0.168
50-Year	0.202
100-Year	0.245
200-Year	0.246
500-Year	0.248

********** Link: IT-03 ********** Link Outflow 1 Frequency Stats

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	4.075E-06
5-Year	6.683E-06
10-Year	1.012E-05
25-Year	1.209E-05
50-Year	3.818E-02
100-Year	5.872E-02
200-Year	9.279E-02
500-Year	0.138

********** Link: BIO-01 ********** Link Inflow Frequency Stats

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	7.833E-02
5-Year	0.110
10-Year	0.125
25-Year	0.153
50-Year	0.204
100-Year	0.232
200-Year	0.251
500-Year	0.277

********** Link: BIO-01 ********** Link Outflow 1

Frequency Stats

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	5.134E-07
5-Year	1.713E-06
10-Year	2.488E-06
25-Year	3.682E-06
50-Year	2.213E-02
100-Year	6.225E-02
200-Year	0.103
500-Year	0.157

********** Link: BIO-01 ********** Link WSEL Stats

WSEL Frequency Data(ft)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	WSEL Peak (ft)
1.05-Year	100.009
1.11-Year	100.010
1.25-Year	100.011
2.00-Year	100.051
3.33-Year	100.115
5-Year	100.171
10-Year	100.249
25-Year	100.368
50-Year	100.525
100-Year	100.551

********** Link: BIO-02 ********** Link Inflow Frequency Stats

Flood Frequency Data(cfs)

(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	6.225E-02

5-Year	8.480E-02
10-Year	9.834E-02
25-Year	0.124
50-Year	0.151
100-Year	0.181
200-Year	0.187
500-Year	0.193

********** Link: BIO-02 ********** Link Outflow 1
Frequency Stats
Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	1.222E-07
5-Year	5.928E-07
10-Year	1.326E-06
25-Year	2.294E-06
50-Year	3.111E-06
100-Year	4.170E-06
200-Year	4.372E-06
500-Year	4.640E-06

********** Link: BIO-02 ********** Link WSEL
Stats
WSEL Frequency Data(ft)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	WSEL Peak (ft)
1.05-Year	100.007
1.11-Year	100.007
1.25-Year	100.009
2.00-Year	100.012
3.33-Year	100.036
5-Year	100.059
10-Year	100.133
25-Year	100.229
50-Year	100.311
100-Year	100.417

************Groundwater Recharge Summary **************
Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Model Element	Total Predeveloped Recharge During Simulation Recharge Amount (ac-ft)
Subbasin: PD-1	190.326
Link: Predeveloped-POC	0.000
Total:	190.326

Total Post Developed Recharge During Simulation

Model Element		Recharge Amount (ac-ft)
Subbasin: PGHS-1		0.000
Subbasin: NPGHS-1		0.000
Subbasin: PGHS-2		0.000
Subbasin: NPHGS-2		0.000
Subbasin: NPGHS-3		0.000
Subbasin: LAWN-1		8.917
Subbasin: LAWN-2		9.166
Subbasin: PGHS-3		0.000
Subbasin: PGHS-4		0.000
Subbasin: LAWN-4		6.684
Subbasin: LAWN-3		12.809
Link:	Postdeveloped-POC	0.000
Link:	IT-01	139.303
Link:	IT-02	85.531
Link:	IT-03	74.752
Link:	BIO-01	62.689
Link:	BIO-02	53.633
Total:		453.485

Total Predevelopment Recharge is Less than Post Developed
Average Recharge Per Year, (Number of Years= 121)
Predeveloped: 1.573 ac-ft/year, Post Developed: 3.748 ac-ft/year

*************Water Quality Facility Data ***************

----------SCENARIO: PREDEVELOPED

Number of Links: 1

********** Link: Predeveloped-POC **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 103.89
Inflow Volume Including PPT-Evap (ac-ft): 103.89
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 103.89
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

----------SCENARIO: POSTDEVELOPED

Number of Links: 6

********** Link: Postdeveloped-POC **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 0.01

Inflow Volume Including PPT-Evap (ac-ft): 0.01
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 0.01
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 0.00%

********** Link: IT-01 **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 139.30
Inflow Volume Including PPT-Evap (ac-ft): 139.30
Total Runoff Infiltrated (ac-ft): 139.30, 100.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 0.00
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 100.00%

********** Link: IT-02 **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 85.53
Inflow Volume Including PPT-Evap (ac-ft): 85.53
Total Runoff Infiltrated (ac-ft): 85.53, 100.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 0.00
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 100.00%

********** Link: IT-03 **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 74.75
Inflow Volume Including PPT-Evap (ac-ft): 74.75
Total Runoff Infiltrated (ac-ft): 74.75, 100.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 0.00
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 100.00%

********** Link: BIO-01 **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 62.40
Inflow Volume Including PPT-Evap (ac-ft): 62.69
Total Runoff Infiltrated (ac-ft): 62.69, 100.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 0.00
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 100.00%

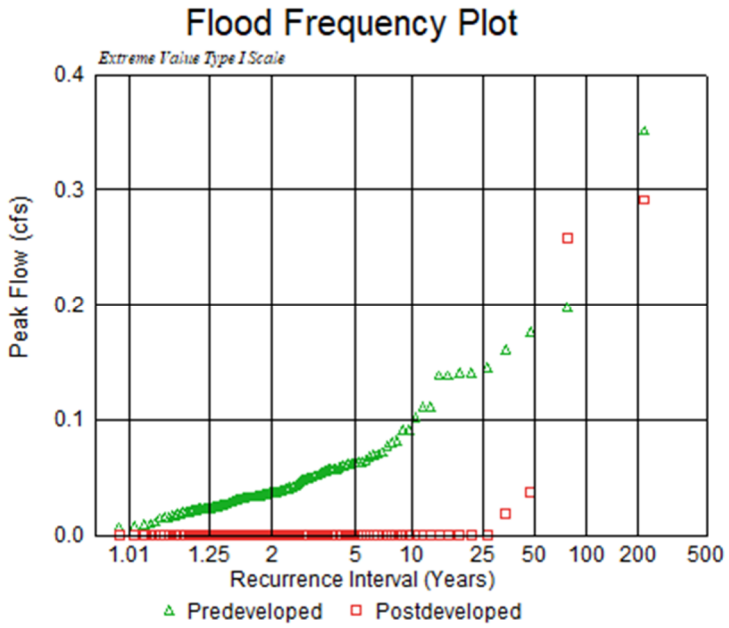
********** Link: BIO-02 **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 53.41
Inflow Volume Including PPT-Evap (ac-ft): 53.63
Total Runoff Infiltrated (ac-ft): 53.63, 100.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 0.00
Secondary Outflow To Downstream System (ac-ft): 0.00
Volume Lost to ET (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered+ET)/Total Volume: 100.00%

**********Compliance Point Results **********

Scenario Predeveloped Compliance Link: Predeveloped-POC
Scenario Postdeveloped Compliance Link: Postdeveloped-POC

*** Point of Compliance Flow Frequency Data ***

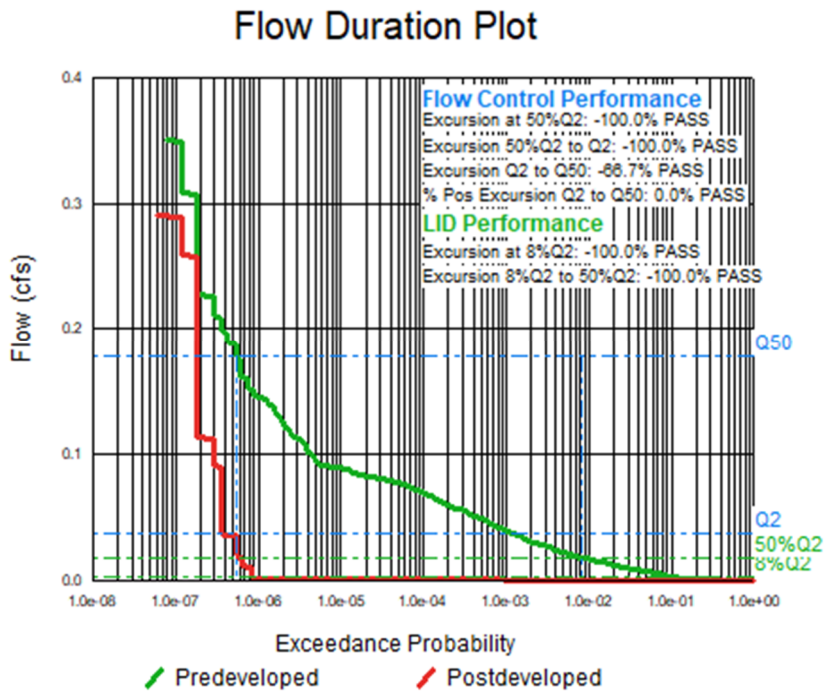


Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	3.762E-02	2-Year	0.000
5-Year	6.314E-02	5-Year	0.000
10-Year	9.605E-02	10-Year	0.000
25-Year	0.144	25-Year	0.000
50-Year	0.178	50-Year	6.187E-02
100-Year	0.235	100-Year	0.266
200-Year	0.339	200-Year	0.289
500-Year	0.477	500-Year	0.318

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

****** Flow Duration Performance ******



Excursion at Predeveloped 50%Q2 (Must be Less Than or Equal to 0%):	-100.0%	PASS
Maximum Excursion from 50%Q2 to Q2 (Must be Less Than or Equal to 0%):	-100.0%	PASS
Maximum Excursion from Q2 to Q50 (Must be less than 10%):	-66.7%	PASS
Percent Excursion from Q2 to Q50 (Must be less than 50%):	0.0%	PASS

MEETS ALL FLOW DURATION DESIGN CRITERIA: PASS

****** LID Duration Performance ******

Excursion at Predeveloped 8%Q2 (Must be Less Than 0%):	-100.0%	PASS
Maximum Excursion from 8%Q2 to 50%Q2 (Must be Less Than 0%):	-100.0%	PASS

MEETS ALL LID DURATION DESIGN CRITERIA: PASS

APPENDIX B

INFILTRATION TEST RESULTS

INFILTRATION TEST DATA SHEET

Project Information

Project Name:	Goerig Apartments	***Project No.:***	22046
Project Address:	1776 N Goerig Street, Woodland, WA 98674		
Test Hole No.:	IT-01	***Tested By:***	DDH
Test Depth:	6 in	***Date:***	5/17/2022
Depth to Groundwater:	>10 ft	***Weather:***	Sunny, 59°

Calculations

Parameters

Parameter	Description	Equation	Value
L	Length of Flow/Embedment Depth (in)	n/a	6
t	Elapsed Drawdown Time (hr)	Stop Time - Start Time	Varies
k_T	Tested Coefficient of Permeability (in/hr)	$k_T=(L/t)*\ln(h_i/h_f)$	Varies
k_{AVG}	Avg. Tested Coefficient of Permeability (in/hr)	$k_{AVG}=k_{T1+T2+...Tn}$/No. of Trials	3.06
CF	Correction Factor		2
k_{DES}	Design Coefficient of Permeability (in/hr)	$k_{DES}=k_{AVG}/CF_{TOT}$	1.53

Notes:

Field Data

Trial No.	Start Time	Stop Time	Elapsed Drawdown Time, t (hr)	Initial Depth to Water (in)	Final Depth to Water (in)	Initial Head, h_i (in)	Final Head, h_f (in)	k_T (in/hr)
1	8:48 AM	9:48 AM	1.00	0.00	6.00	15.00	9.00	3.06
2	9:48 AM	10:48 AM	1.00	0.00	6.00	15.00	9.00	3.06
3	10:48 AM	11:48 AM	1.00	0.00	6.00	15.00	9.00	3.06

INFILTRATION TEST DATA SHEET

Project Information

Project Name:	Goerig Apartments	***Project No.:***	22046
Project Address:	1776 N Goerig Street, Woodland, WA 98674		
Test Hole No.:	IT-02	***Tested By:***	DDH
Test Depth:	5 ft	***Date:***	5/17/2022
Depth to Groundwater:	>10 ft	***Weather:***	Sunny, 59°

Calculations

Parameters

Parameter	Description	Equation	Value
L	Length of Flow/Embedment Depth (in)	n/a	6
t	Elapsed Drawdown Time (hr)	Stop Time - Start Time	Varies
k_T	Tested Coefficient of Permeability (in/hr)	$k_T=(L/t)*\ln(h_i/h_f)$	Varies
k_{AVG}	Avg. Tested Coefficient of Permeability (in/hr)	$k_{AVG}=k_{T1+T2+...Tn}$/No. of Trials	91.95
CF	Correction Factor		2
k_{DES}	Design Coefficient of Permeability (in/hr)	$k_{DES}=k_{AVG}/CF_{TOT}$	45.97

Notes:

Field Data

Trial No.	Start Time	Stop Time	Elapsed Drawdown Time, t (hr)	Initial Depth to Water (in)	Final Depth to Water (in)	Initial Head, h_i (in)	Final Head, h_f (in)	k_T (in/hr)
1	10:31 AM	10:33 AM	0.03	0.00	6.00	15.00	9.00	91.95
2	10:33 AM	10:35 AM	0.03	0.00	6.00	15.00	9.00	91.95
3	10:35 AM	10:37 AM	0.03	0.00	6.00	15.00	9.00	91.95

INFILTRATION TEST DATA SHEET

Project Information

Project Name:	Goerig Apartments	***Project No.:***	22046
Project Address:	1776 N Goerig Street, Woodland, WA 98674		
Test Hole No.:	IT-03	***Tested By:***	DDH
Test Depth:	6 ft	***Date:***	5/17/2022
Depth to Groundwater:	>10 ft	***Weather:***	Sunny, 59°

Calculations

Parameters

Parameter	Description	Equation	Value
L	Length of Flow/Embedment Depth (in)	n/a	6
t	Elapsed Drawdown Time (hr)	Stop Time - Start Time	Varies
k_T	Tested Coefficient of Permeability (in/hr)	$k_T=(L/t)*\ln(h_i/h_f)$	Varies
k_{AVG}	Avg. Tested Coefficient of Permeability (in/hr)	$k_{AVG}=k_{T1+T2+...Tn}$/No. of Trials	91.95
CF	Correction Factor		2
k_{DES}	Design Coefficient of Permeability (in/hr)	$k_{DES}=k_{AVG}/CF_{TOT}$	45.97

Notes:

Field Data

Trial No.	Start Time	Stop Time	Elapsed Drawdown Time, t (hr)	Initial Depth to Water (in)	Final Depth to Water (in)	Initial Head, h_i (in)	Final Head, h_f (in)	k_T (in/hr)
1	10:50 AM	10:52 AM	0.03	0.00	6.00	15.00	9.00	91.95
2	10:52 AM	10:54 AM	0.03	0.00	6.00	15.00	9.00	91.95
3	10:54 AM	10:56 AM	0.03	0.00	6.00	15.00	9.00	91.95

APPENDIX C

SWPPP

Construction Stormwater General Permit (CSWGP)

Stormwater Pollution Prevention Plan (SWPPP)

for

Goerig Apartments

Prepared for:

Department of Ecology

Southwest Regional Office

Permittee / Owner	Developer	Operator / Contractor
Goerig St, LLC	Goerig St, LLC	TBD

Located at: 1776 N. Goerig St, Woodland, WA 98674

Parcel No. 50630

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
TBD	TBD	TBD

SWPPP Prepared By

Name	Organization	Contact Phone Number
David G. Spencer	Jolma Design, LLC	(306) 723-0392

SWPPP Preparation Date

May 31st, 2022

Project Construction Dates

Activity / Phase	Start Date	End Date
Sitework Construction	9/1/2022	9/1/2023

List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO_2	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
su	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
VFO	Vancouver Field Office of the Department of Ecology
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

Project Information (1.0)

Project/Site Name: Goerig Apartments
Street/Location: 1776 N. Goerig St
City: Woodland State:WA Zip code: 98674
Subdivision: N/A
Receiving waterbody: N/A: Stormwater runoff will be managed on site via infiltration

Existing Conditions (1.1)

Total acreage (including support activities such as off-site equipment staging yards, material storage areas, borrow areas).

Total acreage: 1.14 ac+/-

Disturbed acreage: 1.14 ac+/-

Existing structures: Existing shop and shed

Landscape topography: Rolling slopes trending toward southeast corner of site

Drainage patterns: Majority of stormwater likely infiltrates into near-surface soils, runoff from the site could migrate south and east to the neighboring property.

Existing Vegetation: Primarily field grasses, trees, and herbaceous ground cover

Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes): None known.

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: None known in the area of the site.

Table 1 includes a list of suspected and/or known contaminants associated with the construction activity.

Table 1 – Summary of Site Pollutant Constituents

Constituent (Pollutant)	Location	Depth	Concentration
None	N/A	N/A	N/A

Proposed Construction Activities (1.2)

Description of site development (example: subdivision):
This project proposes to construct two 3-story apartment buildings totaling 7,816 sf and parking, walkways, landscape, etc.

Description of construction activities (example: site preparation, demolition, excavation):
Site preparation, site stripping, earthwork, utilities, stormwater, building and parking lot construction.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:
Minimal flow from adjacent properties. Site will minimize flow to adjacent properties. See erosion control plan.

Description of final stabilization (example: extent of revegetation, paving, landscaping):
Site will be stabilized by construction of buildings, parking lot and stabilized landscaping.

Contaminated Site Information:
Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):
N/A - No known contaminated soils or groundwater.

Construction Stormwater Best Management Practices (BMPs) (2.0)

The SWPPP is a living document reflecting current conditions and changes throughout the life of the project. These changes may be informal (i.e. hand-written notes and deletions). Update the SWPPP when the CESCL has noted a deficiency in BMPs or deviation from original design.

The 13 Elements (2.1)

Element 1: Preserve Vegetation / Mark Clearing Limits (2.1.1)

List and describe BMPs: To the extent possible, areas where grading is proposed shall be kept vegetated until activity in those areas begins. No grading will occur within two feet of the existing property boundary where it borders private property.

Installation Schedules: Grading limits shall be marked with silt fence prior to the start of construction.

Inspection and Maintenance plan: Inspect silt fence regularly to make sure it has not been removed or damaged. If silt fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

Responsible Staff: TBD

Element 2: Establish Construction Access (2.1.2)

List and describe BMPs: : A stabilized construction entrance shall be installed in accordance with City of Woodland standard detail E-05 at the new shared driveway entrance onto Scott Ave. Vehicles entering or exiting the site shall use this entrance to prevent tracking sediment onto the adjacent asphalt pavement.

Installation Schedules: The stabilized construction entrance/exit shall be installed prior to the start of major grading activities.

Inspection and Maintenance plan: Quarry spalls shall be added if the pad is no longer in accordance with the specifications.

- 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 replacement/cleaning of the existing quarry spalls, street sweeping, an increase in the dimensions of the entrance, or the installation of a wheel wash.
- 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 high efficiency 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 to contain the wash water shall be considered. The sediment would then be washed into the sump where it can be controlled.

- Perform street sweeping by hand or with a high efficiency sweeper. Do not use a non-high efficiency mechanical sweeper because this creates dust and throws soils into storm systems or conveyance ditches.
- Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.
- If vehicles are entering or exiting the site at points other than the construction entrance(s), fencing (BMP C103) shall be installed to control traffic.

Upon project completion and site stabilization, all construction accesses intended as permanent access for maintenance shall be permanently stabilized.

Responsible Staff: TBD

Element 3: Control Flow Rates (2.1.3)

Will you construct stormwater retention and/or detention facilities?
☐ Yes ☒ No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?
☐ Yes ☒ No

List and describe BMPs: Offsite runoff is not expected to occur during construction; therefore, no specific BMPs are currently proposed. In the unexpected event runoff does leave the site, the contractor will install the necessary BMPs using standard methods (e.g., wattles, temporary sediment pond) and/or materials on hand to control flow rates. Silt fence (see BMP C233 below) will be installed to prevent coarse sediment migration off site, and will also help mitigate flow rates if offsite runoff occurs.

Installation Schedules: Immediately after runoff from the site is observed.

Inspection and Maintenance plan: Follow the applicable maintenance and inspection guidelines contained in Volume II of the Stormwater Management Manual for Western Washington.

Responsible Staff: TBD

Element 4: Install Sediment Controls (2.1.4)

List and describe BMPs: Silt fence will be installed along the entire perimeter of the Project Site, except at the construction entrancef.

Installation Schedules: Silt fence shall be installed prior to the start of site grading activities.

Inspection and Maintenance plan: Repair any damage immediately.

- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment pond.

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.

Responsible Staff: TBD

Element 5: Stabilize Soils (2.1.5)

West of the Cascade Mountains Crest

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	May 1 – September 30	7 days
During the Wet Season	October 1 – April 30	2 days

Soils must be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast.

Anticipated project dates: Start date: 9/1/2022 End date: 9/1/2023

Will you construct during the wet season?
☒ Yes ☐ No

BMP C120: Temporary and Permanent Seeding

List and describe BMPs: The following areas shall be seeded during construction:

- Disturbed areas that have reached final grade and are not surfaced with asphalt, concrete, gravel, or landscape plantings within 30 days after being worked
- Disturbed areas that will remain unworked for more than 30 days

Installation Schedules: Optimum seeding windows for western Washington are April 1 through June 30, and September 1 through October 1.

- Between July 1 and August 30, seeding requires irrigation until 75 percent grass cover is established.
- Between October 1 and March 30 seeding requires a cover of mulch with straw or an erosion control blanket until 75 percent grass cover is established.

- Review all disturbed areas in late August to early September and complete all seeding by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.
- Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See BMP C121: Mulching for specifications.

Seed and mulch all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions or geotextiles) which will prevent erosion.

Inspection and Maintenance plan:

- Reseed any seeded areas that fail to establish at least 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows). If reseeding is ineffective, use an alternate method such as sodding, mulching, or nets/blankets. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the local authority when sensitive areas would otherwise be protected.
- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. Reseed and protect by mulch any eroded area.
- Supply seeded areas with adequate moisture, but do not water to the extent that it generates runoff.

Responsible Staff: TBD

BMP C121: Mulching

Description: Mulching provides immediate temporary erosion protection, and enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. Mulch should be used on disturbed areas requiring cover for less than 30 days, and for all times for seeded areas.

Installation Schedules: As needed for immediate temporary erosion protection, and when seeding is applied.

Inspection and Maintenance plan:

- The thickness of the cover must be maintained.
- Any areas that experience erosion shall be remulched and/or protected with a net or blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

Responsible Staff: TBD

BMP C123: Plastic Covering

Description: Plastic covering should be used to provide immediate, short-term erosion protection to stockpiles. Sand-filled burlap or geotextile bags shall be placed every 3 to 6 feet along seams, and tied together with twine to hold them in place.

Installation Schedules: As needed for immediate temporary erosion protection of soil stockpiles.

Inspection and Maintenance plan:

- Torn sheets must be replaced and open seams repaired.
- Completely remove and replace the plastic if it begins to deteriorate due to ultraviolet radiation.
- Completely remove plastic when no longer needed.
- Dispose of old tires used to weight down plastic sheeting appropriately.

Responsible Staff: TBD

BMP C140: Dust Control

Description: Dust control shall be implemented to prevent wind transport of dust from disturbed soil surfaces onto roadways, drainage ways, and surface waters. Control measures that may be used include the following:

- Vegetating, mulching, or applying gravel or landscaping rock to areas that will not receive vehicle traffic
- Clearing only those areas where immediate activity will take place, leaving the remaining area(s) in original condition. Maintain the original ground cover as long as practicable.
- Sprinkle the site with water until surface is wet. Repeat as needed. To prevent carryout of mud onto street, refer to Stabilized Construction Entrance (BMP C105).

Installation Schedules: As needed for immediate temporary erosion protection of soil stockpiles.

Inspection and Maintenance plan:
• Respray area as necessary to minimize dust.

Responsible Staff: TBD

Element 6: Protect Slopes (2.1.6)

☐ Yes ☒ No
Steep slopes are not expected to be present at the site during construction; therefore, no BMPs addressing Element 6 are proposed.

Element 7: Protect Drain Inlets (2.1.7)

List and describe BMPs: Existing and new storm drain inlets that could likely receive runoff generated from the site will be protected using one of the following measures:

- Curb inlet protection
- Curb and gutter sediment barrier
- Catchbasin filters
- Other approved protection measures

Installation Schedules: Storm drain inlet protection measures shall be installed prior to ground-disturbing activities in areas that could generate runoff into existing or proposed storm drain inlets.

Inspection and Maintenance plan:

- Inspect catch basin filters frequently, especially after storm events.
- Clean and replace clogged inserts. For systems with clogged stone filters: pull away the stones from the inlet and clean or replace. An alternative approach would be to use the clogged stone as fill and put fresh stone around the inlet.
- 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.
- Inlet protection devices will be cleaned (or removed and replaced), when sediment has filled the device by one third (1/3) or as specified by the manufacturer.
- Inlets will be inspected weekly at a minimum and daily during storm events.

Responsible Staff: TBD

Element 8: Stabilize Channels and Outlets (2.1.8)

The site contains no existing onsite conveyance channels, nor are any proposed; therefore, BMPs addressing Element 8 are not applicable.

Element 9: Control Pollutants (2.1.9)

The following pollutants are anticipated to be present on-site:

Table 2 – Pollutants

Pollutant (and source, if applicable)
Petroleum products, including fuel, oil, and grease, used for equipment operation and maintenance.
pH-modifying products used in cement concrete, including cement, cement kiln dust, fly ash, new concrete washing and curing waters, waste streams generated from concrete grinding and sawing, concrete pumping, and mixer washout waters.

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?
☐ Yes ☒ No

BMP C153: Material Delivery, Storage, and Containment

Description: The following procedures should be utilized to prevent, reduce, or eliminate discharge of pollutants to the stormwater system from material delivery and storage activities. The overall objectives of this BMP are to minimize onsite hazardous material storage, store materials in a designated area, and install secondary containment if necessary. 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

The following steps should be taken to minimize risk:

- Temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Material Safety Data Sheets (MSDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (Oct 1 – April 30), consider storing materials in a covered area.
- 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.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, and within secondary containment.
- 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.
- 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.

- Temporary secondary containment facilities shall provide for a spill containment volume able to contain 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- 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.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:
    - 1-Water Resistant Nylon Bag
    - 3-Oil Absorbent Socks 3”x 4’
    - 2-Oil Absorbent Socks 3”x 10’
    - 12-Oil Absorbent Pads 17”x19”
    - 1-Pair Splash Resistant Goggles
    - 3-Pair Nitrile Gloves
    - 10-Disposable Bags with Ties
    - Instructions

Installation Schedules: Material handling and storage procedures should be followed any time hazardous or environmentally detrimental materials are handled or stored on site.

Responsible Staff: TBD

Will wheel wash or tire bath system BMPs be used during construction?
☐ Yes ☒ No

Will pH-modifying sources be present on-site?
☒ Yes ☐ No

Table 3 – pH-Modifying Sources

	None
	Bulk cement
	Cement kiln dust
	Fly ash
☒	Other cementitious materials
☒	New concrete washing or curing waters
	Waste streams generated from concrete grinding and sawing
	Exposed aggregate processes

	Dewatering concrete vaults
☒	Concrete pumping and mixer washout waters
	Recycled concrete
	Other (i.e. calcium lignosulfate) [please describe]

BMP C151: Concrete Handling

Description: The following management practices should be utilized any time concrete is used on site:

- Wash out concrete truck chutes, pumps, and internals into formed areas only. Assure that washout of concrete trucks is performed off site or in designated concrete washout areas. Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams. Refer to BMP C154 for information on concrete washout areas.
- Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not dump excess concrete on site, except in designated concrete washout areas.
- Wash off hand tools including, but not limited to, screeds, shovels, rakes, floats, and trowels into formed areas only.
- Wash equipment difficult to move, such as concrete pavers, in areas that do not directly drain to natural or constructed stormwater conveyances.
- Do not allow washdown from areas, such as concrete aggregate driveways, to drain directly to natural or constructed stormwater conveyances.
- Contain washwater and leftover product in a lined container when no formed areas are available. Dispose of contained concrete in a manner that does not violate ground water or surface water quality standards.
- Always use forms or solid barriers for concrete pours, such as pilings, within 15-feet of surface waters.

Installation Schedules: Concrete handling measures should be implemented any time onsite concrete cement construction activities take place.

Inspection and Maintenance plan: Check containers for holes in the liner daily during concrete pours and repair the same day.

Responsible Staff: TBD

BMP C152: Sawcutting and Surfacing Pollution Prevention

Description: 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. Concrete spillage or concrete discharge to surface waters of the State is prohibited. Use this BMP to minimize and eliminate process water and slurry created through sawcutting or surfacing from entering waters of the State. Utilize the

following management practices anytime sawcutting or surfacing operations take place. These activities include, but are not limited to, sawing, coring, grinding, roughening, hydro-demolition, bridge and road surfacing. This BMP should be implemented by following the guidelines listed below:

- Vacuum slurry and cuttings during cutting and surfacing operations.
- Slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight.
- Slurry and cuttings shall not drain to any natural or constructed drainage conveyance including stormwater systems. This may require temporarily blocking catch basins.
- Dispose of collected slurry and cuttings in a manner that does not violate ground water or surface water quality standards.
- Do not allow process water generated during hydro-demolition, surface roughening, or similar operations to drain to any natural or constructed drainage conveyance including stormwater systems.
- Dispose of process water in a manner that does not violate ground water or surface water quality standards.
- Handle and dispose cleaning waste material and demolition debris in a manner that does not cause contamination of water. Dispose of sweeping material from a pick-up sweeper at an appropriate disposal site.

Installation Schedules: The above-referenced sawcutting and surfacing pollution prevention measures should be implemented anytime either of these activities take place.

Inspection and Maintenance plan: 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.

Responsible Staff: TBD

BMP C154: Concrete Washout Area

Description: To prevent or reduce discharge of concrete waste pollutants to stormwater, concrete washout will be conducted off site where practicable; in the event onsite washout is required, the following procedures should be followed:

Perform washout of concrete trucks off-site or in designated concrete washout areas only.

- Do not wash out concrete trucks onto the ground, or into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped on-site, except in designated concrete washout areas.
- Concrete washout areas may be prefabricated concrete washout containers, or self-installed structures (above-grade or below-grade).

- Prefabricated containers are most resistant to damage and protect against spills and leaks. Companies may offer delivery service and provide regular maintenance and disposal of solid and liquid waste.
- If self-installed concrete washout areas are used, below-grade structures are preferred over above-grade structures because they are less prone to spills and leaks.
- Self-installed above-grade structures should only be used if excavation is not practical. Installation Schedules: The above-referenced sawcutting and surfacing pollution prevention measures should be implemented anytime either of these activities take place.
- Education
    - Discuss the concrete management techniques described in this BMP with the ready-mix concrete supplier before any deliveries are made.
    - Educate employees and subcontractors on the concrete waste management techniques described in this BMP.
    - Arrange for contractor's superintendent or Certified Erosion and Sediment Control Lead (CESCL) to oversee and enforce concrete waste management procedures.
    - A sign should be installed adjacent to each temporary concrete washout facility to inform concrete equipment operators to utilize the proper facilities.

Inspection and Maintenance plan:

- Inspect and verify that concrete washout BMPs are in place prior to the commencement of concrete work.
- During periods of concrete work, inspect daily to verify continued performance.
    - Check overall condition and performance.
    - Check remaining capacity (% full).
    - If using self-installed washout facilities, verify plastic liners are intact and sidewalls are not damaged.
    - If using prefabricated containers, check for leaks.
- Washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 12 inches.
- Washout facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- If the washout is nearing capacity, vacuum and dispose of the waste material in an approved manner.
- Do not discharge liquid or slurry to waterways, storm drains or directly onto ground.
- Do not use sanitary sewer without local approval.
- Place a secure, non-collapsing, non-water collecting cover over the concrete washout facility prior to predicted wet weather to prevent accumulation and overflow of precipitation.
- Remove and dispose of hardened concrete and return the structure to a functional condition. Concrete may be reused on-site or hauled away for disposal or recycling.
- When you remove materials from the self-installed concrete washout, build a new structure; or, if the previous structure is still intact, inspect for signs of weakening or

damage, and make any necessary repairs. Re-line the structure with new plastic after each cleaning.

Responsible Staff: TBD

Concrete trucks must not be washed out onto the ground, or into storm drains, open ditches, streets, or streams. Excess concrete must not be dumped on-site, except in designated concrete washout areas with appropriate BMPs installed.

Will uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters?
☐ Yes ☒ No

Water-only based shaft drilling is not expected to take place during construction.

Element 10: Control Dewatering (2.1.10)

Dewatering at the site is not expected to be required. In the event it is required, the contractor shall update the SWPPP to include dewatering control BMPs.

Element 11: Maintain BMPs (2.1.11)

All temporary and permanent Erosion and Sediment Control (ESC) BMPs shall be maintained and repaired as needed to ensure continued performance of their intended function.

Maintenance and repair shall be conducted in accordance with each particular BMP specification (see *Volume II of the SWMMWW or Chapter 7 of the SWMMEW*).

Visual monitoring of all BMPs installed at the site will be conducted at least once every calendar week and within 24 hours of any stormwater or non-stormwater discharge from the site. If the site becomes inactive and is temporarily stabilized, the inspection frequency may be reduced to once every calendar month.

All temporary ESC BMPs shall be removed within 30 days after final site stabilization is achieved or after the temporary BMPs are no longer needed.

Trapped sediment shall be stabilized on-site or removed. Disturbed soil resulting from removal of either BMPs or vegetation shall be permanently stabilized.

Additionally, protection must be provided for all BMPs installed for the permanent control of stormwater from sediment and compaction. BMPs that are to remain in place following completion of construction shall be examined and restored to full operating condition. If sediment enters these BMPs during construction, the sediment shall be removed and the facility shall be returned to conditions specified in the construction documents.

Element 12: Manage the Project (2.1.12)

The project will be managed based on the following principles:

- Projects will be phased to the maximum extent practicable and seasonal work limitations will be taken into account.
- Inspection and monitoring:
    - Inspection, maintenance and repair of all BMPs will occur as needed to ensure performance of their intended function.
    - Site inspections and monitoring will be conducted in accordance with Special Condition S4 of the CSWGP. Sampling locations are indicated on the Site Map. Sampling station(s) are located in accordance with applicable requirements of the CSWGP.
- Maintain an updated SWPPP.
    - The SWPPP will be updated, maintained, and implemented in accordance with Special Conditions S3, S4, and S9 of the CSWGP.

As site work progresses the SWPPP will be modified routinely to reflect changing site conditions. The SWPPP will be reviewed monthly to ensure the content is current.

Table 5 – Management

☒	Design the project to fit the existing topography, soils, and drainage patterns
☒	Emphasize erosion control rather than sediment control
☒	Minimize the extent and duration of the area exposed
☒	Keep runoff velocities low
☒	Retain sediment on-site
☒	Thoroughly monitor site and maintain all ESC measures
	Schedule major earthwork during the dry season
	Other (please describe)

Element 13: Protect Low Impact Development (LID) BMPs (2.1.13)

Bioretention and infiltration facilities will be constructed to manage stormwater runoff generated from post-developed new impervious areas of the Project Site. The facility shall be protected using the following procedures:

- Protect Bioretention BMPs from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the facility. Restore the BMP to its fully functioning condition if it accumulates sediment during construction. Restoring the BMP must include removal of sediment and any sediment-laden amended soils, and replacing the removed soils with soils meeting the design specification.
- Prevent compacting infiltration BMPs by excluding construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.
- Keep all heavy equipment off existing soils under infiltration/bioretention facilities that have been excavated to final grade to retain the infiltration rate of the soils.

Pollution Prevention Team (3.0)

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)		
Resident Engineer	David G. Spencer,PE	360-723-0392
Emergency Ecology Contact		
Emergency Permittee/ Owner Contact	Aidan Willis	503-957-0966
Non-Emergency Owner Contact	Aidan Willis	503-957-0966
Monitoring Personnel		
Ecology Regional Office	Southwest Region	360-407-6300

Monitoring and Sampling Requirements (4.0)

Monitoring includes visual inspection, sampling for water quality parameters of concern, and documentation of the inspection and sampling findings in a site log book. A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Stormwater sampling data

File a blank form under Appendix D.

The site log book must be maintained on-site within reasonable access to the site and be made available upon request to Ecology or the local jurisdiction.

Numeric effluent limits may be required for certain discharges to 303(d) listed waterbodies. See CSWGP Special Condition S8 and Section 5 of this template.

Site Inspection (4.1)

Site inspections will be conducted at least once every calendar week and within 24 hours following any discharge from the site. For sites that are temporarily stabilized and inactive, the required frequency is reduced to once per calendar month.

Reporting and Record Keeping (6.0)

Record Keeping (6.1)

Site Log Book (6.1.1)

A site log book will be maintained for all on-site construction activities and will include:

- A record of the implementation of the SWPPP and other permit requirements
- Site inspections
- Sample logs

Records Retention (6.1.2)

Records will be retained during the life of the project and for a minimum of three (3) years following the termination of permit coverage in accordance with Special Condition S5.C of the CSWGP.

Permit documentation to be retained on-site:

- CSWGP
- Permit Coverage Letter
- SWPPP
- Site Log Book

Permit documentation will be provided within 14 days of receipt of a written request from Ecology. A copy of the SWPPP or access to the SWPPP will be provided to the public when requested in writing in accordance with Special Condition S5.G.2.b of the CSWGP.

Updating the SWPPP (6.1.3)

The SWPPP will be modified if:

- Found ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site.
- There is a change in design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the State.

The SWPPP will be modified within seven (7) days if inspection(s) or investigation(s) determine additional or modified BMPs are necessary for compliance. An updated timeline for BMP implementation will be prepared.

Reporting (6.2)

Discharge Monitoring Reports (6.2.1)

Cumulative soil disturbance is less than one (1) acre; therefore, Discharge Monitoring Reports (DMRs) will not be submitted to Ecology because water quality sampling is not being conducted at the site.

Notification of Noncompliance (6.2.2)

If any of the terms and conditions of the permit is not met, and the resulting noncompliance may cause a threat to human health or the environment, the following actions will be taken:

1. Ecology will be notified within 24-hours of the failure to comply by calling the applicable Regional office ERTS phone number (Regional office numbers listed below).
2. Immediate action will be taken to prevent the discharge/pollution or otherwise stop or correct the noncompliance. If applicable, sampling and analysis of any noncompliance will be repeated immediately and the results submitted to Ecology within five (5) days of becoming aware of the violation.
3. A detailed written report describing the noncompliance will be submitted to Ecology within five (5) days, unless requested earlier by Ecology.

Anytime turbidity sampling indicates turbidity is 250 NTUs or greater, or water transparency is 6 cm or less, the Ecology Regional office will be notified by phone within 24 hours of analysis as required by Special Condition S5.A of the CSWGP.

- Central Region at (509) 575-2490 for Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, or Yakima County
- Eastern Region at (509) 329-3400 for Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, or Whitman County
- Northwest Region at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County
- Southwest Region at (360) 407-6300 for Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, or Wahkiakum

Include the following information:

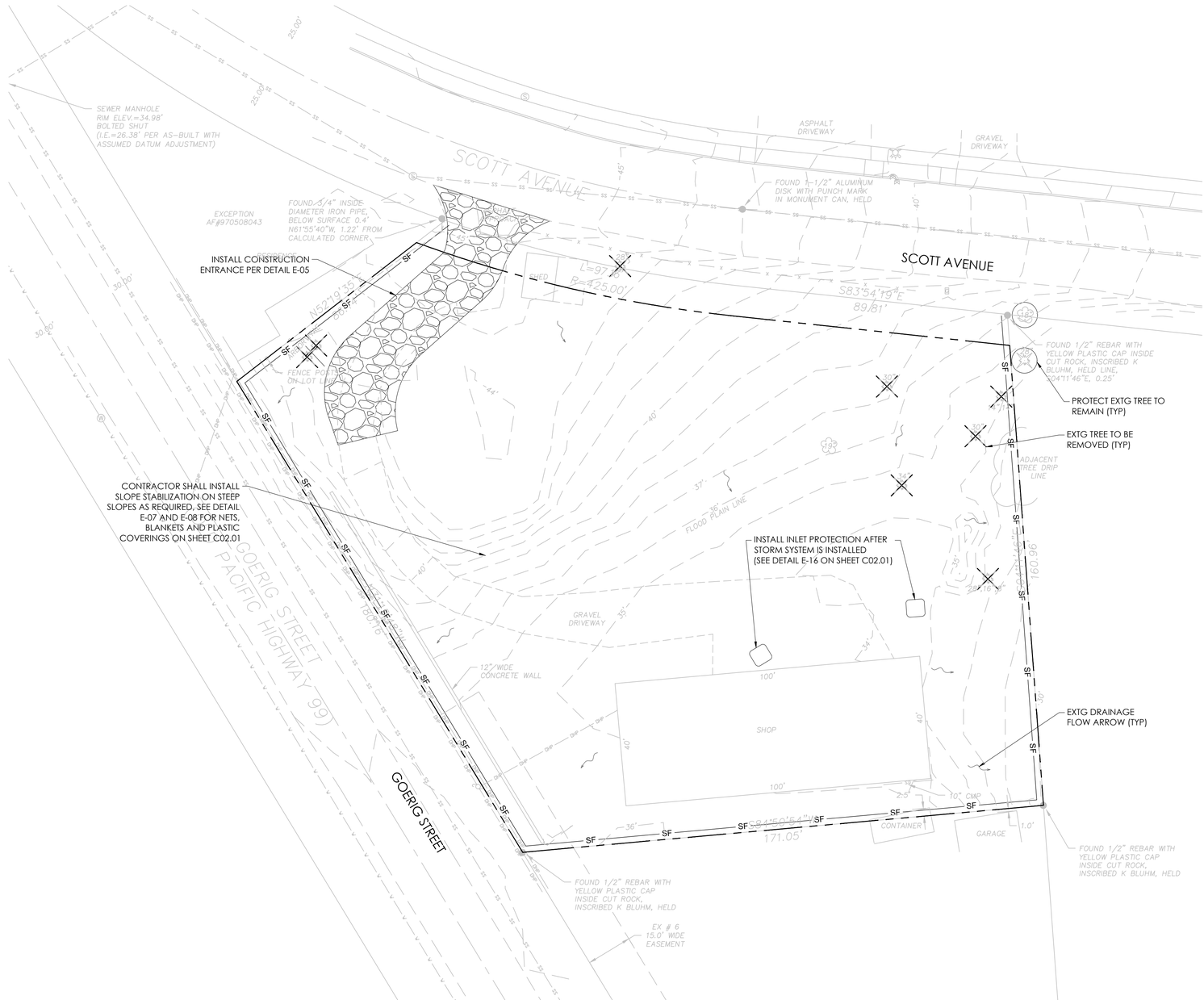
1. Your name and / Phone number
2. Permit number
3. City / County of project
4. Sample results
5. Date / Time of call

6. Date / Time of sample
7. Project name

In accordance with Special Condition S4.D.5.b of the CSWGP, the Ecology Regional office will be notified if chemical treatment other than CO_2 sparging is planned for adjustment of high pH water.

A. Site Map
B. BMP Details
C. Site Inspection Form

APPENDIX A: SITE MAP



EROSION CONTROL NOTES:

1. CONTRACTOR SHALL INSTALL EROSION CONTROL MEASURES AS NECESSARY TO PREVENT SEDIMENT LADEN RUNOFF FROM LEAVING THE PROJECT SITE.
2. EROSION CONTROL MEASURES SHALL BE KEPT IN PLACE AT ALL TIMES DURING CONSTRUCTION, AND SHALL NOT BE REMOVED UNTIL SITE HAS BEEN FULLY STABILIZED.
3. SILT FENCE IS SHOWN AT THE PROPERTY LINES. IF SILT FENCE IS SHOWN UPGRADIENT FROM SITE, IT MAY NOT BE NECESSARY AT THE DISCRETION OF THE CONTRACTOR. IN THE CASE WHERE IT IS NOT NECESSARY, SOME SORT OF DEMARCATION SHALL BE MADE AT THE PROPERTY LINE (IE CONSTRUCTION FENCING) TO PREVENT CONSTRUCTION WORK FROM CROSSING ONTO ADJACENT PROPERTY. SITE GRADING LIMITS ARE REQUIRED TO BE SHOWN, HIGH VISIBILITY FENCE MAY BE USED INSTEAD OF SILT FENCE AT UPGRADIENT LOCATIONS.
4. CONTRACTOR SHALL KEEP THE PUBLIC STREET FREE FROM SEDIMENT, WHEEL TRACKING. WHEEL WASH SHALL BE INSTALLED IF CONTRACTOR IS TRACKING SEDIMENT ONTO THE PUBLIC STREET.
5. CONTRACTOR SHALL COMPLY WITH ALL REQUESTS OF THE CITY OR STATE REGARDING EROSION CONTROL. IT IS THE CONTRACTOR'S RESPONSIBILITY TO APPROPRIATELY HANDLE ALL CONSTRUCTION STORMWATER IN COMPLIANCE WITH LOCAL AND STATE REQUIREMENTS.
6. FOR SITES LESS THAN 3 ACRES BEING DISTURBED, CONTRACTOR SHALL INSTALL SEDIMENT TRAPS IF NECESSARY TO CONTROL SEDIMENT FROM LEAVING THE CONSTRUCTION SITE. STANDARD DETAIL FOR SEDIMENT TRAP IS E-2.40.
7. POST-CONSTRUCTION SOIL QUALITY AND DEPTH PER BMP T5.13 IS REQUIRED FOR LANDSCAPED AREAS AFTER GRADING IS COMPLETE.
8. SILT FENCE INDICATES APPROXIMATE CLEARING LIMITS.
9. SEE DETAIL E-03 FOR EROSION AND SEDIMENT CONTROL NOTES ON PAGE C02.01.

DEMOLITION NOTES:

1. IF APPLICABLE, EXISTING STRUCTURES AND APPURTENANCES SHALL BE DEMOLISHED AS INDICATED ON THIS PLAN IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REQUIREMENTS.
2. IF APPLICABLE, LEAD PAINT, ASBESTOS OR OTHER HAZARDOUS MATERIALS SHALL BE APPROPRIATELY HANDLED BY THE CONTRACTOR IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REQUIREMENTS.
3. TREE REMOVAL SHALL BE COORDINATED WITH THE CITY FORESTER PRIOR TO REMOVAL OF ANY TREE OUTSIDE THE BOUNDARY OF THIS PROPERTY. WHERE TREES ARE MARKED FOR PROTECTION, THEY SHALL BE PROTECTED TO THE DRIP LINE / ROOT ZONE BY A TREE PROTECTION FENCE. NO GRADING SHALL OCCUR WITHIN THE TREE PROTECTION FENCE WITHOUT AUTHORIZATION FROM THE CITY'S FORESTER.

DEMO & EROSION CONTROL LEGEND

- SF — SILT FENCE PER E-20
- CONSTRUCTION ENTRANCE PER E-05
- EXTG TREE TO BE REMOVED
- PROTECT EXTG TREE TO REMAIN
- INLET PROTECTION

N

0 20' 40'

NOTE: BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALE ACCORDINGLY.

PRELIMINARY SITE PLAN REVIEW

Jolma Design, LLC
10 South Parkway Ave.
Ste. 102
Battle Ground, WA 98604
(360) 723-0392
www.jolmadesign.com

DAVID G. SPENCER — STATE OF WASHINGTON — 41148 — REGISTERED PROFESSIONAL ENGINEER

6/23/2022

PROJECT NAME: GOERIG APARTMENTS
CLIENT: AIDAN WILLIS
PROJECT LOCATION: WOODLAND, WA

MARK	DATE	DESCRIPTION
A	6/24/2022	Issued for review.

PROJECT:	22046
DESIGNED:	DGS
DRAWN:	BDT
CHECKED:	DGS
SCALE	
SCALE AS NOTED	
SHEET TITLE	
DEMOLITION & EROSION CONTROL PLAN	
SHEET	
C01.03	

APPENDIX B: BMP DETAILS

BMP C120: Temporary and Permanent Seeding

Purpose

Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

Conditions of Use

Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.

The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1.

Between July 1 and August 30 seeding requires irrigation until 75 percent grass cover is established.

Between October 1 and March 30 seeding requires a cover of mulch or an erosion control blanket until 75 percent grass cover is established.

Review all disturbed areas in late August to early September and complete all seeding by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.

Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See BMP C121: Mulching for specifications.

Seed and mulch all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) which will prevent erosion. See BMP T5.13: Post-Construction Soil Quality and Depth.

Design and Installation Specifications

General

- Install channels intended for vegetation before starting major earthwork and hydroseed with a Bonded Fiber Matrix. For vegetated channels that will have high flows, install erosion control blankets over the top of hydroseed. Before allowing water to flow in vegetated channels, establish 75 percent vegetation cover. If vegetated channels cannot be established by seed before water flow; install sod in the channel bottom — over top of hydromulch and erosion control blankets.

- Confirm the installation of all required surface water control measures to prevent seed from washing away.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. See BMP C121: Mulching for specifications.
- Areas that will have seeding only and not landscaping may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Re-install native topsoil on the disturbed soil surface before application. See BMP T5.13: Post-Construction Soil Quality and Depth.
- When installing seed via hydroseeding operations, only about 1/3 of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. To overcome this, consider increasing seed quantities by up to 50 percent.
- Enhance vegetation establishment by dividing the hydromulch operation into two phases:
    - Phase 1- Install all seed and fertilizer with 25-30 percent mulch and tackifier onto soil in the first lift.
    - Phase 2- Install the rest of the mulch and tackifier over the first lift.

  Or, enhance vegetation by:

    - Installing the mulch, seed, fertilizer, and tackifier in one lift.
    - Spread or blow straw over the top of the hydromulch at a rate of 800-1000 pounds per acre.
    - Hold straw in place with a standard tackifier.

  Both of these approaches will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:

    - Irrigation.
    - Reapplication of mulch.
    - Repair of failed slope surfaces.

  This technique works with standard hydromulch (1,500 pounds per acre minimum) and Bonded Fiber Matrix/ Mechanically Bonded Fiber Matrix (BFM/MBFMs) (3,000 pounds per acre minimum).
- Seed may be installed by hand if:
    - Temporary and covered by straw, mulch, or topsoil.
    - Permanent in small areas (usually less than 1 acre) and covered with mulch, topsoil, or erosion blankets.
- The seed mixes listed in Table II-3.4: Temporary and Permanent Seed Mixes include recommended mixes for both temporary and permanent seeding.
- Apply these mixes, with the exception of the wet area seed mix, at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used. Apply the wet area seed mix at a

rate of 60 pounds per acre.

- Consult the local suppliers or the local conservation district for their recommendations. The appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the local authority may be used, depending on the soil type and hydrology of the area.

Table II-3.4: Temporary and Permanent Seed Mixes

Common Name	Latin Name	% Weight	% Purity	% Germination
Temporary Erosion Control Seed Mix A standard mix for areas requiring a temporary vegetative cover.				
Chewings or annual blue grass	*Festuca rubra var. commutata* or *Poa anna*	40	98	90
Perennial rye	*Lolium perenne*	50	98	90
Redtop or colonial bentgrass	*Agrostis alba* or *Agrostis tenuis*	5	92	85
White dutch clover	*Trifolium repens*	5	98	90
Landscaping Seed Mix A recommended mix for landscaping seed.				
Perennial rye blend	*Lolium perenne*	70	98	90
Chewings and red fescue blend	*Festuca rubra var. commutata* or *Festuca rubra*	30	98	90
Low-Growing Turf Seed Mix A turf seed mix for dry situations where there is no need for watering. This mix requires very little maintenance.				
Dwarf tall fescue (several varieties)	*Festuca arundinacea var.*	45	98	90
Dwarf perennial rye (Barclay)	*Lolium perenne var. barclay*	30	98	90
Red fescue	*Festuca rubra*	20	98	90
Colonial bentgrass	*Agrostis tenuis*	5	98	90
Bioswale Seed Mix A seed mix for bioswales and other intermittently wet areas.				
Tall or meadow fescue	*Festuca arundinacea* or *Festuca elatior*	75-80	98	90
Seaside/Creeping bentgrass	*Agrostis palustris*	10-15	92	85

Common Name	Latin Name	% Weight	% Purity	% Germination
Redtop bentgrass	*Agrostis alba* or *Agrostis gigantea*	5-10	90	80
Wet Area Seed Mix A low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Consult Hydraulic Permit Authority (HPA) for seed mixes if applicable.				
Tall or meadow fescue	*Festuca arundinacea* or *Festuca elatior*	60-70	98	90
Seaside/Creeping bentgrass	*Agrostis palustris*	10-15	98	85
Meadow foxtail	*Alepocurus pratensis*	10-15	90	80
Alsike clover	*Trifolium hybridum*	1-6	98	90
Redtop bentgrass	*Agrostis alba*	1-6	92	85
Meadow Seed Mix A recommended meadow seed mix for infrequently maintained areas or non-maintained areas where colonization by native plants is desirable. Likely applications include rural road and utility right-of-way. Seeding should take place in September or very early October in order to obtain adequate establishment prior to the winter months. Consider the appropriateness of clover, a fairly invasive species, in the mix. Amending the soil can reduce the need for clover.				
Redtop or Oregon bentgrass	*Agrostis alba* or *Agrostis oregonensis*	20	92	85
Red fescue	*Festuca rubra*	70	98	90
White dutch clover	*Trifolium repens*	10	98	90

Roughening and Rototilling

- The seedbed should be firm and rough. Roughen all soil no matter what the slope. Track walk slopes before seeding if engineering purposes require compaction. Backblading or smoothing of slopes greater than 4H:1V is not allowed if they are to be seeded.
- Restoration-based landscape practices require deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical, initially rip the subgrade to improve long-term permeability, infiltration, and water inflow qualities. At a minimum, permanent areas shall use soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches complete the rototilling process in multiple lifts, or prepare the engineered soil system per specifications and place to achieve the specified depth.

Fertilizers

- Conducting soil tests to determine the exact type and quantity of fertilizer is recommended. This will prevent the over-application of fertilizer.

- Organic matter is the most appropriate form of fertilizer because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form.
- In general, use 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer at a rate of 90 pounds per acre. Always use slow-release fertilizers because they are more efficient and have fewer environmental impacts. Do not add fertilizer to the hydromulch machine, or agitate, more than 20 minutes before use. Too much agitation destroys the slow-release coating.
- There are numerous products available that take the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal provides a good source of long-term, slow-release, available nitrogen.

Bonded Fiber Matrix and Mechanically Bonded Fiber Matrix

- On steep slopes use Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) products. Apply BFM/MBFM products at a minimum rate of 3,000 pounds per acre with approximately 10 percent tackifier. Achieve a minimum of 95 percent soil coverage during application. Numerous products are available commercially. Most products require 24-36 hours to cure before rainfall and cannot be installed on wet or saturated soils. Generally, products come in 40-50 pound bags and include all necessary ingredients except for seed and fertilizer.
- Install products per manufacturer's instructions.
- BFMs and MBFMs provide good alternatives to blankets in most areas requiring vegetation establishment. Advantages over blankets include:
    - BFM and MBFMs do not require surface preparation.
    - Helicopters can assist in installing BFM and MBFMs in remote areas.
    - On slopes steeper than 2.5H:1V, blanket installers may require ropes and harnesses for safety.
    - Installing BFM and MBFMs can save at least $1,000 per acre compared to blankets.

Maintenance Standards

Reseed any seeded areas that fail to establish at least 75 percent cover (100 percent cover for areas that receive sheet or concentrated flows). If reseeding is ineffective, use an alternate method such as sodding, mulching, nets, or blankets.

- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. Reseed and protect by mulch any eroded area.
- Supply seeded areas with adequate moisture, but do not water to the extent that it causes runoff.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies

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BMP C121: Mulching

Purpose

Mulching soils provides immediate temporary protection from erosion. Mulch also enhances plant establishment by conserving moisture, holding fertilizer, seed, and topsoil in place, and moderating soil temperatures. There are a variety of mulches that can be used. This section discusses only the most common types of mulch.

Conditions of Use

As a temporary cover measure, mulch should be used:

- For less than 30 days on disturbed areas that require cover.
- At all times for seeded areas, especially during the wet season and during the hot summer months.
- During the wet season on slopes steeper than 3H:1V with more than 10 feet of vertical relief.

Mulch may be applied at any time of the year and must be refreshed periodically.

For seeded areas, mulch may be made up of 100 percent:

- cottonseed meal;
- fibers made of wood, recycled cellulose, hemp, or kenaf;
- compost;
- or blends of these.

Tackifier shall be plant-based, such as guar or alpha plantago, or chemical-based such as polyacrylamide or polymers.

Generally, mulches come in 40-50 pound bags. Seed and fertilizer are added at time of application.

Recycled cellulose may contain polychlorinated biphenyl (PCBs). Ecology recommends that products should be evaluated for PCBs prior to use.

Refer to BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body.

Any mulch or tackifier product used shall be installed per the manufacturer's instructions.

Design and Installation Specifications

For mulch materials, application rates, and specifications, see Table II-3.6: Mulch Standards and Guidelines. Consult with the local supplier or the local conservation district for their recommendations. Increase the application rate until the ground is 95% covered (i.e. not visible under the mulch layer). Note: Thickness may be increased for disturbed areas in or near sensitive areas or other areas highly susceptible to erosion.

Where the option of “Compost” is selected, it should be a coarse compost that meets the size gradations listed in Table II-3.5: Size Gradations of Compost as Mulch Material when tested in accordance with Test Method 02.02-B found in *Test Methods for the Examination of Composting and Compost* (Thompson, 2001).

Table II-3.5: Size Gradations of Compost as Mulch Material

Sieve Size	Percent Passing
3"	100%
1"	90% - 100%
3/4"	70% - 100%
1/4"	40% - 100%

Mulch used within the ordinary high-water mark of surface waters should be selected to minimize potential flotation of organic matter. Composted organic materials have higher specific gravities (densities) than straw, wood, or chipped material. Consult the Hydraulic Permit Authority (HPA) for mulch mixes if applicable.

Maintenance Standards

The thickness of the mulch cover must be maintained.

Any areas that experience erosion shall be remulched and/or protected with a net or blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

Table II-3.6: Mulch Standards and Guidelines

Mulch Material	Guideline	Description
Straw	**Quality Standards**	Air-dried; free from undesirable seed and coarse material.
	Application Rates	2"-3" thick; 5 bales per 1,000 sf or 2-3 tons per acre

Mulch Material	Guideline	Description
	Remarks	Cost-effective protection when applied with adequate thickness. Hand-application generally requires greater thickness than blown straw. The thickness of straw may be reduced by half when used in conjunction with seeding. In windy areas straw must be held in place by crimping, using a tackifier, or covering with netting. Blown straw always has to be held in place with a tackifier as even light winds will blow it away. Straw, however, has several deficiencies that should be considered when selecting mulch materials. It often introduces and/or encourages the propagation of weed species and it has no significant long-term benefits It should also not be used within the ordinary high-water elevation of surface waters (due to flotation).
Hydromulch	**Quality Standards**	No growth inhibiting factors.
	Application Rates	Approx. 35-45 lbs per 1,000 sf or 1,500 - 2,000 lbs per acre
	Remarks	Shall be applied with hydromulcher. Shall not be used without seed and tackifier unless the application rate is at least doubled. Fibers longer than about 3/4 - 1 inch clog hydromulch equipment. Fibers should be kept to less than 3/4 inch.
Compost	**Quality Standards**	No visible water or dust during handling. Must be produced per WAC 173-350, Solid Waste Handling Standards, but may have up to 35% biosolids.
	Application Rates	2" thick min.; approx. 100 tons per acre (approx. 750 lbs per cubic yard)
	Remarks	More effective control can be obtained by increasing thickness to 3". Excellent mulch for protecting final grades until landscaping because it can be directly seeded or tilled into soil as an amendment. Compost used for mulch has a coarser size gradation than compost used for BMP C125: Topsoiling / Composting or BMP T5.13: Post-Construction Soil Quality and Depth. It is more stable and practical to use in wet areas and during rainy weather conditions. Do not use near wetlands or near phosphorous impaired water bodies.
Chipped Site Vegetation	**Quality Standards**	Gradations from fines to 6 inches in length for texture, variation, and interlocking properties. Include a mix of various sizes so that the average size is between 2- and 4-inches.
	Application Rates	2" thick min.;
	Remarks	This is a cost-effective way to dispose of debris from clearing and grubbing, and it eliminates the problems associated with burning. Generally, it should not be used on slopes above approx. 10% because of its tendency to be transported by runoff. It is not recommended within 200 feet of surface waters. If permanent seeding or planting is expected shortly after mulch, the decomposition of the chipped vegetation may tie up nutrients important to grass establishment. Note: thick application of this material over existing grass, herbaceous species, and some groundcovers could smother and kill vegetation.
Wood-Based Mulch	**Quality Standards**	No visible water or dust during handling. Must be purchased from a supplier with a Solid Waste Handling Permit or one exempt from solid waste regulations.

Mulch Material	Guideline	Description
	Application Rates	2" thick min.; approx. 100 tons per acre (approx. 750 lbs. per cubic yard)
	Remarks	This material is often called "wood straw" or "hog fuel". The use of mulch ultimately improves the organic matter in the soil. Special caution is advised regarding the source and composition of wood-based mulches. Its preparation typically does not provide any weed seed control, so evidence of residual vegetation in its composition or known inclusion of weed plants or seeds should be monitored and prevented (or minimized).
Wood Strand Mulch	**Quality Standards**	A blend of loose, long, thin wood pieces derived from native conifer or deciduous trees with high length-to-width ratio.
	Application Rates	2" thick min.
	Remarks	Cost-effective protection when applied with adequate thickness. A minimum of 95-percent of the wood strand shall have lengths between 2 and 10-inches, with a width and thickness between 1/16 and 1/2-inches. The mulch shall not contain resin, tannin, or other compounds in quantities that would be detrimental to plant life. Sawdust or wood shavings shall not be used as mulch. [Specification 9-14.4(4) from the *Standard Specifications for Road, Bridge, and Municipal Construction* (WSDOT, 2016)

BMP C123: Plastic Covering

Purpose

Plastic covering provides immediate, short-term erosion protection to slopes and disturbed areas.

Conditions of Use

Plastic covering may be used on disturbed areas that require cover measures for less than 30 days, except as stated below.

- Plastic is particularly useful for protecting cut and fill slopes and stockpiles. However, the relatively rapid breakdown of most polyethylene sheeting makes it unsuitable for applications greater than six months.
- Due to rapid runoff caused by plastic covering, do not use this method upslope of areas that might be adversely impacted by concentrated runoff. Such areas include steep and/or unstable slopes.
- Plastic sheeting may result in increased runoff volumes and velocities, requiring additional on-site measures to counteract the increases. Creating a trough with wattles or other material can convey clean water away from these areas.
- To prevent undercutting, trench and backfill rolled plastic covering products.
- Although the plastic material is inexpensive to purchase, the cost of installation, maintenance, removal, and disposal add to the total costs of this BMP.
- Whenever plastic is used to protect slopes, install water collection measures at the base of the slope. These measures include plastic-covered berms, channels, and pipes used to convey clean rainwater away from bare soil and disturbed areas. Do not mix clean runoff from a plastic covered slope with dirty runoff from a project.
- Other uses for plastic include:
    - Temporary ditch liner.
    - Pond liner in temporary sediment pond.
    - Liner for bermed temporary fuel storage area if plastic is not reactive to the type of fuel being stored.
    - Emergency slope protection during heavy rains.
    - Temporary drainpipe (“elephant trunk”) used to direct water.

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
    1. Run plastic up and down the slope, not across the slope.
    2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.
    3. Provide a minimum of 8-inch overlap at the seams.
    4. On long or wide slopes, or slopes subject to wind, tape all seams.
    5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
    6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
    7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil, which causes extreme erosion.
    8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.
- Plastic sheeting shall have a minimum thickness of 6 mil.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

- Torn sheets must be replaced and open seams repaired.
- Completely remove and replace the plastic if it begins to deteriorate due to ultraviolet radiation.
- Completely remove plastic when no longer needed.
- Dispose of old tires used to weight down plastic sheeting appropriately.

Approved as Functionally Equivalent

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

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BMP C140: Dust Control

Purpose

Dust control prevents wind transport of dust from disturbed soil surfaces onto roadways, drainage ways, and surface waters.

Conditions of Use

Use dust control in areas (including roadways) subject to surface and air movement of dust where on-site or off-site impacts to roadways, drainage ways, or surface waters are likely.

Design and Installation Specifications

- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition. Maintain the original ground cover as long as practical.
- Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- Sprinkle the site with water until the surface is wet. Repeat as needed. To prevent carryout of mud onto the street, refer to BMP C105: Stabilized Construction Access and BMP C106: Wheel Wash.
- Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
- Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local governments may approve other dust palliatives such as calcium chloride or PAM.
- PAM (BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection) added to water at a rate of 0.5 pounds per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may reduce the quantity of water needed for dust control. Note that the application rate specified here applies to this BMP, and is not the same application rate that is specified in BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection, but the downstream protections still apply.

Refer to BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body.

- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes compliance with this BMP.
- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Techniques that can be used for unpaved roads and lots include:
    - Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
    - Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
    - 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.
    - Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
    - Encourage the use of alternate, paved routes, if available.
    - 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.
    - Limit dust-causing work on windy days.
    - Pave unpaved permanent roads and other trafficked areas.

Maintenance Standards

Respray area as necessary to keep dust to a minimum.

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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. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate concrete, concrete process water, and concrete slurry from entering waters of the State.

Conditions of Use

Any time concrete is used, utilize these management practices. Concrete construction project components include, but are not limited to:

- Curbs
- Sidewalks
- Roads
- Bridges
- Foundations
- Floors
- Runways

Disposal options for concrete, in order of preference are:

1. Off-site disposal
2. Concrete wash-out areas (see BMP C154: Concrete Washout Area)
3. De minimus washout to formed areas awaiting concrete

Design and Installation Specifications

- Wash concrete truck drums at an approved off-site location or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground (including formed areas awaiting concrete), or into storm drains, open ditches, streets, or streams. Refer to BMP C154: Concrete Washout Area for information on concrete washout areas.

- Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not dump excess concrete on site, except in designated concrete washout areas as allowed in BMP C154: Concrete Washout Area.

- Wash small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) into designated concrete washout areas or into formed areas awaiting concrete pour.
- At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow washwater from areas, such as concrete aggregate driveways, to drain directly (without detention or treatment) to natural or constructed stormwater conveyances.
- Contain washwater and leftover product in a lined container when no designated concrete washout areas (or formed areas, allowed as described above) are available. Dispose of contained concrete and concrete washwater (process water) properly.
- Always use forms or solid barriers for concrete pours, such as pilings, within 15-feet of surface waters.
- Refer to BMP C252: Treating and Disposing of High pH Water for pH adjustment requirements.
- Refer to the Construction Stormwater General Permit (CSWGP) for pH monitoring requirements if the project involves one of the following activities:
    - Significant concrete work (as defined in the CSWGP).
    - The use of soils amended with (but not limited to) Portland cement-treated base, cement kiln dust or fly ash.
    - Discharging stormwater to segments of water bodies on the 303(d) list (Category 5) for high pH.

Maintenance Standards

Check containers for holes in the liner daily during concrete pours and repair the same day.

BMP C152: Sawcutting 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. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate process water and slurry created through sawcutting or surfacing from entering waters of the State.

Conditions of Use

Utilize these management practices anytime sawcutting or surfacing operations take place. Sawcutting and surfacing operations include, but are not limited to:

- Sawing
- Coring
- Grinding
- Roughening
- Hydro-demolition
- Bridge and road surfacing

Design and Installation Specifications

- Vacuum slurry and cuttings during cutting and surfacing operations.
- Slurry and cuttings shall not remain on permanent concrete or asphalt pavement overnight.
- Slurry and cuttings shall not drain to any natural or constructed drainage conveyance including stormwater systems. This may require temporarily blocking catch basins.
- Dispose of collected slurry and cuttings in a manner that does not violate ground water or surface water quality standards.
- Do not allow process water generated during hydro-demolition, surface roughening or similar operations to drain to any natural or constructed drainage conveyance including stormwater systems. Dispose of process water in a manner that does not violate ground water or surface water quality standards.

- Handle and dispose of cleaning waste material and demolition debris in a manner that does not cause contamination of water. Dispose of sweeping material from a pick-up sweeper at an appropriate disposal 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/or vacuum trucks.

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BMP C153: Material Delivery, Storage, and Containment

Purpose

Prevent, reduce, or eliminate the discharge of pollutants to the stormwater system or watercourses from material delivery and storage. Minimize the storage of hazardous materials on-site, store materials in a designated area, and install secondary containment.

Conditions of Use

Use at 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 temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Safety Data Sheets (SDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (Oct 1 – April 30), consider storing materials in a covered area.
- Materials should be stored in secondary containments, such as an 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.

- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, within secondary containment.
- 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.
- 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.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:
    - 1-Water Resistant Nylon Bag
    - 3-Oil Absorbent Socks 3”x 4’
    - 2-Oil Absorbent Socks 3”x 10’
    - 12-Oil Absorbent Pads 17”x19”
    - 1-Pair Splash Resistant Goggles
    - 3-Pair Nitrile Gloves
    - 10-Disposable Bags with Ties
    - Instructions

Maintenance Standards

- 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.

- Re-stock spill kit materials as needed.

Washington State Department of Ecology

2019 Stormwater Management Manual for Western Washington (2019 SWMMWW)

Publication No.19-10-021

BMP C154: Concrete Washout Area

Purpose

Prevent or reduce the discharge of pollutants from concrete waste to stormwater by conducting washout off-site, or performing on-site washout in a designated area.

Conditions of Use

Concrete washout areas are implemented on construction projects where:

- Concrete is used as a construction material
- It is not possible to dispose of all concrete wastewater and washout off-site (ready mix plant, etc.).
- Concrete truck drums are washed on-site.

  Note that auxiliary concrete truck components (e.g. chutes and hoses) and small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) may be washed into formed areas awaiting concrete pour.

At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.

Design and Installation Specifications

Implementation

- Perform washout of concrete truck drums at an approved off-site location or in designated concrete washout areas only.
- Do not wash out concrete onto non-formed areas, or into storm drains, open ditches, streets, or streams.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow excess concrete to be dumped on-site, except in designated concrete washout areas as allowed above.
- Concrete washout areas may be prefabricated concrete washout containers, or self-installed structures (above-grade or below-grade).
- Prefabricated containers are most resistant to damage and protect against spills and leaks. Companies may offer delivery service and provide regular maintenance and disposal of solid and liquid waste.

- If self-installed concrete washout areas are used, below-grade structures are preferred over above-grade structures because they are less prone to spills and leaks.
- Self-installed above-grade structures should only be used if excavation is not practical.
- Concrete washout areas shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

Education

- Discuss the concrete management techniques described in this BMP with the ready-mix concrete supplier before any deliveries are made.
- Educate employees and subcontractors on the concrete waste management techniques described in this BMP.
- Arrange for the contractor's superintendent or Certified Erosion and Sediment Control Lead (CESCL) to oversee and enforce concrete waste management procedures.
- A sign should be installed adjacent to each concrete washout area to inform concrete equipment operators to utilize the proper facilities.

Contracts

Incorporate requirements for concrete waste management into concrete supplier and subcontractor agreements.

Location and Placement

- Locate concrete washout areas at least 50 feet from sensitive areas such as storm drains, open ditches, water bodies, or wetlands.
- Allow convenient access to the concrete washout area for concrete trucks, preferably near the area where the concrete is being poured.
- If trucks need to leave a paved area to access the concrete washout area, prevent track-out with a pad of rock or quarry spalls (see BMP C105: Stabilized Construction Access). These areas should be far enough away from other construction traffic to reduce the likelihood of accidental damage and spills.
- The number of concrete washout areas you install should depend on the expected demand for storage capacity.
- On large sites with extensive concrete work, concrete washout areas should be placed in multiple locations for ease of use by concrete truck drivers.

Concrete Truck Washout Procedures

- Washout of concrete truck drums shall be performed in designated concrete washout areas only.

- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated concrete washout areas or properly disposed of off-site.

Concrete Washout Area Installation

- Concrete washout areas should be constructed as shown in the figures below, with a recommended minimum length and minimum width of 10 ft, but with sufficient quantity and volume to contain all liquid and concrete waste generated by washout operations.
- Plastic lining material should be a minimum of 10 mil polyethylene sheeting and should be free of holes, tears, or other defects that compromise the impermeability of the material.
- Lath and flagging should be commercial type.
- Liner seams shall be installed in accordance with manufacturers' recommendations.
- Soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.

Maintenance Standards

Inspection and Maintenance

- Inspect and verify that concrete washout areas are in place prior to the commencement of concrete work.
- Once concrete wastes are washed into the designated washout area and allowed to harden, the concrete should be broken up, removed, and disposed of per applicable solid waste regulations. Dispose of hardened concrete on a regular basis.
- During periods of concrete work, inspect the concrete washout areas daily to verify continued performance.
    - Check overall condition and performance.
    - Check remaining capacity (% full).
    - If using self-installed concrete washout areas, verify plastic liners are intact and sidewalls are not damaged.
    - If using prefabricated containers, check for leaks.
- Maintain the concrete washout areas to provide adequate holding capacity with a minimum freeboard of 12 inches.
- Concrete washout areas must be cleaned, or new concrete washout areas must be constructed and ready for use once the concrete washout area is 75% full.
- If the concrete washout area is nearing capacity, vacuum and dispose of the waste material in an approved manner.

- Do not discharge liquid or slurry to waterways, storm drains or directly onto ground.
- Do not discharge to the sanitary sewer without local approval.
- Place a secure, non-collapsing, non-water collecting cover over the concrete washout area prior to predicted wet weather to prevent accumulation and overflow of precipitation.
- Remove and dispose of hardened concrete and return the structure to a functional condition. Concrete may be reused on-site or hauled away for disposal or recycling.

- When you remove materials from a self-installed concrete washout area, build a new structure; or, if the previous structure is still intact, inspect for signs of weakening or damage, and make any necessary repairs. Re-line the structure with new plastic after each cleaning.

Removal of Concrete Washout Areas

- When concrete washout areas are no longer required for the work, the hardened concrete, slurries and liquids shall be removed and properly disposed of.
- Materials used to construct concrete washout areas shall be removed from the site of the work and disposed of or recycled.
- Holes, depressions or other ground disturbance caused by the removal of the concrete washout areas shall be backfilled, repaired, and stabilized to prevent erosion.

Figure II-3.7: Concrete Washout Area with Wood Planks

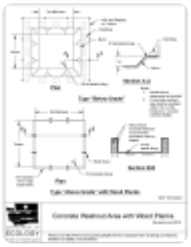

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Figure II-3.8: Concrete Washout Area with Straw Bales

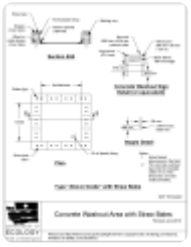

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Figure II-3.9: Prefabricated Concrete Washout Container w/Ramp

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2019 Stormwater Management Manual for Western Washington (2019 SWMMWW)

Publication No.19-10-021

APPENDIX C: SITE INSPECTION FORM

Construction Stormwater Site Inspection Form

Project Name _____ Permit # _____ Inspection Date _____ Time _____

Name of Certified Erosion Sediment Control Lead (CESCL) or qualified inspector if *less than one acre*
Print Name: _____

Approximate rainfall amount since the last inspection (in inches): _____

Approximate rainfall amount in the last 24 hours (in inches): _____

Current Weather Clear ☐ Cloudy ☐ Mist ☐ Rain ☐ Wind ☐ Fog ☐

A. Type of inspection: Weekly ☐ Post Storm Event ☐ Other ☐

B. Phase of Active Construction (*check all that apply*):

Pre Construction/installation of erosion/sediment controls	☐	Clearing/Demo/Grading	☐	Infrastructure/storm/roads	☐
Concrete pours	☐	Vertical Construction/buildings	☐	Utilities	☐
Offsite improvements	☐	Site temporary stabilized	☐	Final stabilization	☐

C. Questions:

1. Were all areas of construction and discharge points inspected? Yes ___ No ___
2. Did you observe the presence of suspended sediment, turbidity, discoloration, or oil sheen Yes ___ No ___
3. Was a water quality sample taken during inspection? (*refer to permit conditions S4 & S5*) Yes ___ No ___
4. Was there a turbid discharge 250 NTU or greater, or Transparency 6 cm or less?* Yes ___ No ___
5. If yes to #4 was it reported to Ecology? Yes ___ No ___
6. Is pH sampling required? pH range required is 6.5 to 8.5. Yes ___ No ___

If answering yes to a discharge, describe the event. Include when, where, and why it happened; what action was taken, and when.

_____

_____

_____

*If answering yes to # 4 record NTU/Transparency with continual sampling daily until turbidity is 25 NTU or less/ transparency is 33 cm or greater.

Sampling Results: Date: _____

Parameter	Method (circle one)	Result			Other/Note
		NTU	cm	pH	
Turbidity	tube, meter, laboratory				
pH	Paper, kit, meter				

Construction Stormwater Site Inspection Form

D. Check the observed status of all items. Provide "Action Required "details and dates.

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
1 Clearing Limits	Before beginning land disturbing activities are all clearing limits, natural resource areas (streams, wetlands, buffers, trees) protected with barriers or similar BMPs? (high visibility recommended)						
2 Construction Access	Construction access is stabilized with quarry spalls or equivalent BMP to prevent sediment from being tracked onto roads?						
	Sediment tracked onto the road way was cleaned thoroughly at the end of the day or more frequent as necessary.						
3 Control Flow Rates	Are flow control measures installed to control stormwater volumes and velocity during construction and do they protect downstream properties and waterways from erosion?						
	If permanent infiltration ponds are used for flow control during construction, are they protected from siltation?						
4 Sediment Controls	All perimeter sediment controls (e.g. silt fence, wattles, compost socks, berms, etc.) installed, and maintained in accordance with the Stormwater Pollution Prevention Plan (SWPPP).						
	Sediment control BMPs (sediment ponds, traps, filters etc.) have been constructed and functional as the first step of grading.						
	Stormwater runoff from disturbed areas is directed to sediment removal BMP.						
5 Stabilize Soils	Have exposed un-worked soils been stabilized with effective BMP to prevent erosion and sediment deposition?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
5 Stabilize Soils Cont.	Are stockpiles stabilized from erosion, protected with sediment trapping measures and located away from drain inlet, waterways, and drainage channels?						
	Have soils been stabilized at the end of the shift, before a holiday or weekend if needed based on the weather forecast?						
6 Protect Slopes	Has stormwater and ground water been diverted away from slopes and disturbed areas with interceptor dikes, pipes and or swales?						
	Is off-site storm water managed separately from stormwater generated on the site?						
	Is excavated material placed on uphill side of trenches consistent with safety and space considerations?						
	Have check dams been placed at regular intervals within constructed channels that are cut down a slope?						
7 Drain Inlets	Storm drain inlets made operable during construction are protected.						
	Are existing storm drains within the influence of the project protected?						
8 Stabilize Channel and Outlets	Have all on-site conveyance channels been designed, constructed and stabilized to prevent erosion from expected peak flows?						
	Is stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes and downstream conveyance systems?						
9 Control Pollutants	Are waste materials and demolition debris handled and disposed of to prevent contamination of stormwater?						
	Has cover been provided for all chemicals, liquid products, petroleum products, and other material?						
	Has secondary containment been provided capable of containing 110% of the volume?						
	Were contaminated surfaces cleaned immediately after a spill incident?						
	Were BMPs used to prevent contamination of stormwater by a pH modifying sources?						

Construction Stormwater Site Inspection Form

Element #	Inspection	BMPs Inspected			BMP needs maintenance	BMP failed	Action required (describe in section F)
		yes	no	n/a			
9 Cont.	Wheel wash wastewater is handled and disposed of properly.						
10 Control Dewatering	Concrete washout in designated areas. No washout or excess concrete on the ground.						
	Dewatering has been done to an approved source and in compliance with the SWPPP.						
	Were there any clean non turbid dewatering discharges?						
11 Maintain BMP	Are all temporary and permanent erosion and sediment control BMPs maintained to perform as intended?						
12 Manage the Project	Has the project been phased to the maximum degree practicable?						
	Has regular inspection, monitoring and maintenance been performed as required by the permit?						
	Has the SWPPP been updated, implemented and records maintained?						
13 Protect LID	Is all Bioretention and Rain Garden Facilities protected from sedimentation with appropriate BMPs?						
	Is the Bioretention and Rain Garden protected against over compaction of construction equipment and foot traffic to retain its infiltration capabilities?						
	Permeable pavements are clean and free of sediment and sediment laden-water runoff. Muddy construction equipment has not been on the base material or pavement.						
	Have soiled permeable pavements been cleaned of sediments and pass infiltration test as required by stormwater manual methodology?						
	Heavy equipment has been kept off existing soils under LID facilities to retain infiltration rate.						

E. Check all areas that have been inspected. ✔

All in place BMPs ☐ All disturbed soils ☐ All concrete wash out area ☐ All material storage areas ☐
All discharge locations ☐ All equipment storage areas ☐ All construction entrances/exits ☐

F. Elements checked "Action Required" (section D) describe corrective action to be taken. List the element number; be specific on location and work needed. Document, initial, and date when the corrective action has been completed and inspected.

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

Sign the following certification:

"I certify that this report is true, accurate, and complete, to the best of my knowledge and belief"

Inspected by: (print) _____ (Signature) _____ Date: _____

Title/Qualification of Inspector: _____

APPENDIX D

SOIL REPORT

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Cowlitz County, Washington

May 24, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

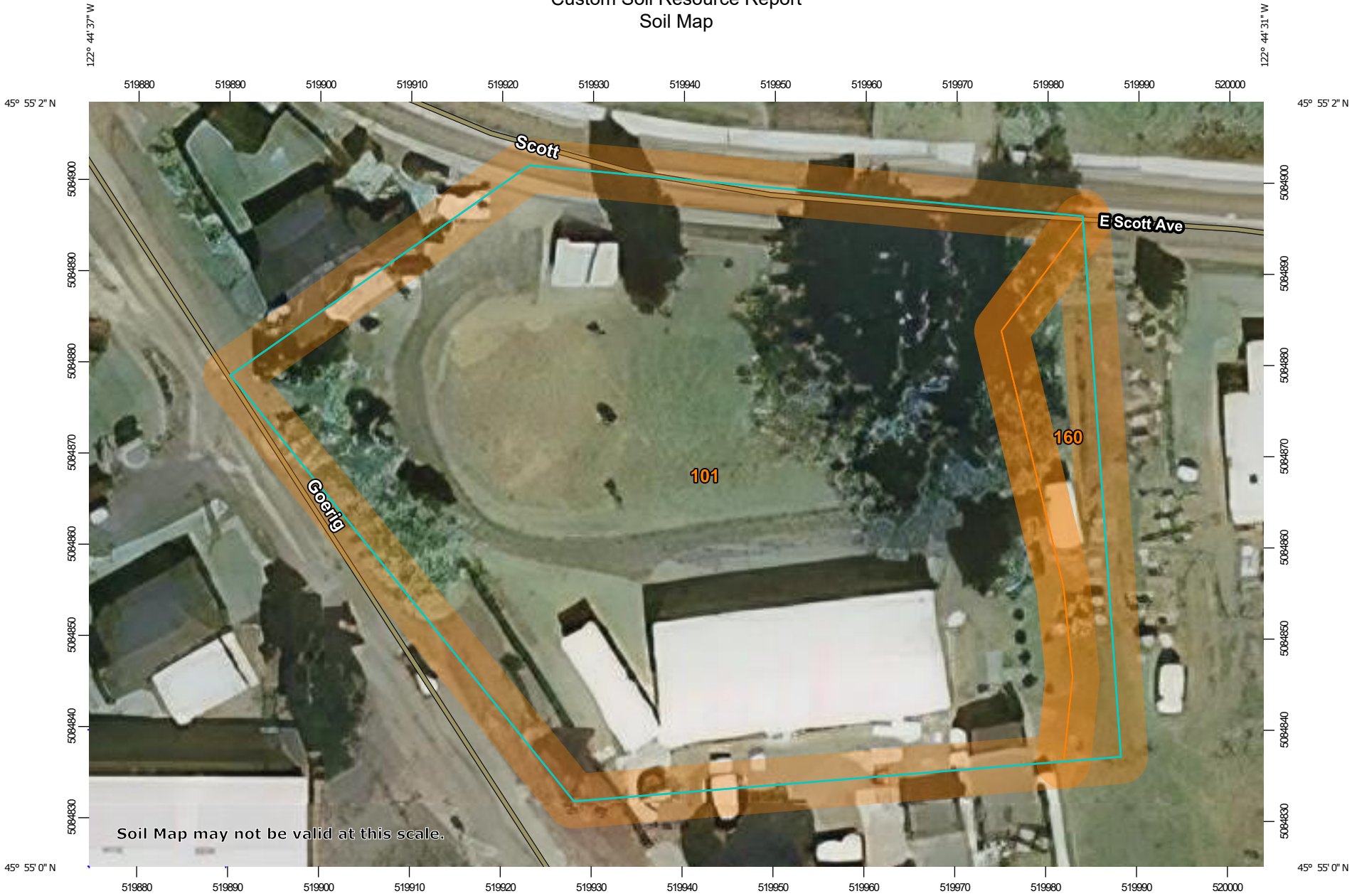
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:591 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

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: Cowlitz County, Washington
Survey Area Data: Version 22, Aug 23, 2021

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

Date(s) aerial images were photographed: Apr 26, 2019—Jun 11, 2019

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
101	Kelso silt loam, 8 to 15 percent slopes	1.2	92.9%
160	Pilchuck loamy fine sand, 0 to 8 percent slopes	0.1	7.1%
Totals for Area of Interest		**1.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Cowlitz County, Washington

101—Kelso silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2f13
Elevation: 50 to 200 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 52 degrees F
Frost-free period: 165 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Kelso and similar soils: 80 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kelso

Setting

Landform: Escarpments, terraces
Parent material: Alluvium

Typical profile

H1 - 0 to 11 inches: silt loam
H2 - 11 to 34 inches: silt loam
H3 - 34 to 60 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F002XA004WA - Puget Lowlands Forest
Forage suitability group: Soils with Moderate Limitations (G002XV602WA)
Other vegetative classification: Soils with Moderate Limitations (G002XV602WA)
Hydric soil rating: No

Minor Components

Hazeldell

Percent of map unit: 5 percent
Hydric soil rating: No

Olympic

Percent of map unit: 5 percent

Hydric soil rating: No

160—Pilchuck loamy fine sand, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2f45
Elevation: 10 to 50 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 195 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Pilchuck and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pilchuck

Setting

Landform: Flood plains
Parent material: Alluvium

Typical profile

H1 - 0 to 12 inches: loamy fine sand
H2 - 12 to 36 inches: fine sand
H3 - 36 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: NoneRare
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: F002XA005WA - Puget Lowlands Moist Forest
Forage suitability group: Droughty Soils (G002XV402WA)
Other vegetative classification: Droughty Soils (G002XV402WA)
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf