CORE STATES GROUP

2/3/26

STORMWATER SITE PLAN

Normandy Heights – Puyallup, WA

PREPARED BY

Brent Kunz, P.E.

PREPARED FOR	CLIENT ADDRESS
RM Homes	2913 5th Ave NE, Suite #201 Puyallup, WA 98372

SITE ADDRESS	PROJECT NO.	DATE	JURISDICTION
2007 Shaw Rd Puyallup, WA	12663	02/03/2026	City of Puyallup

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7.0 SPECIAL REPORTS AND STUDIES

7.1 "Geotechnical Engineering Study Proposed Normandy Heights" prepared by Earth Solutions NW LLC, Dated November 9, 2006, updated May 03, 2022

7.2 “Groundwater Monitoring Program Results” prepared by Earth Solutions NW LLC, dated August 9, 2022

7.3 “Response to Comments” prepared by Earth Solutions NW LLC, dated March 4, 2024.

7.4 “Wetland and Fish and Wildlife Habitat Assessment Report” prepared by Soundview Consultants LLC, dated February 21, 2024, revised September 17, 2025

7.5 "Normandy Retention Tree Assessment" Prepared by Sound Urban Forestry LLC, dated May 16, 2022

8.0 OTHER PERMITS

9.0 OPERATIONS AND MAINTENANCE MANUAL

10.0 CONSTRUCTION COST ESTIMATE

Tab 1.0

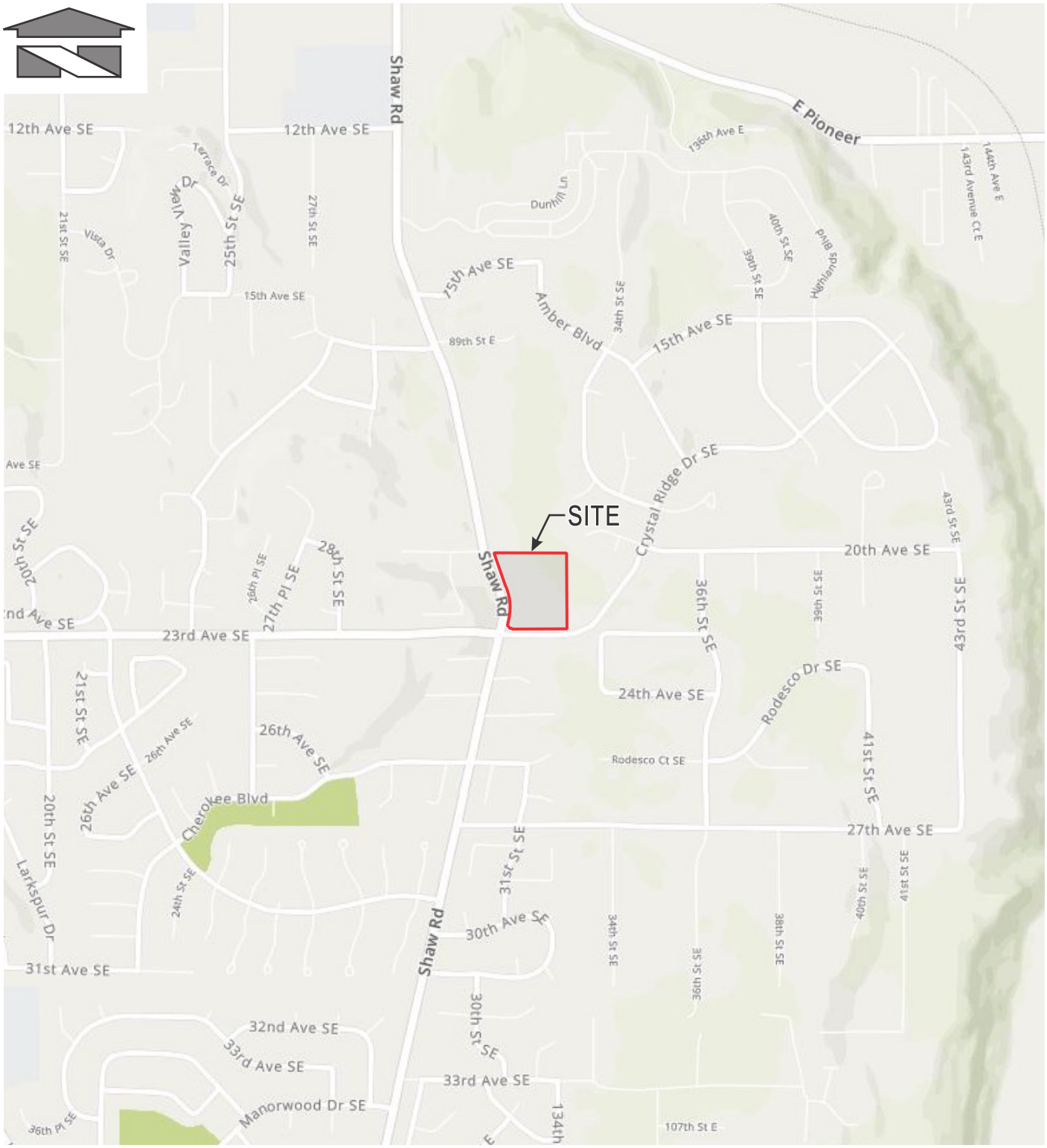
1.0 PROJECT OVERVIEW

The proposed Normandy Heights plat will develop approximately 7.35 acres of land within a portion of the southwest quarter of the southeast quarter of Section 35, Township 20 N, Range 4 E, Willamette Meridan, Pierce County, Washington. The site is located on Tax Parcel 0420354039, at 2007 Shaw Road E.

This project proposes subdividing the existing parcel into 25 single-family residential lots, with critical area and storm drainage tracts. The project site will be accessed from Crystal Ridge Dr SE. Within the development approximately 740 feet of new public roadway is proposed to provide access in accordance with City of Puyallup standards. The onsite roads will be completed with paving, concrete curb and gutter, landscaping, and sidewalks on both sides. In addition, the project will provide domestic water service, sanitary sewer, stormwater mitigation, and landscaping.

A stormwater detention vault is proposed to mitigate stormwater onsite. The drainage facilities have been sized to match the mitigated discharge durations to the predeveloped discharge durations for the range of predeveloped peak discharge rates from 50 percent of the 2-year up to the full 50-year storm event. A proprietary media filter drain with Ecology's GULD approval will provide water quality treatment.

The project methodology and design criteria are based on the City of Puyallup Stormwater Management Design Standards and the 2024 Department of Ecology Stormwater Management Manual for Western Washington (24SWMMWW).



REFERENCE: MapQuest (2022)

Scale: Horizontal: **N.T.S.** Vertical: **N/A**	For: Normandy Heights Puyallup, Washington	Job Number 12663
Barghausen Consulting Engineers, Inc. 18215 72nd Avenue South Kent, WA 98032 425.251.6222 barghausen.com	Title: VICINITY MAP	FIGURE 1
		DATE: 04/19/22

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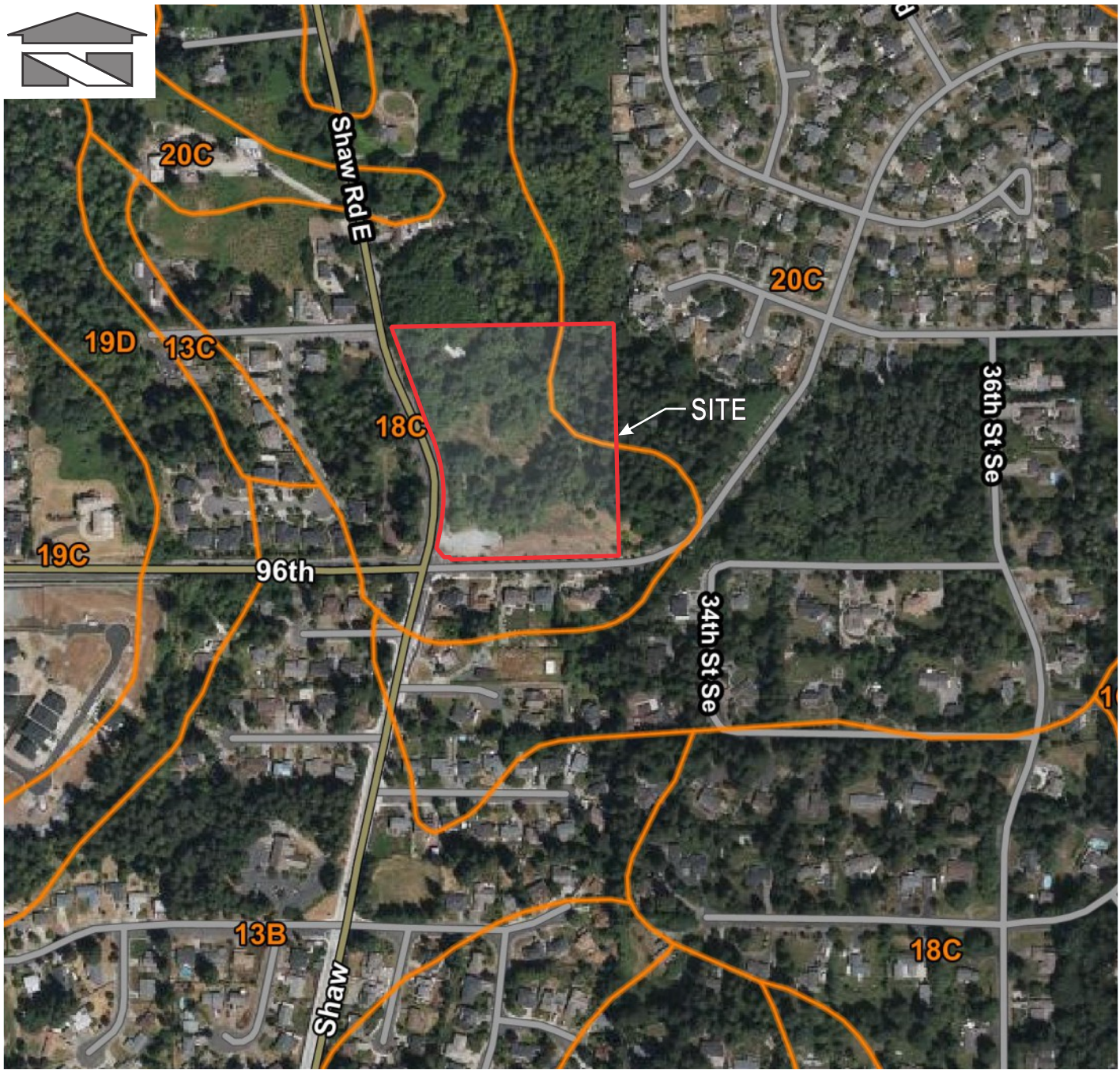

REFERENCE: USDA, Natural Resources Conservation Service

LEGEND:	HSG
18C = Indianola loamy sand, 5-15% slopes	A
20C = Kitsap silt loam, 8-15% slopes	C/D

Scale:
Horizontal: **N.T.S.** Vertical: **N/A**

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Title:
SOIL SURVEY MAP

FIGURE 2

DATE: 04/19/22

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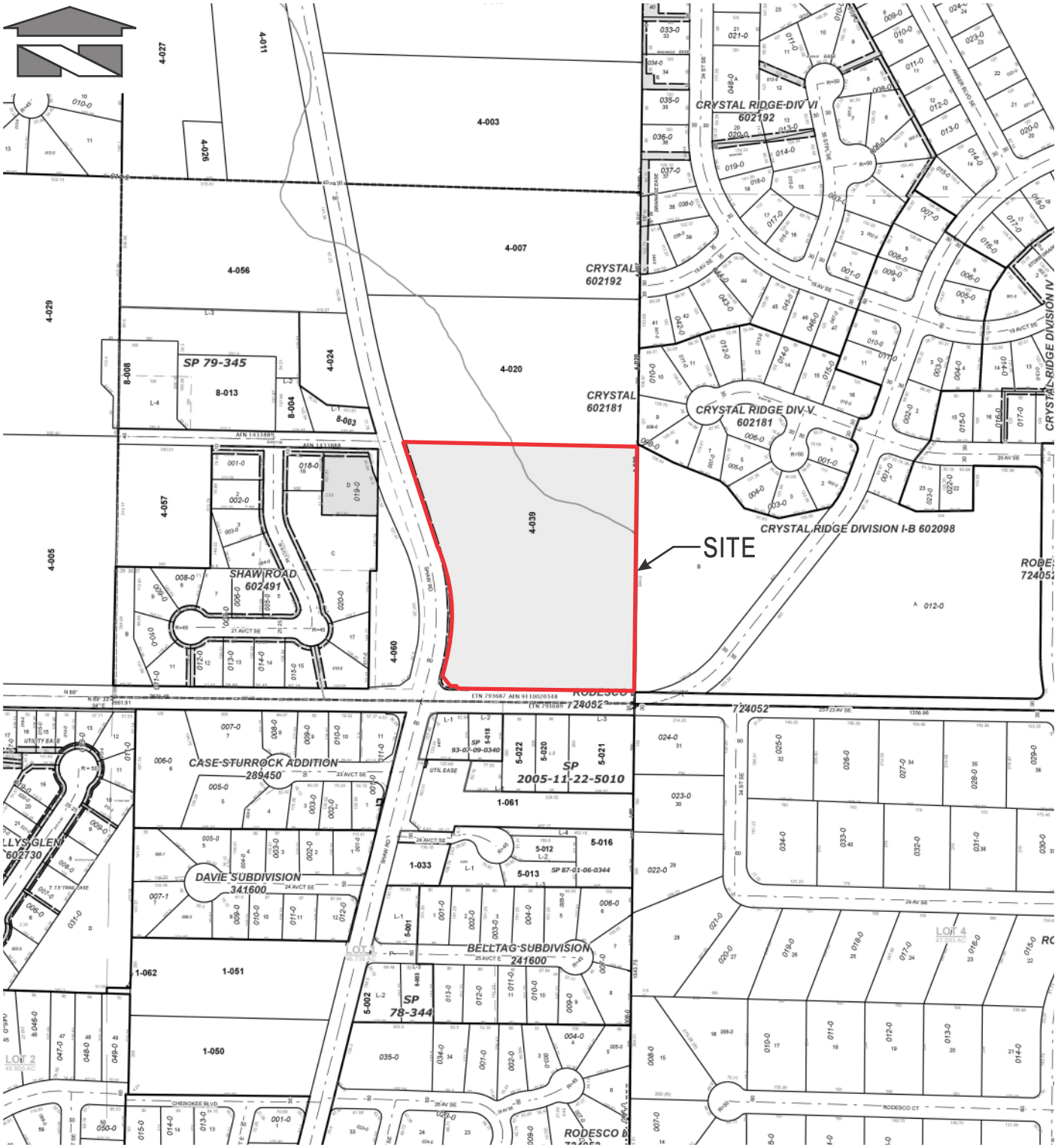

REFERENCE: Pierce County Department of Assessments (Feb. 2021)

Scale:
Horizontal: **N.T.S.** Vertical: **N/A**

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Normandy Heights
Puyallup, Washington

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12663

Title:
ASSESSOR MAP

FIGURE 3

DATE: 04/19/22

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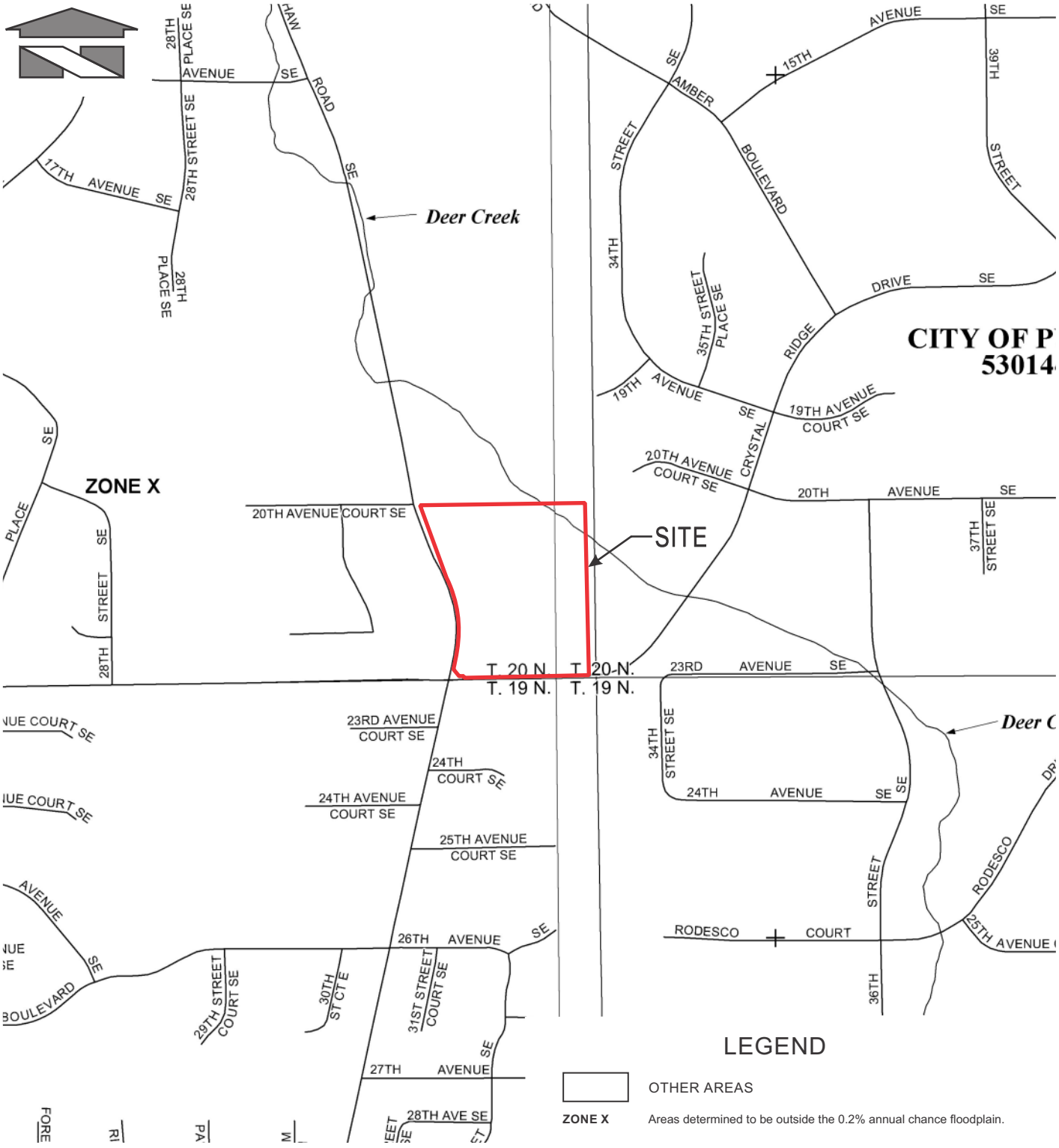
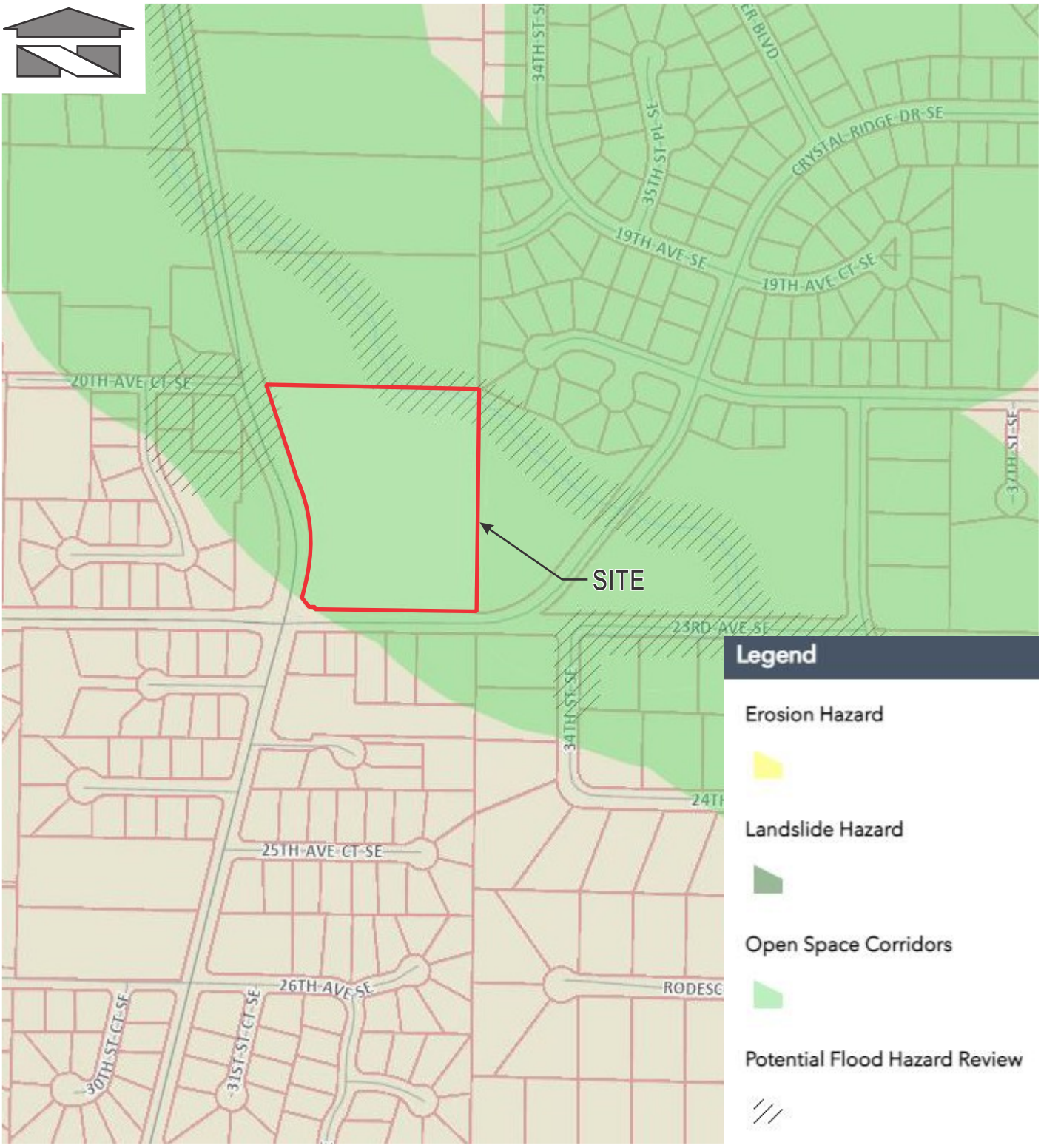


REFERENCE: Federal Emergency Management Agency (Portion of Map 53053C0342E, March 2017)

Scale: Horizontal: N.T.S. Vertical: N/A	For: Normandy Heights Puyallup, Washington	Job Number 12663
Barghausen Consulting Engineers, Inc. 18215 72nd Avenue South Kent, WA 98032 425.251.6222 barghausen.com	Title: FEMA MAP	FIGURE 4
		DATE: 04/19/22

P:\12000s\12663\exhibit\graphics\12663 fema.cdr



REFERENCE: Pierce County PublicGIS

Scale:
Horizontal: **N.T.S.** Vertical: **N/A**

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18215 72nd Avenue South
Kent, WA 98032
425.251.6222 **barghausen.com**

For:
Normandy Heights
Puyallup, Washington

Title:
SENSITIVE AREAS MAP

Job Number
12663

FIGURE 5

DATE: 04/19/22

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Tab 2.0

2.0 ANALYSIS OF THE MINIMUM REQUIREMENTS

Summary of compliance with Minimum Requirements of the 2024SWMMWW. The developed project will add over 5,000 square feet of new impervious surfacing, therefore minimum requirements #1-#9 apply.

Minimum Requirement No. 1*: Preparation of Stormwater Site Plans.*

Response: This document hereby meets Minimum Requirement No. 1.

Minimum Requirement No. 2*: Construction Stormwater Pollution Prevention (SWPP)*

Response: Please refer to the Erosion and Sediment Control Plan for the Construction Stormwater Pollution Prevention Plan (SWPPP) prepared for this project. A copy of the SWPPP will be provided with the final version of this report.

Minimum Requirement No. 3*: Water Pollution Source Control for New Development.*

Response: All Known, available, and reasonable Source Control BMPs will be applied to this project in accordance with those applicable to residential development.

Minimum Requirement No. 4*: Preservation of natural drainage systems and outfalls, and provisions of off-site mitigation.*

Response: The developed site will be installing a detention facility to match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The pre-developed condition to be matched is the forested land cover. The detention facility will drain to the on-site wetland.

Minimum Requirement No. 5*: On-site Stormwater Management.*

Response: The project will consider all applicable BMPs in the order listed in List #2, per the requirements of I-3.4.5 of the 24SWMMWW (Table I-3.2).

Lawn and Landscape Areas:

- Soil Preservation and Amendment. All disturbed areas that are not converted to impervious areas will apply soil amendment per BMP T5.13.

Roof Areas:

- Full Dispersion was deemed infeasible due to unfavorable soil and infiltration conditions and overall lack of developable area.

- Bioretention was deemed infeasible due to lack of adequate horizontal area for required footprint.

- Downspout dispersion was deemed infeasible due to lack of adequate horizontal area for required footprint.

- Perforated Stub-Out Connections are deemed infeasible due to unfavorable soil and infiltration conditions and overall lack of developable area.

Other Hard Surface:

- Dispersion was deemed infeasible due to limited flow paths.

- Permeable Pavement was deemed infeasible due to the predominance of low permeability and significant variability of on-site soil conditions. Additionally, the use of on-site soils as fill material or imported borrow for infiltration-based LID BMPs is impractical, as the level of selective screening, quality control, and compactive effort required during construction cannot reliably achieve consistent performance. For additional information, please refer to the Geotechnical information provided in section 7 of this report.

- Bioretention was deemed infeasible due to low permeability of the onsite soils as indicated in the Geotechnical Report.

- Sheet Flow Dispersion was deemed infeasible for driveway areas since controlled dispersion flow paths are not available.

Minimum Requirement No. 6*: Run-off Treatment Requirements.*

Response: This new development project meets thresholds which require runoff treatment. In the northeast corner of the site is the downstream receiving water which is Upper Deer Creek. Pursuant to the step-by-step process as per III-1.2, 24SWMMWW, the receiving water requires Basic Treatment. For this project, a Contech StormFilter has been selected for runoff treatment. This storm filter is a media type drain with Ecology's GULD approval for basic and phosphorous treatment.

Minimum Requirement No. 7*: Flow Control.*

Response: The project will be providing a detention facility to match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow.

Minimum Requirement No. 8: Wetlands Protection.

Response: A site investigation identified one wetland onsite (Wetland A) within the northeast corner of the site. Wetland A is classified as a Category III wetland with a habitat score of 5. In accordance with 24SWMMWW, the project will provide general protection and protection from pollutants as explained in these minimum requirements. General protection measures include maintaining a wetland buffer to preserve native vegetation. The project will also comply with all applicable federal and state regulations governing physical impact to the wetland area.

Minimum Requirement No. 9*: Operations and Maintenance Manual.*

Response: An O&M manual will be included with this report.

Figure I-3.1: Flow Chart for Determining Requirements for New Development

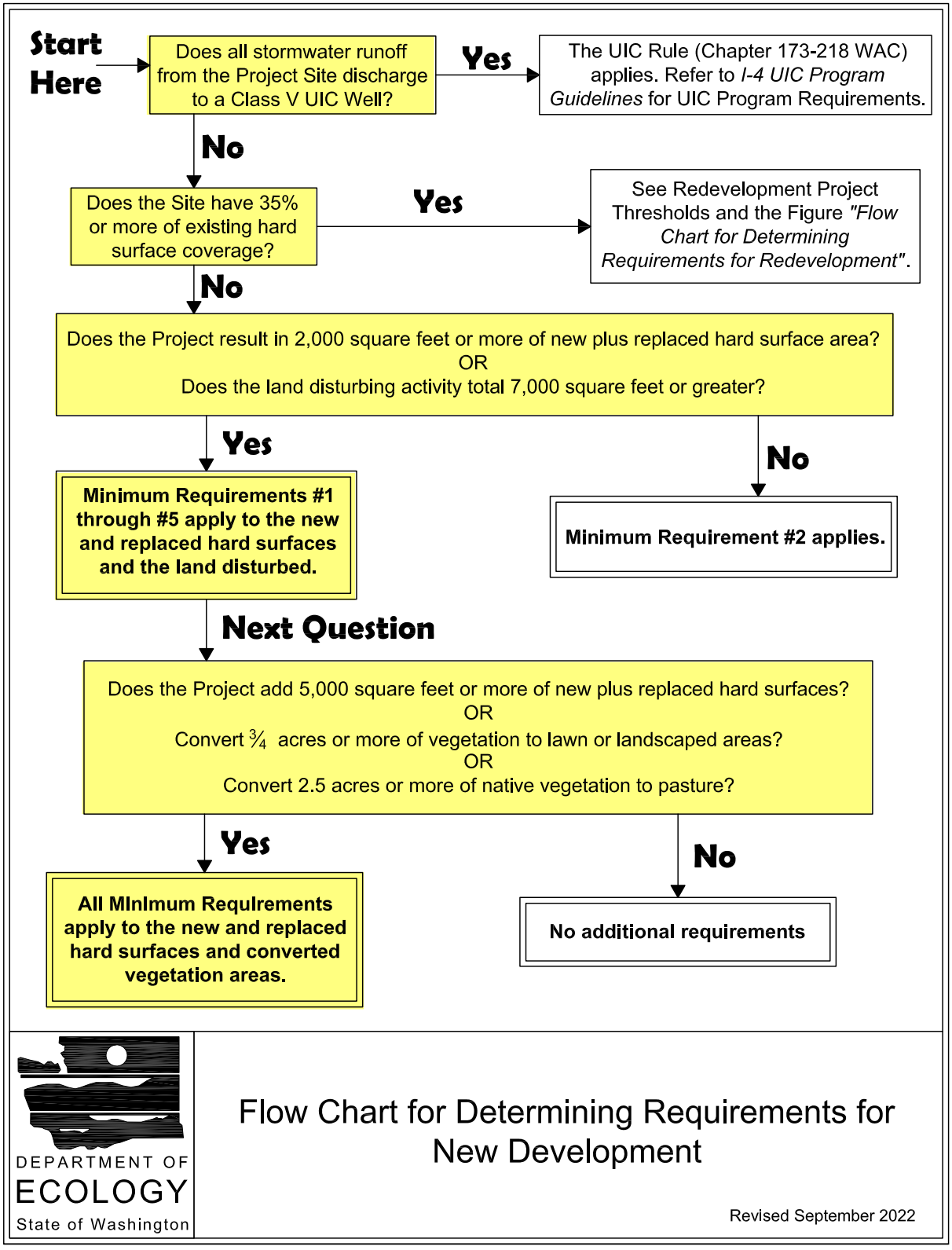


Figure I-3.5: Flow Chart for Determining Wetland Protection Level Requirements

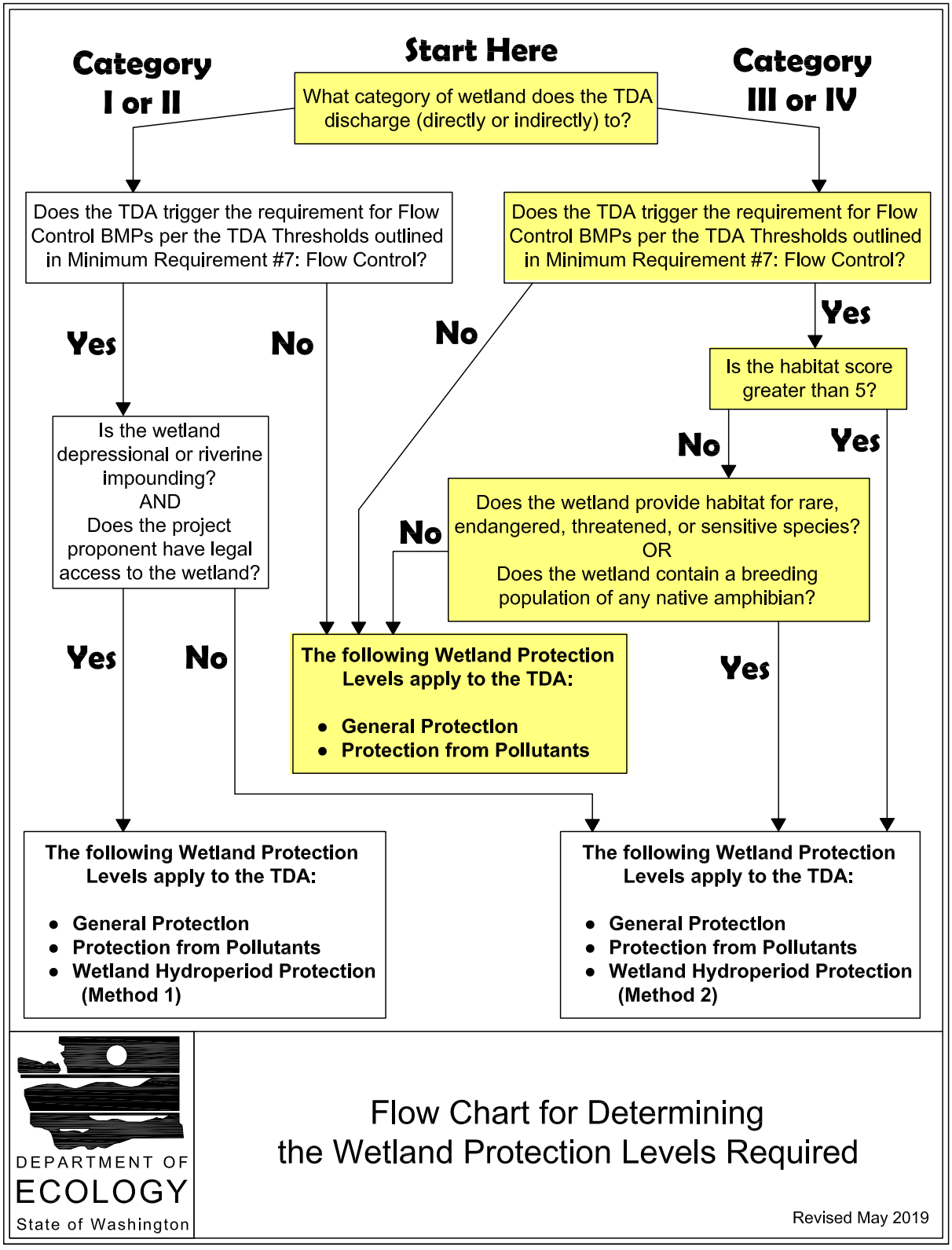
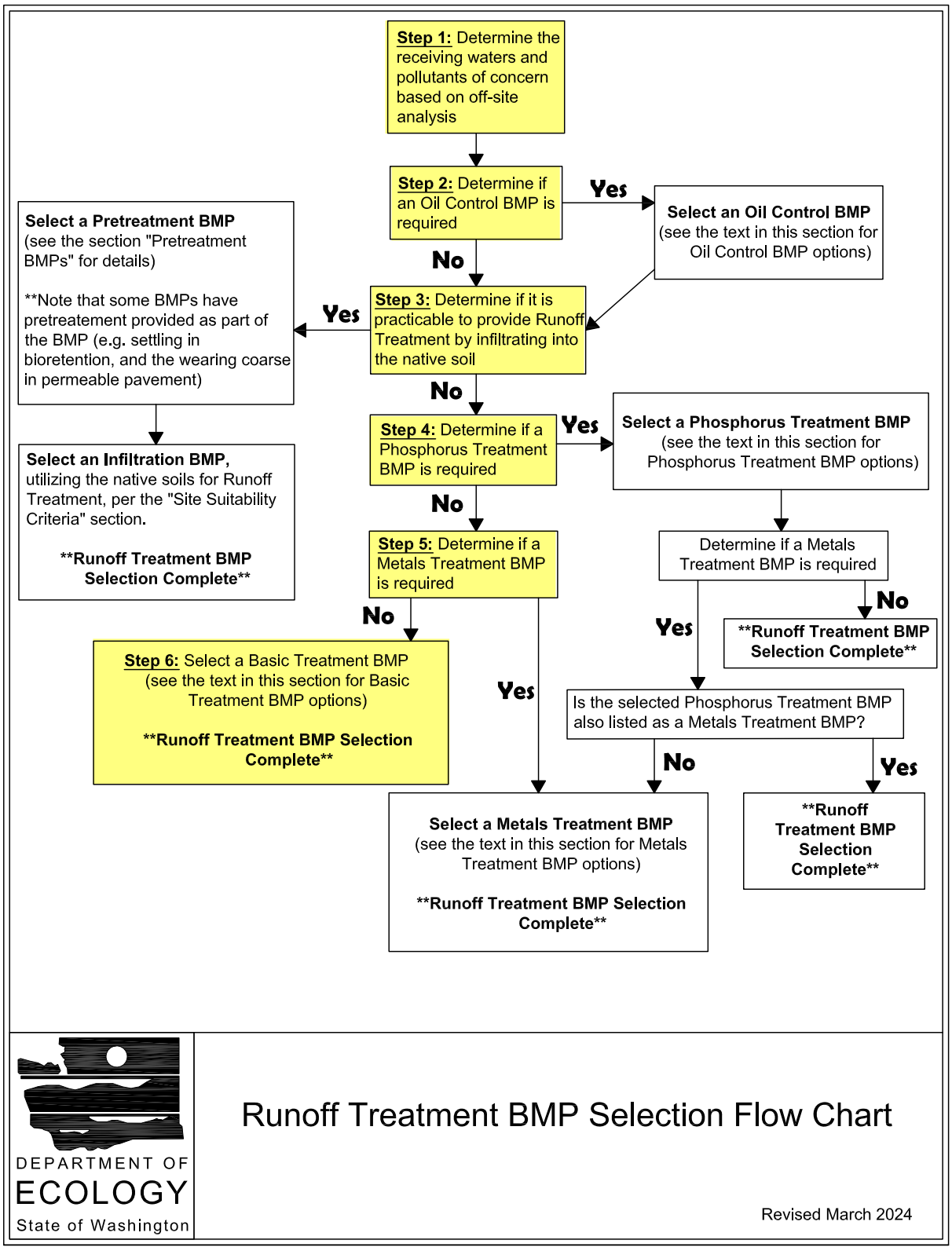


Figure III-1.1: Runoff Treatment BMP Selection Flow Chart



Tab 3.0

3.0 EXISTING CONDITIONS

The site is comprised of one existing parcel totaling approximately 7.35 acres. The site is bordered by Shaw Rd E to the west, Crystal Ridge Dr SE to the south, and undeveloped property to the north and east. The site is mostly undeveloped with thick vegetation and trees; there is one dilapidated single-family house with associated hardscapes and outbuildings.

Site topography is moderate to steep with 86 feet of vertical relief sloping from the southwest corner to the northeast corner at grades ranging from 2% to 40%. Onsite elevations range from 368 to 282. Critical areas of steep slopes are isolated and primarily contained within proposed Tract C and D, which will not be modified with the proposed development. The proposed development will incorporate steep slope buffer setbacks around on-site critical areas pursuant with PMC 21.06.1240.1a(iii).

A site investigation identified one wetland onsite (Wetland A) within the northeast corner of the site. Wetland A is classified as a Category III wetland with a habitat score of 5. The wetland is subject to a standard 80-foot buffer based on the proposed high intensity land use per PMC 21.06.930(2)(d). One stream (Stream Z, locally know as Upper Deer Creek) was identified on the northeastern portion of the property. The stream is considered a perennial, non-fish bearing (Type III) stream and is subject to a 100-foot buffer per PMC 21.06.1050(2)(c). An additional 10-foot building setback is required from the outer edge of all critical area buffers per PMC 21.06.840(1). For additional information, please refer to the wetland study in section 7.

The NRCS Web Soil Survey maps soil across the site as Indianola loamy sand and Kitsap silt loam. Test pit exploration onsite found native soils were characterized poorly graded sand with variable gravel and fines contents and poorly graded gravel with variable fines contents. Groundwater was not encountered at the test pit locations. Additional groundwater monitoring was performed with a focus on the proposed stormwater tract and no groundwater was observed at any of the well locations over the monitoring period. Due to variable soil conditions and existing slope features across the site, infiltration is not recommended.

Tab 4.0

4.0 OFFSITE ANALYSIS

4.1 Upstream Analysis

Based on the project topographic survey, the project site does not receive significant stormwater runoff from upstream drainage areas. The only exception is the eastern half of Shaw Road, which currently drains onto the site. Under post-development conditions, this will change, as Shaw Road will no longer discharge runoff to the site.

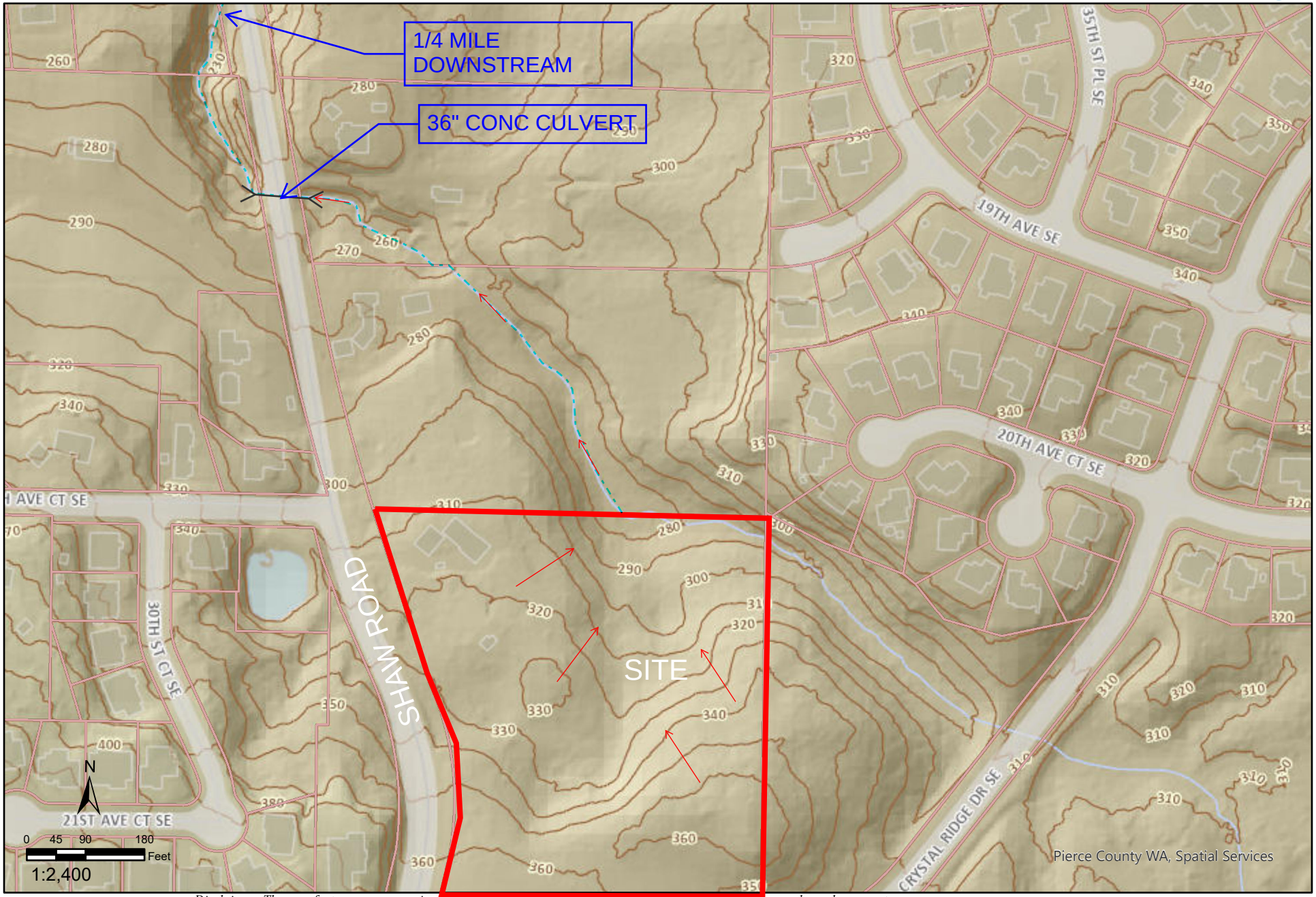
Crystal Ridge Drive contains a conveyance system that captures stormwater runoff from the roadway. All other adjacent properties are either downgradient of the project site or graded to drain away from the site.

4.2 Downstream Analysis

The project lies within the Deer Creek drainage basin, formerly the Shaw Road drainage basin, more specifically the Upper Deer Creek subbasin. City of Puyallup Drainage Basin Maps have been included following this section.

Stormwater runoff flows towards the northeast corner of the site where it enters Wetland A and Upper Deer Creek. The stream meanders northerly, roughly following Shaw Road through green space and man-made ditches. The stream flows for approximately two miles before ultimately reaching the Puyallup River.

Normandy Heights Downstream Map



Disclaimer: The map features are approximate and have not been surveyed. Additional features not yet mapped may be present.
Pierce County assumes no liability for variations ascertained by formal survey.

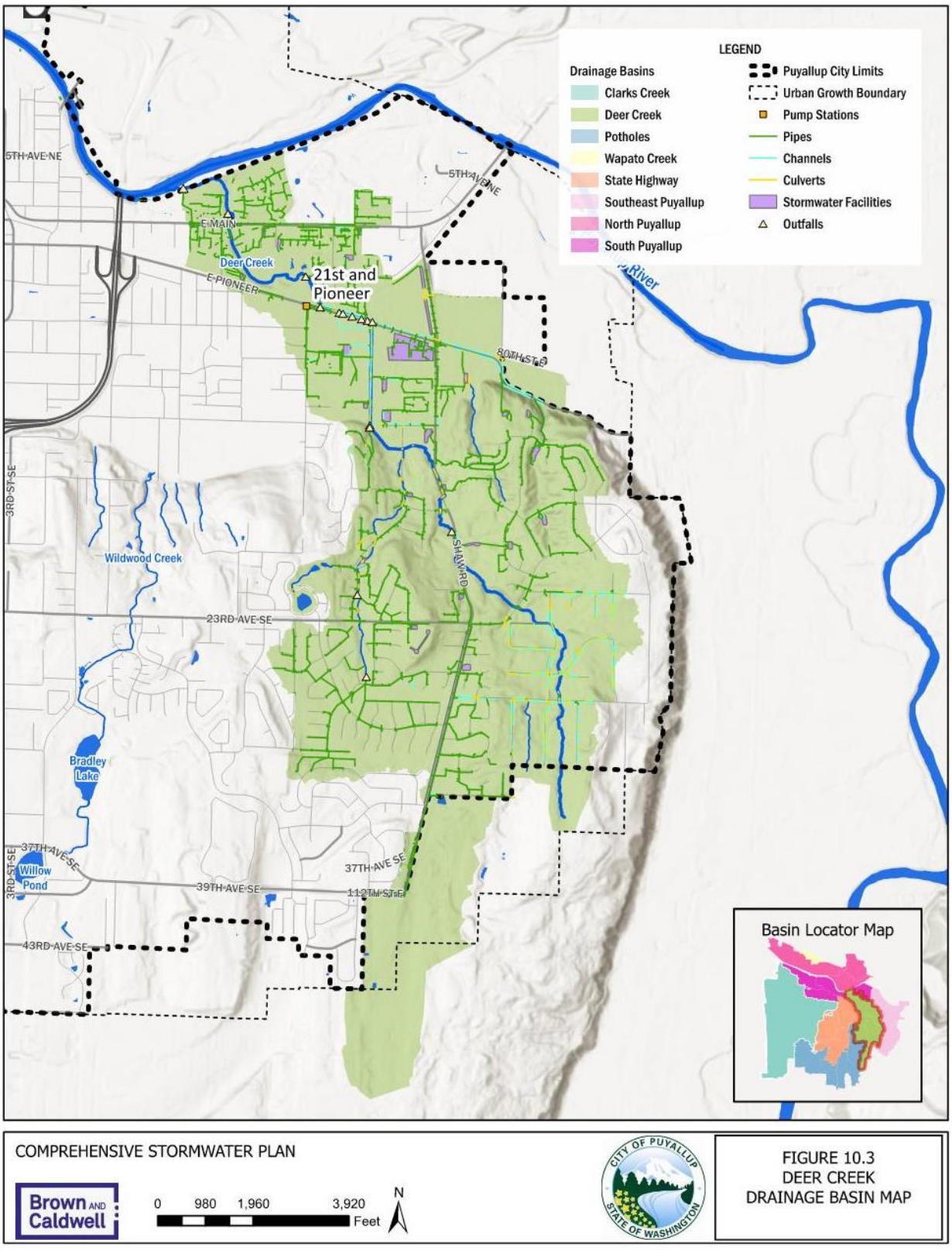
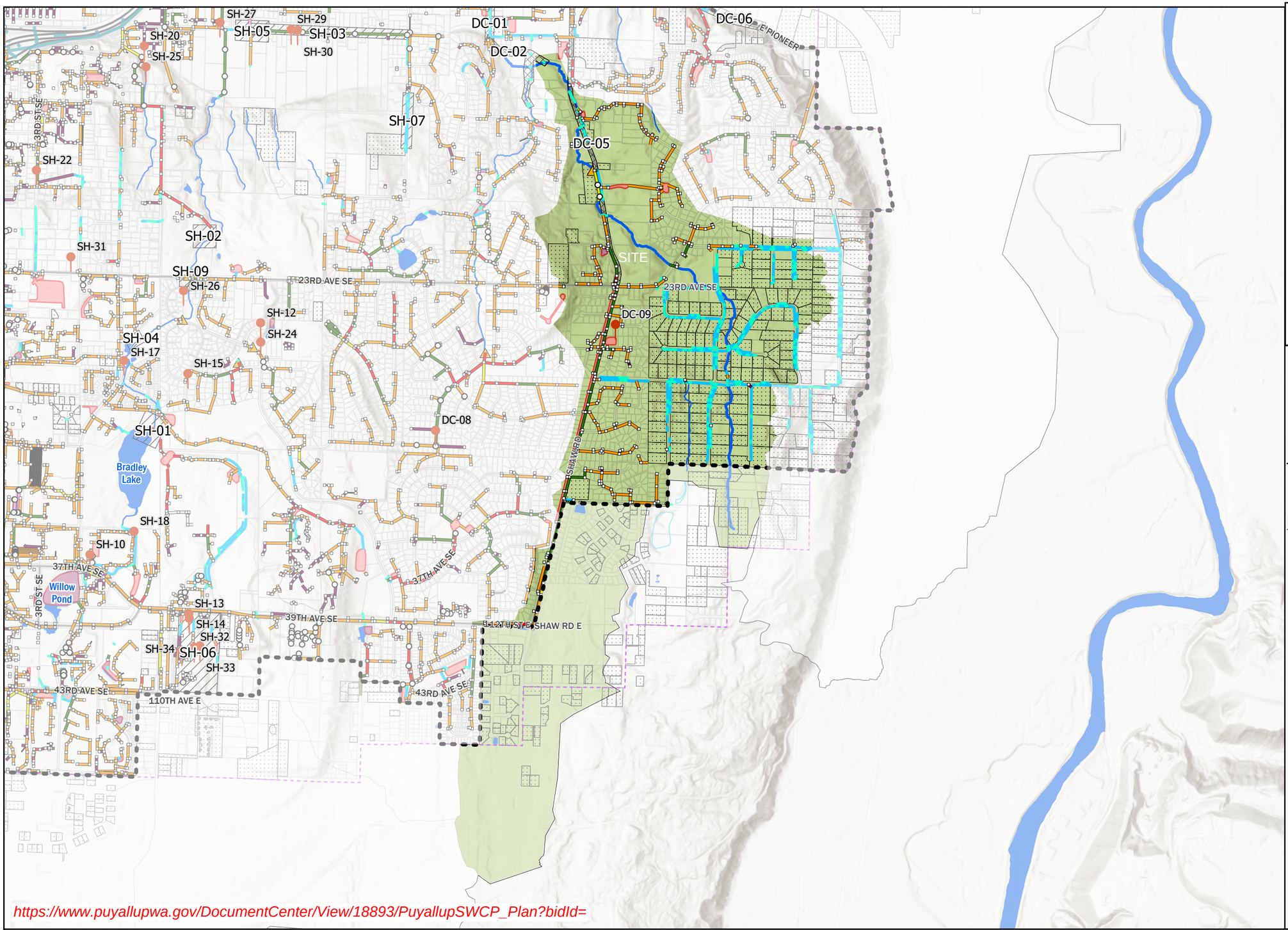
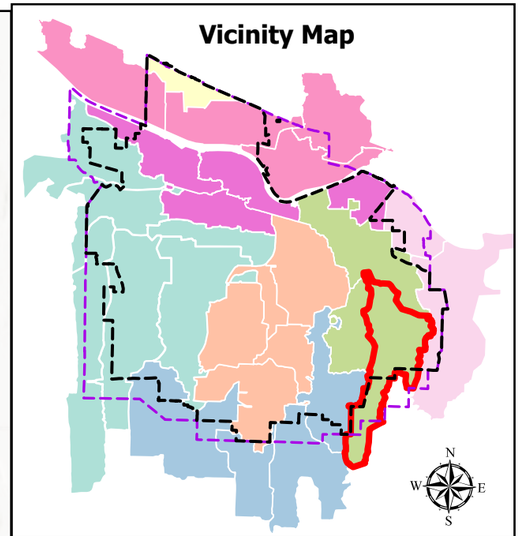


Figure 10-3. Deer Creek drainage basin map

https://www.puyallupwa.gov/DocumentCenter/View/18893/PuyallupSWCP_Plan?bidId=





- Puyallup City Limits
- Urban Growth Boundary
- Drainage Subbasins

Stormwater Infrastructure

- Manholes
- Inlets

Pipe Size by Diameter

- < 8 in
- 8 - <12 in
- 12 - <18 in
- 18 - <24 in
- 24 - <36 in
- 36 - <48 in
- 48 - <60 in
- > 60 in
- unknown
- WSDOT Pipes
- Culverts
- Channels
- Stormwater Facilites
- Stormwater Pump Stations
- Outfalls
- Water Body
- Major Creeks
- Triburaries
- Wetlands
- Major Road/Arterial
- Parcels
- Parcels with Septic

SWCP CIP

- Priority
- Second Tier
- Low

Brown AND Caldwell

N W E S

0 1,000 2,000 4,000 Feet

Basin: Deer Creek
Subbasin: Upper Deer Creek

CITY OF PUYALLUP STATE OF WASHINGTON

Stormwater Comprehensive Plan
City of Puyallup, Washington
December 2024

Figure: DC - UDC

Tab 5.0

5.0 PERMANENT STORMWATER CONTROL PLAN

5.1 Existing Site Hydrology

Site topography suggests a ridge line in the SE quadrant of the project divides the site into two subbasins.

Basin 1: is approximately 5.82 acres and contains the majority of the proposed development area as well as the Shaw Road improvements. Runoff from Shaw Road flows east into Basin 1 and then sheet flows towards the NE quadrant of the project site, discharging into the Wetland A and Upper Deer Creek.

Basin 2: is approximately 0.93 ac and is located in the SE quadrant of the project site. Runoff from this basin sheet flows east into a green space tract within the Crystal Ridge plat. From the tract, runoff flows north before discharging to Upper Deer Creek. Basin 1 and 2 converge within a quarter mile of the site and therefore are considered as one threshold discharge area.

5.2 Developed Site Hydrology

This project will include curb, gutter, sidewalk, and a planter strip within the public right-of-way. Construction will provide access to 25 single family residential lots. Basin 1 and Basin 2 as described in the previous section, will discharge to the proposed detention vault. The vault will release flows near the northeast corner of the plat through a level spreader, thereby preserving the natural discharge location.

Grading and stabilization along Shaw Rd will be completed to accommodate future City improvements and prevent runoff from entering the site. The detention vault has been sized to account for bypassing this area.

5.3 Western Washington Hydrology Model (WWHM)

The detention facility and a control structure were sized using WWHM2012. Please refer to the drainage basin maps and hydrology calculations attached at the end of this section for more information. The detention vault will require a storage volume of 61,661 cubic feet.

Each lot is assumed to have 3,000 sf impervious surface. Private roof drainage (Lots 1-12 and 18-25) and retaining wall drainpipe will be tight lined in a separate system which will flow directly into the proposed detention vault. Roof drainage from Lots 13-17 will connect to the conveyance system within the road right-of-way.

5.4 Water Quality Analysis

A Contech StormFilter has been selected to provide Basic Water Quality treatment.

Per the City of Puyallup 2025 Comprehensive Stormwater Plan, Deer Creek regularly exceeds the Total Maximum Daily Load (TMDL) of fecal coliforms. As

this project does not propose the installation of septic drain fields, Deer Creek is not expected to be impacted as a result of this project.

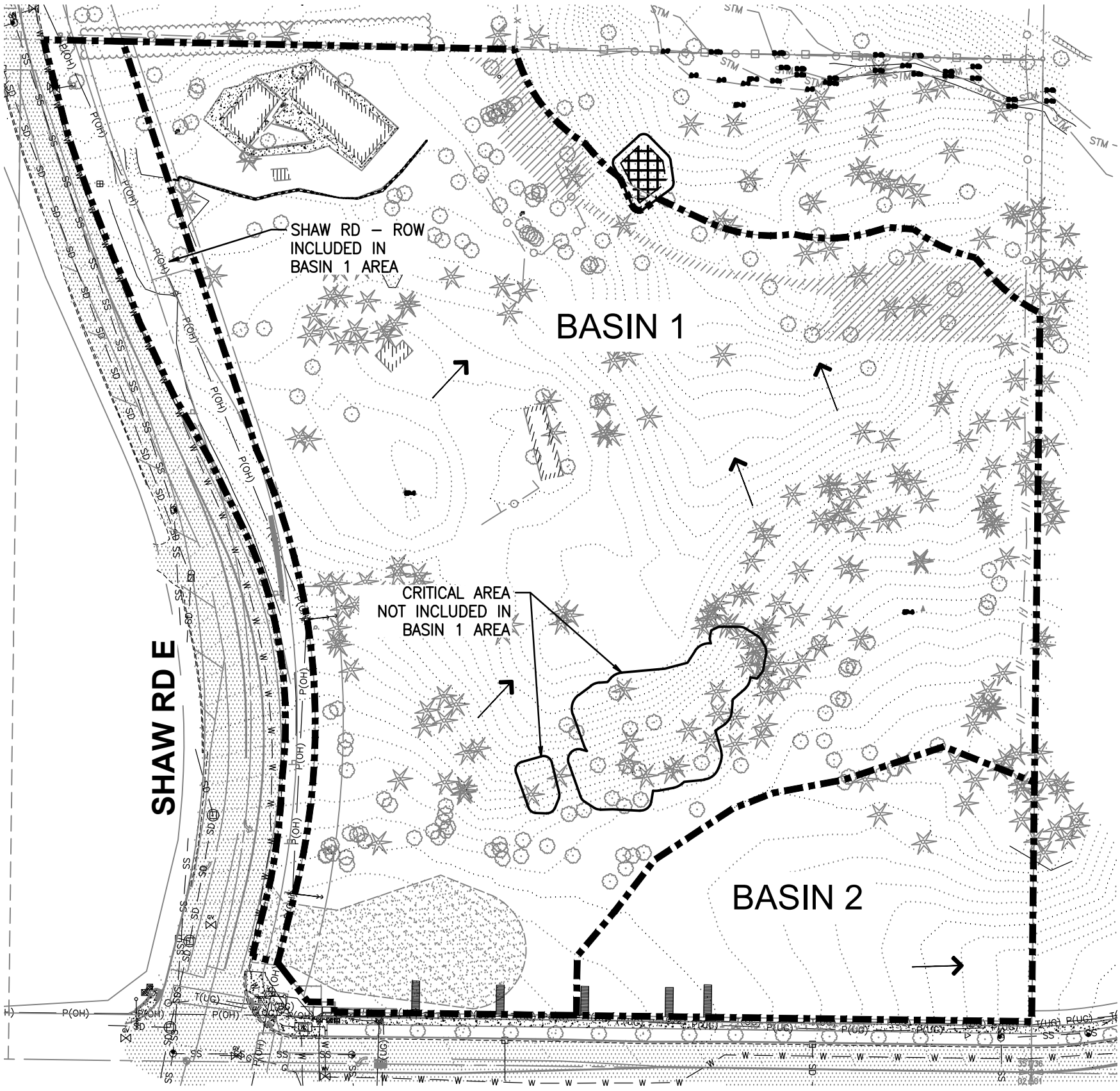
5.5 Conveyance System Analysis

The proposed conveyance system was sized using the Rational Method based on the Pierce County 25-year storm event. Calculations are provided within this section.

N

0 40' 80' 160'

SCALE: 1"=80'



BASIN 1	
BASIN 1 AREA	5.58 AC
C.A.	0.23 AC
SHAW RD	0.47 AC
TOTAL AREA	5.82 AC

BASIN 2	
TOTAL AREA	0.93 AC

No.	Date	By	Ckd.	Appr.	Revision

Job Number 12663

Sheet 1 of 1

Barghausen Consulting Engineers, LLC.
18215 72nd Avenue South
Kent, WA 98032
425.251.6222 barghausen.com

Designed BGK
Drawn BGK
Checked BGK
Approved CMV
Date 9/8/25

Scale:
Horizontal 1"=80
Vertical N/A

Title: **EXISTING BASIN MAP**

For: *NORMANDY HEIGHTS*

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POSTDEVELOPED BASIN MAP EXHIBIT

N

0 20' 40' 80'

SCALE: 1"=40'

BASIN "A" WWHM INPUT TABLE

AREA NAME	COLOR	AREA (AC)	PERVIOUS (AC)			IMPERVIOUS (AC)				
			PASTURE			CONCRETE		ASPHALT		ROOF
			FLAT	MOD.	STEEP	FLAT	MOD.	FLAT	MOD.	FLAT
TRACT A		0.26	0.02	0.09	0.15	–	–	–	–	–
TRACT B		0.15	–	–	–	–	–	0.11	0.04	–
TRACT E		0.10	0.01	0.00	0.09	–	–	–	–	–
ROADS		1.03	0.04	0.09	0.02	0.06	0.12	0.26	0.44	–
LOTS		3.99	1.32	0.23	0.72	–	–	–	–	1.72
TOTAL		5.53	1.39	0.41	0.98	0.06	0.12	0.37	0.48	1.72

BYPASS BASIN WWHM INPUT TABLE

AREA NAME	COLOR	AREA (AC)	PERVIOUS (AC)			IMPERVIOUS (AC)	
			PASTURE			ASPHALT	
			FLAT	MOD.	STEEP	FLAT	MOD.
TRACT D		0.51	0.21	0.04	0.22	0.02	0.02
ROW		0.71	0.12	0.33	0.14	0.12	–
TOTAL		1.22	0.33	0.37	0.36	0.14	0.02

No.	Date	By	Ckd.	Appr.	Revision

Title: POSTDEVELOPED BASIN MAP EXHIBIT

For: RM HOMES
2915 5TH AVE NE
PUYALLUP, WA 98372

Scale: Horizontal 1"=40' Vertical

Designed BGK Drawn BGK Checked BGK Approved CMV Date 9/8/25

Barghausen Consulting Engineers, LLC.
18215 72nd Avenue South
Kent, WA 98032
425.251.6222 barghausen.com

Job Number 12663

Sheet 1 of 1

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5.6 CALCULATIONS

WWHM2012

PROJECT REPORT

Stormwater Detention Vault

General Model Information

WWHM2012 Project Name: Normandy Vault

Site Name:	Normandy Heights
Site Address:	
City:	
Report Date:	1/27/2026
Gage:	42 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	0.000 (adjusted)
Version Date:	2025/05/13
Version:	4.3.2

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Forest, Flat	0.73
C, Forest, Mod	2.81
C, Forest, Steep	3.21
Pervious Total	6.75

Impervious Land Use	acre
Impervious Total	0
Basin Total	6.75

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	1.39
C, Pasture, Mod	0.41
C, Pasture, Steep	0.98
Pervious Total	2.78

Impervious Land Use	acre
ROADS FLAT	0.37
ROADS MOD	0.48
ROOF TOPS FLAT	1.72
SIDEWALKS FLAT	0.06
SIDEWALKS MOD	0.12
Impervious Total	2.75
Basin Total	5.53

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
Vault 1	Vault 1	

Basin 2

Bypass:	Yes
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	0.33
C, Pasture, Mod	0.37
C, Pasture, Steep	0.36
Pervious Total	1.06

Impervious Land Use	acre
ROADS FLAT	0.14
ROADS MOD	0.02
Impervious Total	0.16
Basin Total	1.22

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Vault 1

Width: 17.5 ft.
Length: 243 ft.
Depth: 15 ft.
Discharge Structure
Riser Height: 14.5 ft.
Riser Diameter: 18 in.
Orifice 1 Diameter: 0.750 in. Elevation:0 ft.
Orifice 2 Diameter: 0.750 in. Elevation:2.5 ft.
Orifice 3 Diameter: 2.600 in. Elevation:12 ft.
Element Outlets:
Outlet 1 Outlet 2
Outlet Flows To:

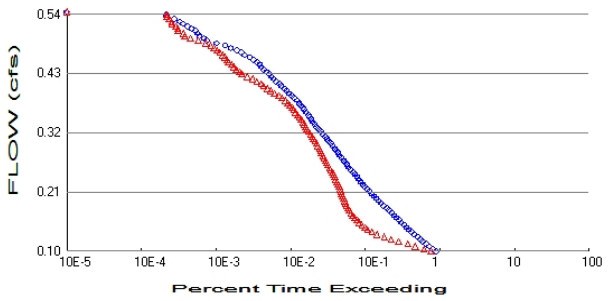
Vault Hydraulic Table

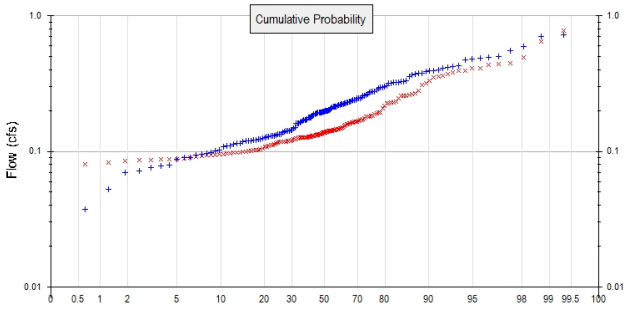
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.097	0.000	0.000	0.000
0.1667	0.097	0.016	0.006	0.000
0.3333	0.097	0.032	0.008	0.000
0.5000	0.097	0.048	0.010	0.000
0.6667	0.097	0.065	0.012	0.000
0.8333	0.097	0.081	0.013	0.000
1.0000	0.097	0.097	0.015	0.000
1.1667	0.097	0.113	0.016	0.000
1.3333	0.097	0.130	0.017	0.000
1.5000	0.097	0.146	0.018	0.000
1.6667	0.097	0.162	0.019	0.000
1.8333	0.097	0.179	0.020	0.000
2.0000	0.097	0.195	0.021	0.000
2.1667	0.097	0.211	0.022	0.000
2.3333	0.097	0.227	0.023	0.000
2.5000	0.097	0.244	0.024	0.000
2.6667	0.097	0.260	0.031	0.000
2.8333	0.097	0.276	0.034	0.000
3.0000	0.097	0.292	0.037	0.000
3.1667	0.097	0.309	0.039	0.000
3.3333	0.097	0.325	0.041	0.000
3.5000	0.097	0.341	0.043	0.000
3.6667	0.097	0.358	0.045	0.000
3.8333	0.097	0.374	0.047	0.000
4.0000	0.097	0.390	0.049	0.000
4.1667	0.097	0.406	0.050	0.000
4.3333	0.097	0.423	0.052	0.000
4.5000	0.097	0.439	0.054	0.000
4.6667	0.097	0.455	0.055	0.000
4.8333	0.097	0.471	0.056	0.000
5.0000	0.097	0.488	0.058	0.000
5.1667	0.097	0.504	0.059	0.000
5.3333	0.097	0.520	0.060	0.000
5.5000	0.097	0.536	0.062	0.000
5.6667	0.097	0.553	0.063	0.000
5.8333	0.097	0.569	0.064	0.000
6.0000	0.097	0.585	0.065	0.000

6.1667	0.097	0.602	0.067	0.000
6.3333	0.097	0.618	0.068	0.000
6.5000	0.097	0.634	0.069	0.000
6.6667	0.097	0.650	0.070	0.000
6.8333	0.097	0.667	0.071	0.000
7.0000	0.097	0.683	0.072	0.000
7.1667	0.097	0.699	0.073	0.000
7.3333	0.097	0.715	0.074	0.000
7.5000	0.097	0.732	0.075	0.000
7.6667	0.097	0.748	0.077	0.000
7.8333	0.097	0.764	0.078	0.000
8.0000	0.097	0.781	0.079	0.000
8.1667	0.097	0.797	0.080	0.000
8.3333	0.097	0.813	0.080	0.000
8.5000	0.097	0.829	0.081	0.000
8.6667	0.097	0.846	0.082	0.000
8.8333	0.097	0.862	0.083	0.000
9.0000	0.097	0.878	0.084	0.000
9.1667	0.097	0.894	0.085	0.000
9.3333	0.097	0.911	0.086	0.000
9.5000	0.097	0.927	0.087	0.000
9.6667	0.097	0.943	0.088	0.000
9.8333	0.097	0.960	0.089	0.000
10.000	0.097	0.976	0.090	0.000
10.167	0.097	0.992	0.090	0.000
10.333	0.097	1.008	0.091	0.000
10.500	0.097	1.025	0.092	0.000
10.667	0.097	1.041	0.093	0.000
10.833	0.097	1.057	0.094	0.000
11.000	0.097	1.073	0.095	0.000
11.167	0.097	1.090	0.095	0.000
11.333	0.097	1.106	0.096	0.000
11.500	0.097	1.122	0.097	0.000
11.667	0.097	1.138	0.098	0.000
11.833	0.097	1.155	0.099	0.000
12.000	0.097	1.171	0.099	0.000
12.167	0.097	1.187	0.175	0.000
12.333	0.097	1.204	0.207	0.000
12.500	0.097	1.220	0.232	0.000
12.667	0.097	1.236	0.252	0.000
12.833	0.097	1.252	0.271	0.000
13.000	0.097	1.269	0.287	0.000
13.167	0.097	1.285	0.303	0.000
13.333	0.097	1.301	0.317	0.000
13.500	0.097	1.317	0.331	0.000
13.667	0.097	1.334	0.344	0.000
13.833	0.097	1.350	0.356	0.000
14.000	0.097	1.366	0.368	0.000
14.167	0.097	1.383	0.379	0.000
14.333	0.097	1.399	0.390	0.000
14.500	0.097	1.415	0.401	0.000
14.667	0.097	1.431	1.485	0.000
14.833	0.097	1.448	3.303	0.000
15.000	0.097	1.464	5.069	0.000
15.167	0.097	1.480	6.194	0.000
15.333	0.000	0.000	6.918	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 6.75
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 3.84
Total Impervious Area: 2.91

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.198928
5 year	0.30647
10 year	0.378525
25 year	0.468988
50 year	0.535472
100 year	0.600957

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.144782
5 year	0.219187
10 year	0.282318
25 year	0.38058
50 year	0.46911
100 year	0.57252

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.199	0.141
1903	0.121	0.103
1904	0.271	0.195
1905	0.110	0.127
1906	0.070	0.080
1907	0.325	0.180
1908	0.221	0.118
1909	0.221	0.128
1910	0.318	0.167
1911	0.194	0.125

1912	0.727	0.362
1913	0.286	0.187
1914	0.076	0.227
1915	0.135	0.132
1916	0.192	0.118
1917	0.078	0.081
1918	0.187	0.147
1919	0.160	0.126
1920	0.200	0.127
1921	0.214	0.160
1922	0.223	0.163
1923	0.173	0.134
1924	0.102	0.098
1925	0.123	0.101
1926	0.195	0.138
1927	0.164	0.102
1928	0.150	0.126
1929	0.322	0.171
1930	0.195	0.122
1931	0.196	0.128
1932	0.160	0.114
1933	0.170	0.149
1934	0.387	0.394
1935	0.193	0.142
1936	0.184	0.127
1937	0.297	0.182
1938	0.170	0.125
1939	0.025	0.095
1940	0.178	0.145
1941	0.131	0.108
1942	0.277	0.382
1943	0.134	0.132
1944	0.356	0.255
1945	0.223	0.139
1946	0.142	0.129
1947	0.108	0.087
1948	0.428	0.192
1949	0.377	0.307
1950	0.120	0.100
1951	0.144	0.117
1952	0.552	0.438
1953	0.486	0.350
1954	0.191	0.127
1955	0.160	0.098
1956	0.087	0.087
1957	0.248	0.143
1958	0.483	0.493
1959	0.305	0.434
1960	0.094	0.098
1961	0.331	0.318
1962	0.202	0.133
1963	0.095	0.086
1964	0.122	0.195
1965	0.369	0.217
1966	0.120	0.088
1967	0.171	0.138
1968	0.194	0.138
1969	0.177	0.120

1970	0.260	0.157
1971	0.391	0.372
1972	0.258	0.229
1973	0.317	0.257
1974	0.194	0.141
1975	0.415	0.394
1976	0.214	0.181
1977	0.110	0.087
1978	0.372	0.278
1979	0.114	0.108
1980	0.200	0.146
1981	0.203	0.126
1982	0.118	0.095
1983	0.324	0.226
1984	0.184	0.147
1985	0.231	0.167
1986	0.196	0.145
1987	0.378	0.354
1988	0.245	0.139
1989	0.217	0.128
1990	0.249	0.130
1991	0.207	0.133
1992	0.258	0.256
1993	0.265	0.141
1994	0.400	0.183
1995	0.101	0.121
1996	0.393	0.408
1997	0.200	0.120
1998	0.233	0.161
1999	0.052	0.095
2000	0.149	0.138
2001	0.098	0.082
2002	0.302	0.228
2003	0.239	0.163
2004	0.221	0.146
2005	0.421	0.266
2006	0.130	0.103
2007	0.137	0.137
2008	0.211	0.130
2009	0.141	0.113
2010	0.129	0.118
2011	0.119	0.096
2012	0.247	0.150
2013	0.125	0.101
2014	0.091	0.097
2015	0.196	0.172
2016	0.079	0.085
2017	0.295	0.160
2018	0.494	0.774
2019	0.596	0.413
2020	0.177	0.143
2021	0.275	0.171
2022	0.114	0.111
2023	0.225	0.135
2024	0.705	0.330
2025	0.206	0.140
2026	0.321	0.180
2027	0.132	0.112

2028	0.113	0.093
2029	0.219	0.131
2030	0.412	0.262
2031	0.129	0.090
2032	0.090	0.094
2033	0.122	0.093
2034	0.134	0.110
2035	0.475	0.646
2036	0.239	0.155
2037	0.072	0.088
2038	0.235	0.158
2039	0.038	0.146
2040	0.139	0.118
2041	0.144	0.099
2042	0.500	0.444
2043	0.229	0.175
2044	0.290	0.165
2045	0.189	0.133
2046	0.214	0.233
2047	0.168	0.130
2048	0.233	0.126
2049	0.215	0.144
2050	0.166	0.120
2051	0.277	0.206
2052	0.130	0.106
2053	0.226	0.248
2054	0.241	0.266
2055	0.127	0.091
2056	0.096	0.104
2057	0.141	0.119
2058	0.178	0.124
2059	0.326	0.165

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.7266	0.7743
2	0.7048	0.6463
3	0.5960	0.4927
4	0.5523	0.4442
5	0.5001	0.4380
6	0.4944	0.4338
7	0.4864	0.4127
8	0.4828	0.4085
9	0.4751	0.3937
10	0.4278	0.3936
11	0.4212	0.3819
12	0.4154	0.3716
13	0.4118	0.3616
14	0.3999	0.3541
15	0.3931	0.3498
16	0.3912	0.3304
17	0.3873	0.3185
18	0.3783	0.3069
19	0.3768	0.2780
20	0.3724	0.2664
21	0.3687	0.2662
22	0.3557	0.2621

23	0.3308	0.2573
24	0.3262	0.2558
25	0.3248	0.2555
26	0.3240	0.2476
27	0.3216	0.2334
28	0.3214	0.2287
29	0.3176	0.2279
30	0.3175	0.2269
31	0.3053	0.2258
32	0.3020	0.2167
33	0.2975	0.2065
34	0.2946	0.1947
35	0.2905	0.1946
36	0.2855	0.1919
37	0.2770	0.1874
38	0.2765	0.1830
39	0.2749	0.1817
40	0.2713	0.1812
41	0.2645	0.1805
42	0.2595	0.1804
43	0.2584	0.1753
44	0.2581	0.1718
45	0.2485	0.1713
46	0.2479	0.1708
47	0.2467	0.1668
48	0.2453	0.1666
49	0.2406	0.1646
50	0.2392	0.1645
51	0.2389	0.1634
52	0.2354	0.1631
53	0.2334	0.1609
54	0.2326	0.1602
55	0.2310	0.1596
56	0.2293	0.1583
57	0.2258	0.1572
58	0.2250	0.1549
59	0.2231	0.1505
60	0.2228	0.1492
61	0.2215	0.1470
62	0.2210	0.1469
63	0.2209	0.1464
64	0.2190	0.1462
65	0.2165	0.1461
66	0.2149	0.1454
67	0.2145	0.1445
68	0.2142	0.1441
69	0.2137	0.1432
70	0.2113	0.1426
71	0.2070	0.1420
72	0.2059	0.1414
73	0.2028	0.1413
74	0.2017	0.1411
75	0.2003	0.1400
76	0.2002	0.1395
77	0.1998	0.1394
78	0.1985	0.1379
79	0.1960	0.1378
80	0.1958	0.1376

81	0.1957	0.1375
82	0.1949	0.1367
83	0.1946	0.1348
84	0.1943	0.1339
85	0.1943	0.1334
86	0.1941	0.1333
87	0.1935	0.1329
88	0.1919	0.1321
89	0.1910	0.1317
90	0.1886	0.1310
91	0.1873	0.1303
92	0.1841	0.1302
93	0.1838	0.1302
94	0.1783	0.1289
95	0.1780	0.1281
96	0.1775	0.1277
97	0.1771	0.1276
98	0.1733	0.1273
99	0.1708	0.1272
100	0.1701	0.1271
101	0.1698	0.1267
102	0.1680	0.1265
103	0.1658	0.1263
104	0.1640	0.1261
105	0.1602	0.1256
106	0.1601	0.1250
107	0.1601	0.1250
108	0.1498	0.1238
109	0.1485	0.1223
110	0.1437	0.1214
111	0.1436	0.1198
112	0.1418	0.1197
113	0.1414	0.1196
114	0.1410	0.1185
115	0.1389	0.1184
116	0.1371	0.1180
117	0.1348	0.1178
118	0.1343	0.1175
119	0.1340	0.1165
120	0.1320	0.1144
121	0.1306	0.1130
122	0.1302	0.1120
123	0.1297	0.1110
124	0.1292	0.1103
125	0.1291	0.1083
126	0.1265	0.1082
127	0.1250	0.1058
128	0.1232	0.1037
129	0.1223	0.1027
130	0.1220	0.1025
131	0.1214	0.1023
132	0.1203	0.1014
133	0.1198	0.1014
134	0.1193	0.1001
135	0.1177	0.0992
136	0.1144	0.0983
137	0.1137	0.0982
138	0.1132	0.0981

139	0.1099	0.0973
140	0.1097	0.0961
141	0.1084	0.0955
142	0.1025	0.0949
143	0.1008	0.0945
144	0.0982	0.0941
145	0.0960	0.0934
146	0.0950	0.0927
147	0.0936	0.0911
148	0.0906	0.0905
149	0.0900	0.0882
150	0.0869	0.0878
151	0.0793	0.0874
152	0.0782	0.0873
153	0.0760	0.0865
154	0.0721	0.0863
155	0.0701	0.0855
156	0.0521	0.0823
157	0.0375	0.0807
158	0.0252	0.0802

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0995	48647	42060	86	Pass
0.1039	44326	33922	76	Pass
0.1083	39656	25778	65	Pass
0.1127	36326	20576	56	Pass
0.1171	32659	15374	47	Pass
0.1215	29983	12327	41	Pass
0.1259	27645	10011	36	Pass
0.1303	24969	7933	31	Pass
0.1347	23069	6853	29	Pass
0.1391	21074	5961	28	Pass
0.1435	19640	5462	27	Pass
0.1479	18338	5005	27	Pass
0.1523	16858	4577	27	Pass
0.1567	15684	4296	27	Pass
0.1611	14371	3985	27	Pass
0.1655	13429	3749	27	Pass
0.1699	12532	3548	28	Pass
0.1743	11485	3360	29	Pass
0.1787	10659	3216	30	Pass
0.1831	9751	3074	31	Pass
0.1875	9080	2996	32	Pass
0.1920	8476	2925	34	Pass
0.1964	7762	2826	36	Pass
0.2008	7257	2760	38	Pass
0.2052	6709	2666	39	Pass
0.2096	6271	2614	41	Pass
0.2140	5884	2559	43	Pass
0.2184	5436	2466	45	Pass
0.2228	5100	2396	46	Pass
0.2272	4762	2289	48	Pass
0.2316	4511	2211	49	Pass
0.2360	4296	2146	49	Pass
0.2404	4002	2064	51	Pass
0.2448	3776	2001	52	Pass
0.2492	3505	1898	54	Pass
0.2536	3343	1826	54	Pass
0.2580	3148	1736	55	Pass
0.2624	2995	1672	55	Pass
0.2668	2848	1614	56	Pass
0.2712	2666	1544	57	Pass
0.2756	2526	1486	58	Pass
0.2800	2379	1430	60	Pass
0.2844	2255	1384	61	Pass
0.2888	2156	1341	62	Pass
0.2932	2016	1275	63	Pass
0.2976	1923	1220	63	Pass
0.3021	1789	1165	65	Pass
0.3065	1698	1115	65	Pass
0.3109	1611	1070	66	Pass
0.3153	1481	1016	68	Pass
0.3197	1402	956	68	Pass
0.3241	1298	914	70	Pass
0.3285	1224	880	71	Pass

0.3329	1163	845	72	Pass
0.3373	1103	798	72	Pass
0.3417	1047	769	73	Pass
0.3461	989	725	73	Pass
0.3505	948	681	71	Pass
0.3549	897	643	71	Pass
0.3593	841	609	72	Pass
0.3637	798	577	72	Pass
0.3681	750	535	71	Pass
0.3725	712	503	70	Pass
0.3769	674	467	69	Pass
0.3813	614	419	68	Pass
0.3857	573	383	66	Pass
0.3901	525	332	63	Pass
0.3945	488	298	61	Pass
0.3989	456	272	59	Pass
0.4033	412	238	57	Pass
0.4078	387	222	57	Pass
0.4122	352	194	55	Pass
0.4166	328	171	52	Pass
0.4210	309	145	46	Pass
0.4254	286	123	43	Pass
0.4298	261	114	43	Pass
0.4342	238	103	43	Pass
0.4386	225	96	42	Pass
0.4430	213	89	41	Pass
0.4474	194	81	41	Pass
0.4518	175	77	44	Pass
0.4562	156	73	46	Pass
0.4606	135	67	49	Pass
0.4650	121	62	51	Pass
0.4694	104	57	54	Pass
0.4738	87	52	59	Pass
0.4782	73	47	64	Pass
0.4826	57	40	70	Pass
0.4870	41	32	78	Pass
0.4914	38	25	65	Pass
0.4958	33	21	63	Pass
0.5002	31	20	64	Pass
0.5046	29	17	58	Pass
0.5090	26	17	65	Pass
0.5135	23	16	69	Pass
0.5179	20	14	70	Pass
0.5223	18	14	77	Pass
0.5267	15	13	86	Pass
0.5311	12	12	100	Pass
0.5355	12	12	100	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.382 acre-feet
On-line facility target flow:	0.4364 cfs.
Adjusted for 15 min:	0.4364 cfs.
Off-line facility target flow:	0.2514 cfs.
Adjusted for 15 min:	0.2514 cfs.

Model Default Modifications

Total of 0 changes have been made.

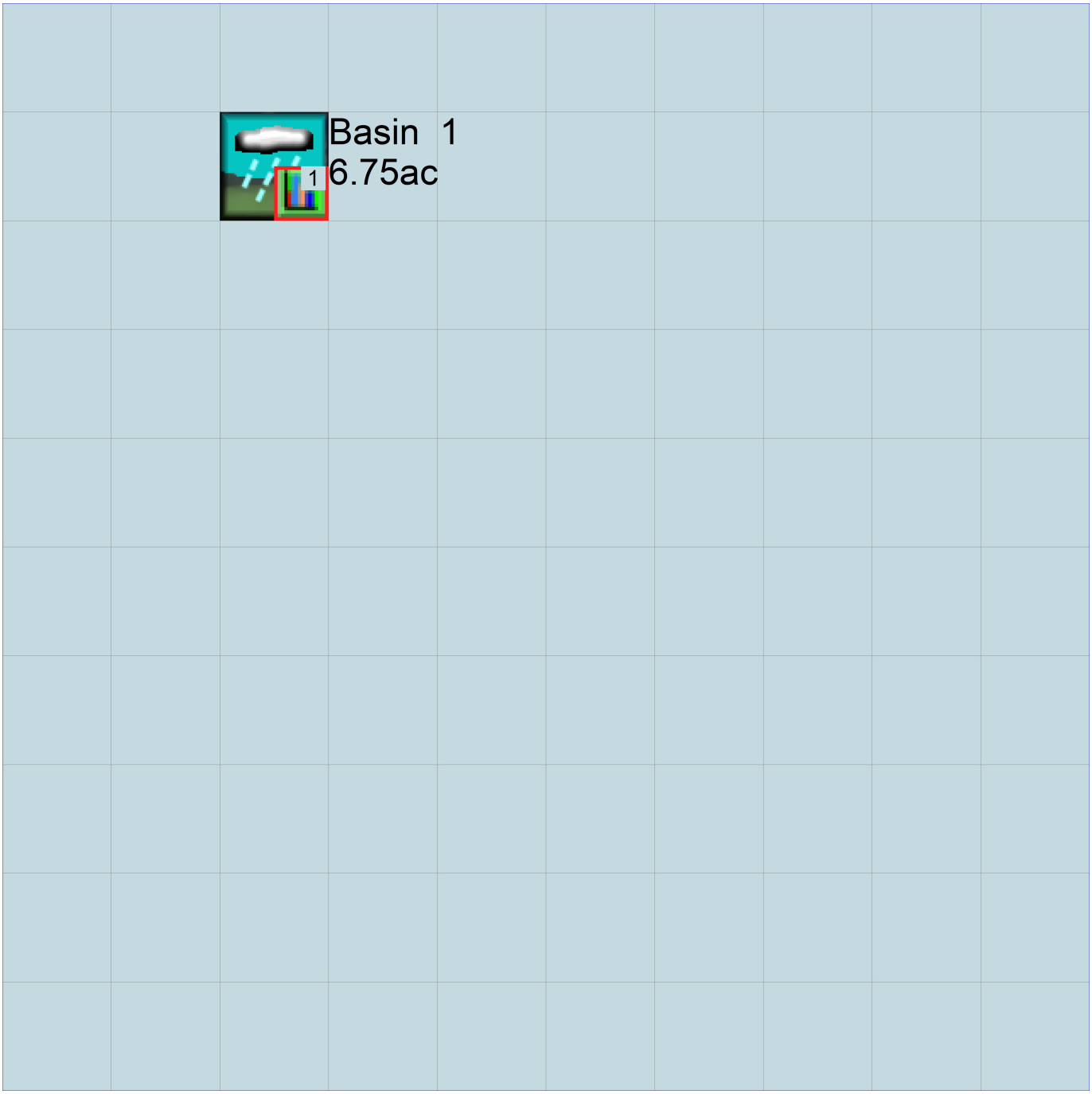
PERLND Changes

No PERLND changes have been made.

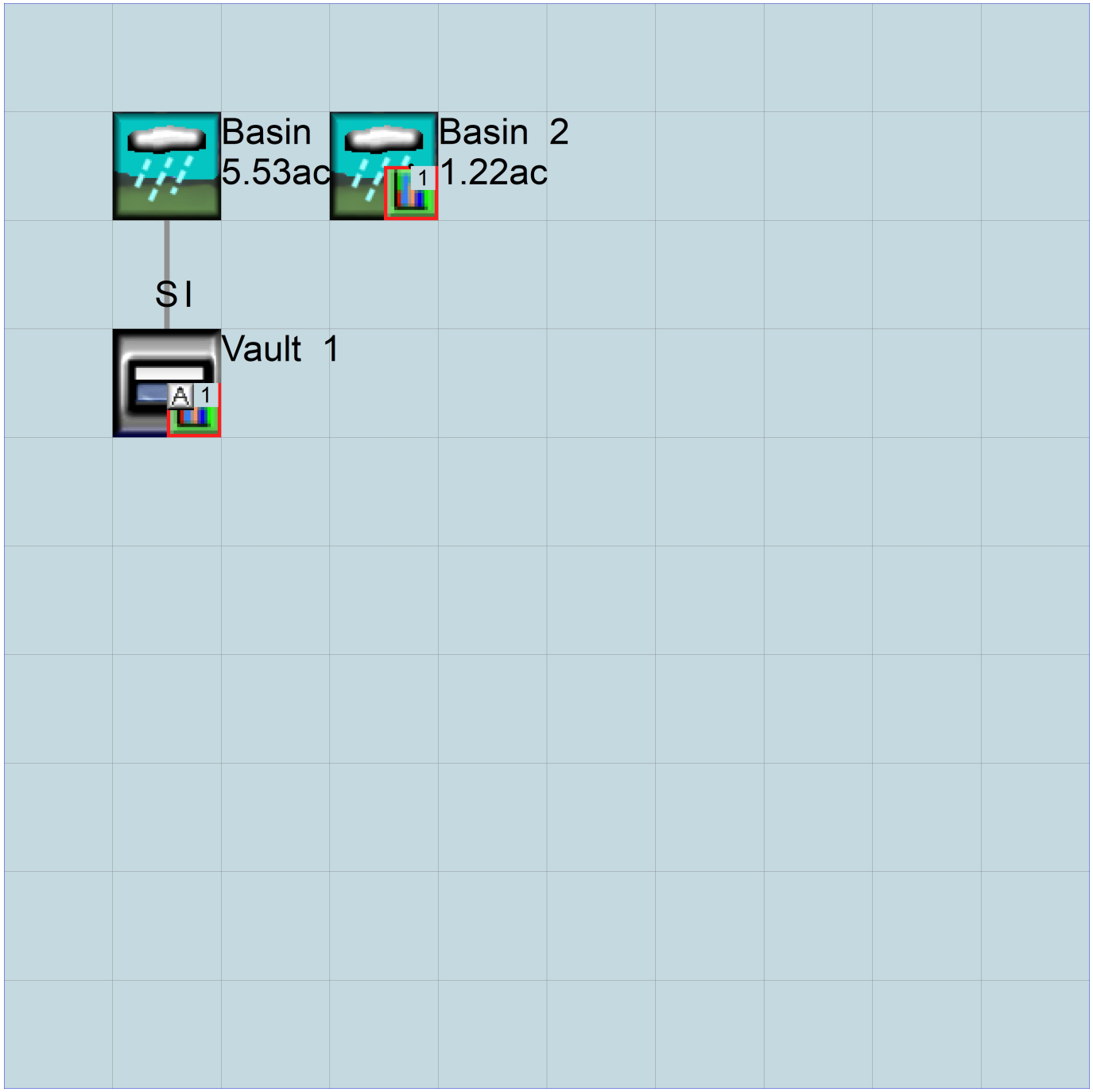
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



WWHM2012

PROJECT REPORT

Water Quality Sizing

General Model Information

WWHM2012 Project Name: 12663-WQ

Site Name:	Water Quality
Site Address:	Normandy
City:	
Report Date:	1/26/2026
Gage:	42 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2025/05/13
Version:	4.3.2

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Forest, Flat	0.69
C, Forest, Mod	2.35
C, Forest, Steep	2.49
Pervious Total	5.53

Impervious Land Use	acre
Impervious Total	0
Basin Total	5.53

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	1.39
C, Pasture, Mod	0.41
C, Pasture, Steep	0.98
Pervious Total	2.78

Impervious Land Use	acre
ROADS FLAT	0.37
ROADS MOD	0.48
ROOF TOPS FLAT	0.34
SIDEWALKS FLAT	0.06
SIDEWALKS MOD	0.12
Impervious Total	1.37
Basin Total	4.15

Element Flow Componants:

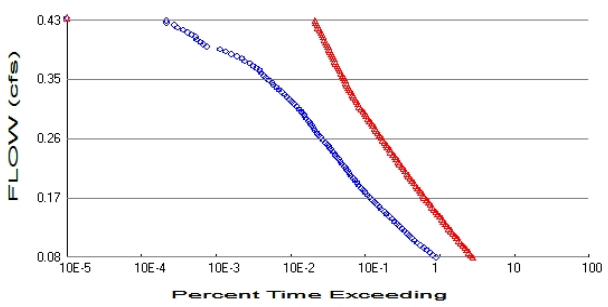
Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

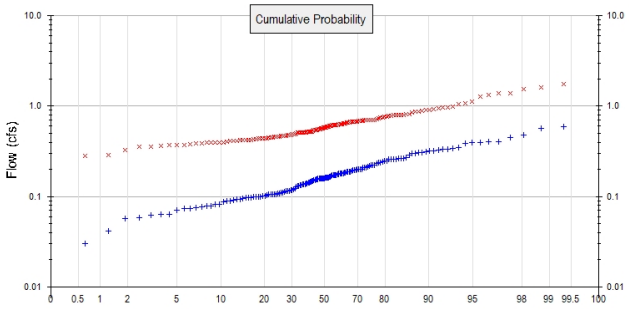
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 5.53
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 2.78
Total Impervious Area: 1.37

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.161191
5 year	0.248573
10 year	0.307161
25 year	0.380753
50 year	0.434858
100 year	0.488165

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.573657
5 year	0.780762
10 year	0.932903
25 year	1.142926
50 year	1.312766
100 year	1.494483

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.161	0.615
1903	0.099	0.676
1904	0.219	0.971
1905	0.089	0.371
1906	0.057	0.400
1907	0.263	0.638
1908	0.179	0.468
1909	0.179	0.507
1910	0.257	0.629
1911	0.158	0.609

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.2364 acre-feet
On-line facility target flow:	0.228 cfs.
Adjusted for 15 min:	0.228 cfs.
Off-line facility target flow:	0.1302 cfs.
Adjusted for 15 min:	0.1302 cfs.

Model Default Modifications

Total of 0 changes have been made.

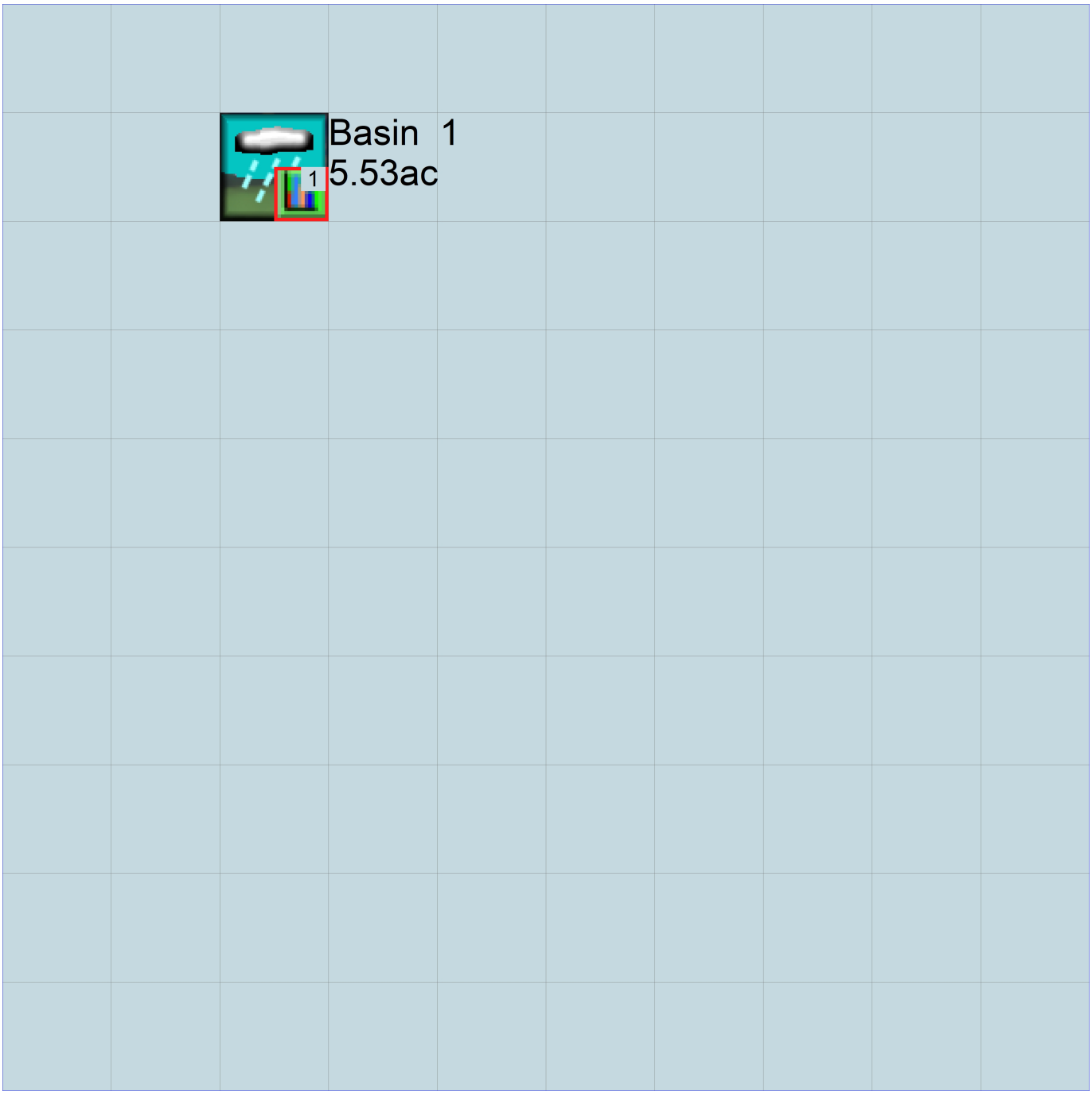
PERLND Changes

No PERLND changes have been made.

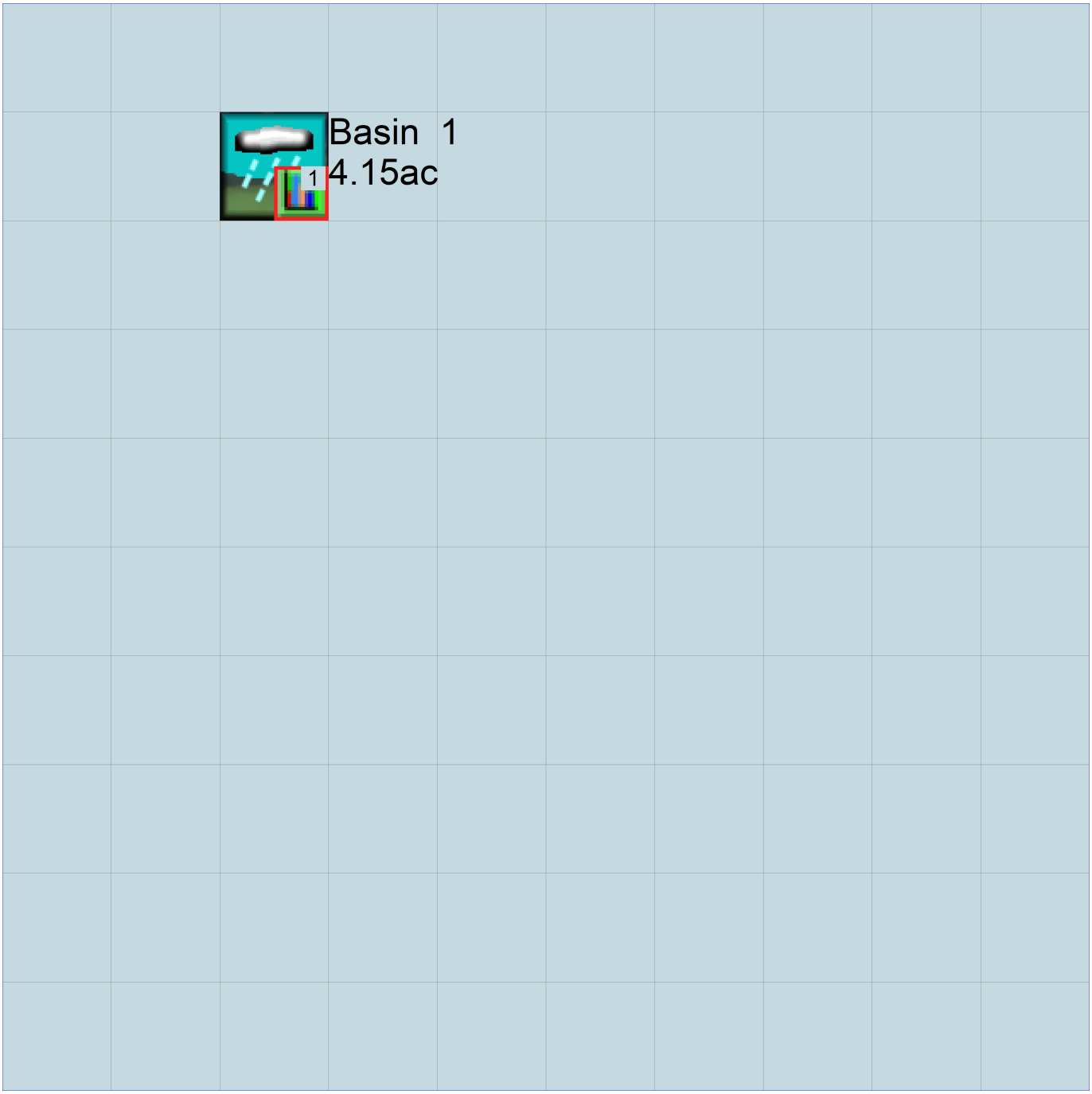
IMPLND Changes

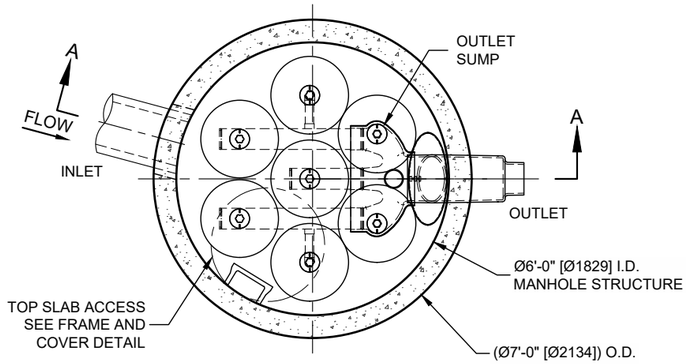
No IMPLND changes have been made.

Appendix
Predeveloped Schematic



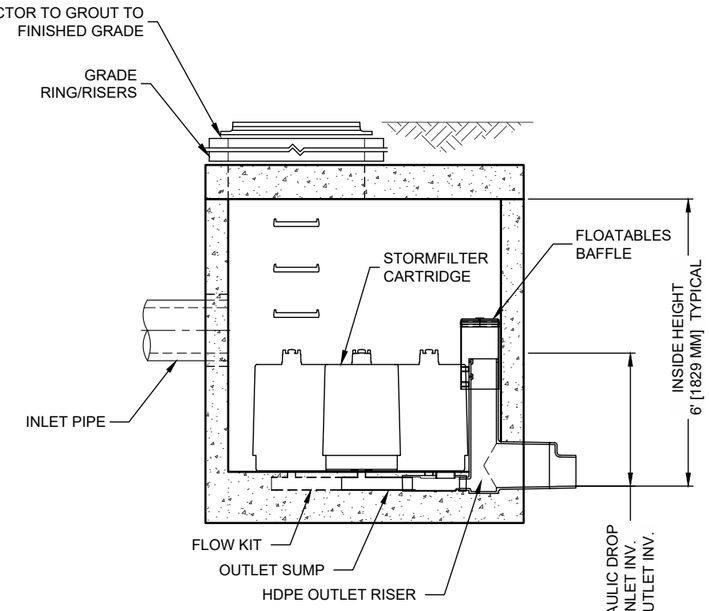
Mitigated Schematic





PLAN VIEW

STANDARD OUTLET RISER
FLOWKIT: 42A



SECTION A-A

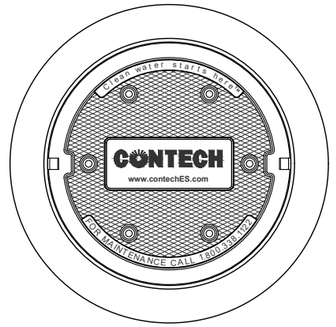
STORMFILTER DESIGN NOTES

STORMFILTER TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN WITH THE MAXIMUM NUMBER OF CARTRIDGES (7). VOLUME SYSTEM IS ALSO AVAILABLE WITH MAXIMUM 7 CARTRIDGES.
Ø6'-0" [1829 mm] MANHOLE STORMFILTER PEAK HYDRAULIC CAPACITY IS 1.5 CFS [42.5 L/s] . IF THE SITE CONDITIONS EXCEED 1.5 CFS [42.5 L/s] AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

CARTRIDGE SELECTION

CARTRIDGE HEIGHT	27" [686 mm]			18" [458 mm]			LOW DROP		
RECOMMENDED HYDRAULIC DROP (H)	3.05' [930 mm]			2.3' [700 mm]			1.8' [550 mm]		
SPECIFIC FLOW RATE (gpm/sf) [L/s/m^2]	2 [1.30]	1.67* [1.08]	1 [0.65]	2 [1.30]	1.67* [1.08]	1 [0.65]	2 [1.30]	1.67* [1.08]	1 [0.65]
CARTRIDGE FLOW RATE (gpm) [L/s]	22.5 [1.42]	18.79 [1.19]	11.25 [0.71]	15 [0.95]	12.53 [0.79]	7.5 [0.44]	10 [0.63]	8.35 [0.54]	5 [0.32]

* 1.67 gpm/sf [1.08 L/s/m^2] SPECIFIC FLOW RATE IS APPROVED WITH PHOSPHOSORB® (PSORB) MEDIA ONLY



FRAME AND COVER

(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	*
WATER QUALITY FLOW RATE (cfs) [L/s]	*
PEAK FLOW RATE (cfs) [L/s]	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
CARTRIDGE HEIGHT (SEE TABLE ABOVE)	*
NUMBER OF CARTRIDGES REQUIRED	*
CARTRIDGE FLOW RATE	*
MEDIA TYPE (PERLITE, ZPG, PSORB)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE #1	*	*	*
INLET PIPE #2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED VAULT DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. STORMFILTER WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS-20 LOAD RATING, ASSUMING EARTH COVER OF 0' - 5' [1524 mm] AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 AND BE CAST WITH THE CONTECH LOGO.
6. FILTER CARTRIDGES SHALL BE MEDIA-FILLED, PASSIVE, SIPHON ACTUATED, RADIAL FLOW, AND SELF CLEANING. RADIAL MEDIA DEPTH SHALL BE 7-INCHES [178 mm]. FILTER MEDIA CONTACT TIME SHALL BE AT LEAST 38 SECONDS.
7. SPECIFIC FLOW RATE IS EQUAL TO THE FILTER TREATMENT CAPACITY (gpm) [L/s] DIVIDED BY THE FILTER CONTACT SURFACE AREA (sq ft)[m^2].
8. STORMFILTER STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMFILTER STRUCTURE.
C. CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET PIPE(S).
E. CONTRACTOR TO PROVIDE AND INSTALL CONNECTOR TO THE OUTLET RISER STUB. STORMFILTER EQUIPPED WITH A DUAL DIAMETER HDPE OUTLET STUB AND SAND COLLAR. IF OUTLET PIPE IS LARGER THAN 8 INCHES [200 mm], CONTRACTOR TO REMOVE THE 8 INCH [200 mm] OUTLET STUB AT MOLDED-IN CUT LINE. COUPLING BY FERNCO OR EQUAL AND PROVIDED BY CONTRACTOR.
F. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

The Stormwater Management StormFilter®

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

SFMH72
STORMFILTER
STANDARD DETAIL

WWHM2012

PROJECT REPORT

TESC Pond Sizing

General Model Information

WWHM2012 Project Name: 12663-Sed Pond

Site Name:	Sediment Pond
Site Address:	Normandy
City:	
Report Date:	1/26/2026
Gage:	42 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2025/05/13
Version:	4.3.2

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Forest, Steep	2.49
C, Forest, Mod	2.35
C, Forest, Flat	0.69
Pervious Total	5.53

Impervious Land Use	acre
Impervious Total	0
Basin Total	5.53

Element Flow Componants:

Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	3.11
C, Pasture, Mod	0.41
C, Pasture, Steep	0.98
Pervious Total	4.5

Impervious Land Use	acre
ROADS FLAT	0.37
ROADS MOD	0.48
SIDEWALKS FLAT	0.06
SIDEWALKS MOD	0.12
Impervious Total	1.03
Basin Total	5.53

Element Flow Componants:

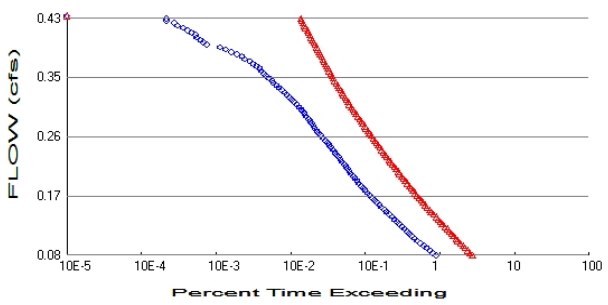
Surface	Interflow	Groundwater
Componant Flows To:		
POC 1	POC 1	

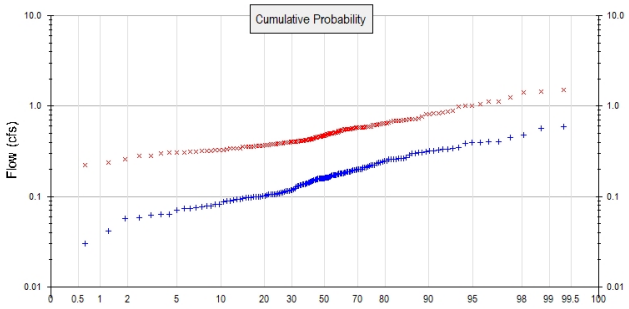
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 5.53
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 4.5
Total Impervious Area: 1.03

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.161191
5 year	0.248573
10 year	0.307161
25 year	0.380753
50 year	0.434858
100 year	0.488165

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.480402
5 year	0.665319
10 year	0.802997
25 year	0.995117
50 year	1.151969
100 year	1.321063

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.161	0.468
1903	0.099	0.515
1904	0.219	0.890
1905	0.089	0.321
1906	0.057	0.310
1907	0.263	0.582
1908	0.179	0.390
1909	0.179	0.413
1910	0.257	0.586
1911	0.158	0.498

1912	0.590	1.455
1913	0.232	0.359
1914	0.061	1.405
1915	0.109	0.333
1916	0.156	0.492
1917	0.063	0.224
1918	0.152	0.395
1919	0.130	0.325
1920	0.162	0.445
1921	0.174	0.412
1922	0.181	0.621
1923	0.141	0.385
1924	0.083	0.554
1925	0.100	0.309
1926	0.158	0.444
1927	0.133	0.396
1928	0.122	0.375
1929	0.260	0.592
1930	0.158	0.582
1931	0.159	0.369
1932	0.129	0.404
1933	0.138	0.435
1934	0.314	0.715
1935	0.157	0.322
1936	0.149	0.456
1937	0.241	0.642
1938	0.137	0.361
1939	0.020	0.323
1940	0.144	0.631
1941	0.106	0.627
1942	0.225	0.586
1943	0.109	0.496
1944	0.287	0.870
1945	0.181	0.464
1946	0.115	0.504
1947	0.088	0.283
1948	0.347	0.573
1949	0.305	0.595
1950	0.098	0.378
1951	0.117	0.625
1952	0.448	1.000
1953	0.394	0.849
1954	0.155	0.408
1955	0.130	0.341
1956	0.071	0.304
1957	0.202	0.355
1958	0.393	0.682
1959	0.248	0.666
1960	0.076	0.344
1961	0.268	1.005
1962	0.163	0.434
1963	0.077	0.279
1964	0.098	1.116
1965	0.299	0.561
1966	0.097	0.359
1967	0.139	0.571
1968	0.157	0.416
1969	0.143	0.408

1970	0.211	0.514
1971	0.317	0.536
1972	0.209	1.253
1973	0.258	0.705
1974	0.157	0.578
1975	0.337	0.820
1976	0.174	0.762
1977	0.089	0.261
1978	0.302	0.625
1979	0.092	0.447
1980	0.163	0.570
1981	0.165	0.451
1982	0.095	0.378
1983	0.263	0.558
1984	0.148	0.530
1985	0.188	0.695
1986	0.159	0.377
1987	0.307	0.687
1988	0.199	0.359
1989	0.176	0.355
1990	0.202	0.469
1991	0.168	0.548
1992	0.209	0.553
1993	0.215	0.501
1994	0.324	0.498
1995	0.082	0.329
1996	0.320	0.598
1997	0.162	0.392
1998	0.188	0.553
1999	0.041	0.483
2000	0.121	0.460
2001	0.079	0.363
2002	0.245	0.829
2003	0.194	0.462
2004	0.179	0.512
2005	0.343	1.118
2006	0.105	0.426
2007	0.111	0.550
2008	0.172	0.455
2009	0.115	0.342
2010	0.104	0.414
2011	0.097	0.391
2012	0.198	0.465
2013	0.101	0.425
2014	0.073	0.375
2015	0.158	0.808
2016	0.064	0.338
2017	0.239	0.580
2018	0.402	0.693
2019	0.483	0.992
2020	0.144	0.537
2021	0.223	0.490
2022	0.093	0.597
2023	0.183	0.731
2024	0.570	1.515
2025	0.167	0.400
2026	0.261	0.647
2027	0.107	0.478

2028	0.092	0.215
2029	0.177	0.402
2030	0.334	0.648
2031	0.105	0.235
2032	0.073	0.327
2033	0.099	0.408
2034	0.109	0.314
2035	0.385	0.671
2036	0.194	0.422
2037	0.058	0.491
2038	0.190	0.582
2039	0.030	0.836
2040	0.112	0.395
2041	0.117	0.453
2042	0.405	0.713
2043	0.186	0.516
2044	0.236	0.428
2045	0.153	0.365
2046	0.174	0.384
2047	0.136	0.380
2048	0.189	0.314
2049	0.174	0.472
2050	0.134	0.430
2051	0.223	0.707
2052	0.105	0.425
2053	0.183	0.361
2054	0.196	1.058
2055	0.102	0.410
2056	0.078	0.519
2057	0.115	0.302
2058	0.145	0.556
2059	0.264	0.714

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.5900	1.5152
2	0.5700	1.4546
3	0.4826	1.4051
4	0.4476	1.2530
5	0.4048	1.1184
6	0.4023	1.1162
7	0.3940	1.0580
8	0.3929	1.0052
9	0.3851	1.0001
10	0.3467	0.9921
11	0.3427	0.8896
12	0.3365	0.8704
13	0.3335	0.8493
14	0.3240	0.8361
15	0.3201	0.8292
16	0.3172	0.8195
17	0.3144	0.8076
18	0.3073	0.7625
19	0.3055	0.7315
20	0.3015	0.7153
21	0.2992	0.7135
22	0.2870	0.7130

23	0.2683	0.7073
24	0.2642	0.7047
25	0.2630	0.6950
26	0.2630	0.6927
27	0.2609	0.6871
28	0.2603	0.6819
29	0.2581	0.6710
30	0.2571	0.6656
31	0.2484	0.6475
32	0.2452	0.6474
33	0.2405	0.6419
34	0.2385	0.6306
35	0.2359	0.6274
36	0.2324	0.6254
37	0.2246	0.6253
38	0.2234	0.6208
39	0.2229	0.5981
40	0.2192	0.5967
41	0.2146	0.5946
42	0.2105	0.5919
43	0.2093	0.5859
44	0.2093	0.5855
45	0.2019	0.5822
46	0.2016	0.5820
47	0.1987	0.5820
48	0.1983	0.5803
49	0.1961	0.5785
50	0.1944	0.5734
51	0.1939	0.5708
52	0.1901	0.5702
53	0.1891	0.5605
54	0.1881	0.5582
55	0.1879	0.5557
56	0.1860	0.5537
57	0.1830	0.5533
58	0.1827	0.5529
59	0.1808	0.5495
60	0.1807	0.5481
61	0.1794	0.5373
62	0.1792	0.5358
63	0.1790	0.5297
64	0.1774	0.5190
65	0.1757	0.5164
66	0.1740	0.5151
67	0.1739	0.5144
68	0.1739	0.5119
69	0.1737	0.5041
70	0.1716	0.5007
71	0.1677	0.4984
72	0.1670	0.4976
73	0.1646	0.4965
74	0.1631	0.4916
75	0.1630	0.4905
76	0.1625	0.4904
77	0.1617	0.4827
78	0.1608	0.4777
79	0.1592	0.4723
80	0.1586	0.4695

81	0.1581	0.4680
82	0.1580	0.4651
83	0.1578	0.4636
84	0.1577	0.4623
85	0.1573	0.4597
86	0.1571	0.4563
87	0.1567	0.4548
88	0.1559	0.4531
89	0.1546	0.4508
90	0.1532	0.4472
91	0.1520	0.4449
92	0.1489	0.4436
93	0.1483	0.4353
94	0.1448	0.4339
95	0.1440	0.4301
96	0.1436	0.4283
97	0.1434	0.4264
98	0.1407	0.4249
99	0.1386	0.4247
100	0.1378	0.4222
101	0.1374	0.4155
102	0.1364	0.4140
103	0.1339	0.4133
104	0.1328	0.4119
105	0.1303	0.4095
106	0.1299	0.4079
107	0.1293	0.4077
108	0.1215	0.4076
109	0.1210	0.4038
110	0.1168	0.4015
111	0.1166	0.4003
112	0.1151	0.3956
113	0.1147	0.3951
114	0.1146	0.3949
115	0.1119	0.3924
116	0.1114	0.3907
117	0.1094	0.3903
118	0.1086	0.3849
119	0.1085	0.3843
120	0.1067	0.3797
121	0.1056	0.3782
122	0.1053	0.3779
123	0.1052	0.3770
124	0.1048	0.3753
125	0.1043	0.3746
126	0.1021	0.3693
127	0.1014	0.3655
128	0.0997	0.3633
129	0.0991	0.3607
130	0.0985	0.3606
131	0.0984	0.3591
132	0.0976	0.3588
133	0.0970	0.3587
134	0.0966	0.3553
135	0.0952	0.3551
136	0.0928	0.3436
137	0.0921	0.3425
138	0.0917	0.3411

139	0.0891	0.3376
140	0.0890	0.3332
141	0.0876	0.3292
142	0.0826	0.3273
143	0.0816	0.3252
144	0.0792	0.3230
145	0.0780	0.3219
146	0.0768	0.3215
147	0.0758	0.3137
148	0.0734	0.3135
149	0.0729	0.3095
150	0.0706	0.3090
151	0.0640	0.3036
152	0.0632	0.3016
153	0.0615	0.2828
154	0.0583	0.2793
155	0.0566	0.2611
156	0.0413	0.2354
157	0.0303	0.2238
158	0.0202	0.2154

TESC Calculations - Sediment Pond

Project: Normandy

BCE#: 12663

REQUIRED SURFACE AREA

SA = (2,080)(Q10)	=	**1,664**	Q2*	0.48
Construction Season:		Wet Season	Q10	0.80
			Q100	1.32

Flow cfs

PRINCIPAL SPILLWAY SIZING (RISER PIPE)

		POND	
$D = [(Q_{10}) / (3.782)(H)^{0.5}]^{0.5}$	=	**0.460**	FT
	=	**5.52**	IN
**H MIN (DEFAULT 1)*	=	*1*	*FT*

∴ USE RISER DIAMETER OF 18"

EMERGENCY OVERFLOW SPILLWAY

		POND	
$L = [Q_{100} / (3.21)(H)^{1.5}] - 2.4H$	=	**4.12**	FT
**H MIN (DEFAULT .2)*	=	*0.2*	*FT*

∴ USE MINIMUM REQ'D LENGTH OF 6 FEET

KEY

INPUT
OUTPUT
CHECK

DEWATERING ORIFICE

		POND		
$A_0 = (S.A.)(2H)^{0.5}/(0.6)(3,600)(T)(g)^{0.5}$	=	**0.015**	SF	
$DIAM. = 13.54\ (A_0)^{0.5}$	=	**1.66**	IN	**DIAM. MIN 1 INCH*
**H MIN (DEFAULT 3.5')*	=	*3.5*	*FT*	

∴ USE ORIFICE DIAMETER OF 1.66"

SURFACE AREAS

POND REQUIRED	=	**1,664**
POND PROVIDED	=	1,785

Pond Dimensions**

3.0:1	Req Ratio
23.6	Req Width
70.7	Req Length

*IF CONSTRUCTION TAKES PLACE OUTSIDE THE WET SEASON IN SUMMER MONTHS, Q2 IS ALLOWED TO SIZE POND S.A.

** POND IS AN IRREGULAR SHAPE. THE REQUIRED DIMENSIONS FIT WITHIN THE IRREGULARLY SHAPED POND AT THE RISER ELEVATION

Using the Rational Method & Manning Formula

PIERCE COUNTY DESIGN FOR 25 YEAR STORM

NOTE: ENTER DEFAULTS AND STORM DATA BEFORE BEGINNING

DEFAULTS

C= 0.6 n= 0.013

d= 12 Tc= 6.3

JOB NAME: Normandy

JOB#: 12663

FILE#:

A= Contributing Area (Ac)	Qd= Design Flow (cfs)
C= Runoff Coefficient	Qf= Full Capacity Flow (cfs)
Tc= Time of Concentration (min)	Vd= Velocity at Design Flow (fps)
I= Intensity at Tc (in/hr)	Vf= Velocity at Full Flow (fps)
d= Diameter of Pipe (in)	s= Slope of pipe (%)
L= Length of Pipe (ft)	n= Manning Roughness Coefficient
D= Water Depth at Qd (in)	Tt= Travel Time at Vd (min)

FROM	TO	A	s	L	d	Tc	n	C	SUM A	A*C	SUM A*C	I	Qd	Qf	Qd/Qf	X	D/d	D	Vf	Vd/Vf	Vd	Tt
18	19	1.08	1.00	17	12	6.3	0.013	0.6	1.08	0.65	0.65	3.06	1.98	3.56	**0.556**	0.520	0.532	6.39	4.54	1.02	4.65	0.06
19	2	0.00	10.45	16	12	6.4	0.013	0.6	1.08	0.00	0.65	3.04	1.97	11.51	**0.171**	0.280	0.277	3.32	14.67	0.75	10.95	0.02
2	3	0.00	1.00	26	12	6.4	0.013	0.6	1.08	0.00	0.65	3.04	1.97	3.56	**0.553**	0.520	0.530	6.36	4.54	1.02	4.64	0.09
3	5	0.40	7.41	197	12	6.5	0.013	0.6	1.48	0.24	0.89	3.02	2.68	9.69	**0.276**	0.360	0.361	4.33	12.35	0.86	10.57	0.31
5	6	0.88	8.02	57	12	6.8	0.013	0.6	2.36	0.53	1.42	2.94	4.16	10.09	**0.413**	0.440	0.449	5.38	12.85	0.96	12.28	0.08
6	8	0.00	19.33	60	12	6.9	0.013	0.6	2.36	0.00	1.42	2.92	4.14	15.66	**0.264**	0.340	0.351	4.22	19.95	0.84	16.85	0.06
8	9	0.45	12.95	29	12	6.9	0.013	0.6	2.81	0.27	1.69	2.91	4.90	12.82	**0.383**	0.420	0.428	5.14	16.33	0.93	15.24	0.03
14	15	0.27	1.00	22	12	6.3	0.013	0.6	0.27	0.16	0.16	3.06	0.50	3.56	**0.139**	0.240	0.251	3.02	4.54	0.70	3.17	0.12
15	16	1.39	10.06	33	12	6.4	0.013	0.6	1.66	0.83	1.00	3.03	3.02	11.30	**0.267**	0.340	0.354	4.24	14.39	0.85	12.19	0.05
16	9	0.00	10.06	44	12	6.5	0.013	0.6	1.66	0.00	1.00	3.02	3.01	11.30	**0.266**	0.340	0.353	4.24	14.39	0.85	12.18	0.06
12	13	0.63	0.50	26	12	6.3	0.013	0.6	0.63	0.38	0.38	3.06	1.16	2.52	**0.459**	0.460	0.477	5.72	3.21	0.99	3.17	0.14
13	11	0.06	0.50	53	12	6.4	0.013	0.6	0.69	0.04	0.41	3.03	1.25	2.52	**0.497**	0.500	0.498	5.98	3.21	1.00	3.22	0.27
11	9	0.65	0.50	174	12	6.7	0.013	0.6	1.34	0.39	0.80	2.96	2.38	2.52	**0.945**	0.760	0.768	9.21	3.21	1.13	3.63	0.80
9	WQ	0.00	1.00	33	18	7.0	0.013	0.6	0	0.00	3.49	2.90	10.11	10.50	**0.963**	0.780	0.783	14.09	5.95	1.13	6.72	0.08
WQ	VAULT	0.00	1.00	14	18	7.0	0.013	0.6	0	0.00	3.49	2.88	10.05	10.50	**0.957**	0.780	0.777	13.98	5.95	1.13	6.72	0.03

Tab 6.0

6.0 CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

A SWPPP will be prepared in advance of construction plan approval. As the total disturbed area is greater than one acre, a NPDES permit is required for this project.

Tab 7.0

7.1 Geotechnical Engineering Study prepared by Earth Solutions Northwest, LLC November 9, 2006 updated May 3, 2022.

Earth Solutions NW LLC

Geotechnical Engineering
Construction Observation/Testing
Environmental Services

UPDATED GEOTECHNICAL ENGINEERING STUDY
PROPOSED NORMANDY HEIGHTS
2007 SHAW ROAD
PUYALLUP, WASHINGTON

ES-0593

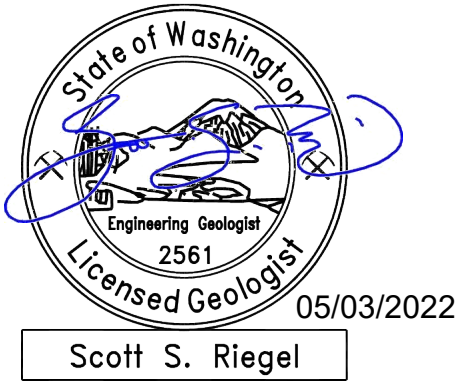
15365 N.E. 90th Street, Suite 100 Redmond, WA 98052
(425) 449-4704 Fax (425) 449-4711
www.earthsolutionsnw.com

PREPARED FOR

RM HOMES, LLC

November 9, 2006
Updated May 3, 2022

Chase G. Halsen, L.G.
Senior Project Geologist



Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

UPDATED GEOTECHNICAL ENGINEERING STUDY
PROPOSED NORMANDY HEIGHTS
2007 SHAW ROAD
PUYALLUP, WASHINGTON

ES-0593

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

Geotechnical-Engineering Report

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

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

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

Understand the Geotechnical-Engineering Services Provided for this Report

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

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

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

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

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

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

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

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

Read this Report in Full

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

You Need to Inform Your Geotechnical Engineer About Change

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

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

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

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

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

This Report's Recommendations Are Confirmation-Dependent

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

This Report Could Be Misinterpreted

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

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

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

Give Constructors a Complete Report and Guidance

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

Read Responsibility Provisions Closely

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

Geoenvironmental Concerns Are Not Covered

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

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

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

GEOPROFESSIONAL BUSINESS ASSOCIATION

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

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

November 9, 2006
Updated May 3, 2022
ES-0593

RM Homes, LLC
2913 – 5th Avenue Northeast, Suite 201
Puyallup, Washington 98372

Attention: Mr. James Kerby

Greetings, Mr. Kerby:

Earth Solutions NW, LLC (ESNW) is pleased to present this updated geotechnical engineering report in support of the proposed residential development. We understand the project is pursuing construction of a residential plat and associated infrastructure improvements. This updated report provides additional subsurface exploration and an updated site layout plan. From a geotechnical standpoint, development as currently proposed is feasible. Based on the conditions encountered during our subsurface exploration, the site is underlain medium dense to dense sand and silt deposits with variable fines contents.

In our opinion, the proposed residential structures can be constructed on conventional continuous and spread foundations bearing on competent native soil, recompacted native soil, or new structural fill placed directly on competent native soils. Native soils considered capable for support of the proposed residences are anticipated to be encountered beginning at depths of about two to four feet below existing grades. Where loose or otherwise unsuitable soil conditions are encountered at foundation subgrades, additional compaction efforts or overexcavation and restoration with structural fill will likely be necessary.

We understand the site is will pursue conventional detention designs as means of stormwater management. From a geotechnical standpoint, the use of infiltration on this site is not recommended given the variable soil conditions and existing slope features across the site.

We appreciate the opportunity to be of service to you on this project. If you have any questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Chase G. Halsen, L.G.
Senior Project Geologist

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ES-0593

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ES-0593

UPDATED GEOTECHNICAL ENGINEERING STUDY
PROPOSED NORMANDY HEIGHTS
2007 SHAW ROAD
PUYALLUP, WASHINGTON

ES-0593

INTRODUCTION

General

This geotechnical engineering study was updated for the proposed residential short plat to be constructed at 2007 Shaw Road East, in Puyallup, Washington. The purpose of this study was to provide geotechnical recommendations for the proposed development and included the following geotechnical services:

- Test pits to characterize site soil and groundwater conditions.
- Laboratory testing of representative soil samples collected at the test pit locations.
- Engineering analyses.
- Preparation of this geotechnical engineering study.

The following documents and resources were reviewed as part of our report preparation:

- Concept Site Plan II, undated.
- Puyallup Municipal Code, Chapter 21.06.
- PublicGIS application, maintained by Pierce County, Washington.
- Hazard Map GIS application, maintained by the City of Puyallup, Washington.
- Geologic Information Portal, maintained by Washington State Department of Natural Resources.
- Geologic Map of the Tacoma Quadrangle, prepared by J. Eric Schuster et al., November 2015.
- Surficial Geologic Map and Section of the Lake Tapps Quadrangle (Tapps), Washington, Crandell, 1963.
- Online Web Soil Survey (WSS) resource, maintained by the Natural Resources Conservation Service under the United States Department of Agriculture (USDA).

Project Description

We understand the project is pursuing construction of a residential plat consisting of 20 home building sites and associated infrastructure improvements. At the time of report submission, specific grading plans and building load plans were not available for review. Based on our experience with similar developments, the proposed residential structures will likely be two to three stories each and constructed using relatively lightly loaded wood framing supported on conventional foundations. Perimeter footing loads will likely be about 2 to 3 kips per lineal foot. Slab-on-grade loading is anticipated to be approximately 150 pounds per square foot (psf). We anticipate a combination of grade modifications (cuts or fills) of about 5 to 10 feet will likely be required to establish building pad and roadway elevations. Deeper excavations will likely be necessary to install utilities and construct the stormwater pond.

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

SITE CONDITIONS

Surface

The subject site is located at the northeast corner of the intersection between Shaw Road East and Crystal Ridge Drive, in Puyallup, Washington. The approximate site location is depicted on Plate 1 (Vicinity Map). The site area consists of Pierce County parcel number 042035-4039 totaling about 8.20 acres. Topography descends to the northwest with about 90 feet of elevation change occurring within the confines of the property. In general, site topography descends from the roadways and includes a vague bench area before descending to the east toward a natural drainage ravine and stream. The site is developed with a single-family residence and associated improvements within the northwestern site area and a gravel pad in the southwestern site area. Remaining portions of the site are surfaced with forested growth and/or brush and brambles.

Subsurface

An ESNW representative observed, logged, and sampled the excavation of eight test pits on October 23, 2006 and three borings near the proposed stormwater facility on February 8, 2022. Both explorations were completed with machinery and operators retained by our firm. The borings were installed to monitor groundwater conditions near the proposed stormwater facility under a separate project phase (ES-593.03). The approximate locations of the explorations are depicted on Plate 2 (Subsurface Exploration Plan). Representative soil samples collected at the test pit and boring locations were analyzed in general accordance with Unified Soil Classification System (USCS) and USDA methods and procedures.

The following sections provide a generalized characterization of the encountered subsurface conditions. Please refer to the test pit logs provided in Appendix A for a more detailed description of subsurface conditions.

Topsoil and Fill

Topsoil was encountered in the upper approximate 7 to 12 inches of existing grades at the test pit locations. The topsoil was characterized by a dark brown color, trace organic matter, and root inclusions. Fill was not encountered at the test pit locations but may be present in proximity existing site structures.

Native Soil

Underlying topsoil, native soils were characterized primarily as poorly graded sand with variable gravel and fines contents and poorly graded gravel with variable fines contents (USCS: SP, SP-SM, GP, and GP-GM) throughout out the majority of the site. At the boring locations completed near the proposed stormwater facility, silty sand (USCS: SM) and silt dominated soils (USCS: ML) were encountered. Native soils were encountered in a loose to medium dense and moist condition, extending to the terminus of each test pit location, and conditions ranged from loose to dense at the boring locations, which were advanced to a maximum depth of 21.5 feet below the ground surface (bgs).

Geologic Setting

The referenced geologic map identifies ice-contact deposits (Qgo_i) as underlying the site and surrounding areas. The outwash deposits described in the referenced geologic map are characterized as sand, gravel, silt and clay in a loose and well sorted condition. The referenced Tapps geologic map resource further refines this geologic setting as Lacustrine sand (Qil) and describes the Lacustrine sand as a somewhat chaotic or random assemblage of lacustrine sand and silt with abundant large boulders that do not correlate well with present topography. The referenced WSS resource identifies Indianola loamy sand (Map Unit Symbol: 18C) as underlying the site and surrounding areas. This soil series is associated with terrace, kames, and esker landforms and formed in sandy glacial outwash. Based on our field exploration, encountered native soils correlate with local geologic mapping designations of ice-contact deposits.

Groundwater

Groundwater was not encountered at the test pit locations during the October 2006 exploration. Groundwater seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater elevations and flow rates are higher during the winter, spring, and early summer months.

To assist with stormwater management designs, targeted groundwater monitoring was performed from February 2022 through the end of April 2022. The monitoring was focused in the proposed stormwater tract and targeted to the proposed design elevation of the facility. Groundwater was not observed at any of the well locations over the course of the monitoring period. While there is a seasonal stream located at the base of the adjacent natural ravine slope, it does not appear that to be fed by a local groundwater regime associated with the site.

Critical Areas Review

Based on review of readily available topographic data, most of the site contains slopes with gradients less than 40 percent. However, isolated and discontinuous slopes of 40 percent or greater may be present. Further topographic evaluation and delineation of slopes is currently underway. Once the final topographic data is made available to ESNW, further discussion and evaluations of potential critical areas and mitigation recommendations will be provided.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our investigation, construction of the proposed residential plat is feasible from a geotechnical standpoint. The primary geotechnical considerations for the proposal are in reference to structural fill placement and compaction, foundation design, and stormwater management.

Site Preparation and Earthwork

Initial site preparation activities will consist of installing temporary erosion control measures, establishing grading limits, and site demolition and clearing activities. Subsequent earthwork activities will involve mass excavation, foundation subgrade preparation activities, and related infrastructure installations.

Temporary Erosion Control

The following temporary erosion and sediment control (TESC) Best Management Practices (BMPs) should be considered:

- Silt fencing should be placed around the site perimeter, where appropriate.

- Temporary construction entrances and drive lanes should be constructed with at least six inches of quarry spalls to minimize off-site soil tracking and provide a stable access entrance surface. A woven geotextile fabric may be placed underneath the quarry spalls to provide greater stability, if needed.

- When not in use, soil stockpiles should be covered or otherwise protected. Soil stockpiles should never be placed near the top of a slope.

- Temporary measures for controlling surface water runoff, such as interceptor trenches, sumps, or interceptor swales, should be installed prior to beginning earthwork activities.

- Dry soils disturbed during construction should be wetted to minimize dust.

Additional TESC BMPs, as specified by the project design team and indicated on the plans, should be incorporated into construction activities. TESC measures must be actively monitored and modified during construction as site conditions require, as approved by the site erosion control Lead to ensure proper performance is maintained.

Excavations and Slopes

Based on the soil conditions observed at the test locations, the following allowable temporary slope inclinations, as a function of horizontal to vertical (H:V) inclination, may be used. The applicable Federal Occupation Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act (WISHA) soil classifications are also provided:

- Loose to medium dense soil — 1.5H:1V (Type C)
- Areas exposing groundwater — 1.5H:1V (Type C)
- Dense native soil — 1H:1V (Type B)

Steeper temporary slope inclinations within undisturbed, very dense native soil may be feasible based on the soil and groundwater conditions exposed within the excavations. If pursued, ESNW can evaluate the feasibility of utilizing steeper temporary slopes on a case-by-case basis at the time of construction. In any case, an ESNW representative should observe temporary slopes to confirm inclinations are suitable for the exposed soil conditions and to provide additional excavation and slope stability recommendations, as necessary. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations. Permanent slopes should be graded to 2H:1V (or flatter) and planted with vegetation to enhance stability and minimize erosion potential. Permanent slopes should be observed by ESNW prior to vegetating and landscaping.

In-situ and Imported Soil

Based on the conditions observed during our subsurface exploration, site soils will exhibit a high sensitivity to moisture and are not suitable for use as structural fill unless the moisture content is at or slightly above optimum (determined using modified Proctor ASTM D-1557) prior to placement and compaction. Successful use of on-site soil as structural fill will largely be dictated by the moisture content at the time of placement and compaction. Depending on the time of year construction occurs, remedial measures (such as soil aeration) may be necessary as part of site grading and earthwork activities. If the on-site soil cannot be successfully compacted, the use of an imported soil may be necessary.

In our opinion, a contingency should be provided in the project budget for export of soil that cannot be successfully compacted as structural fill, particularly if grading activities take place during periods of extended rainfall activity. In general, soils with fines contents greater than 5 percent typically degrade rapidly when exposed to periods of rainfall.

Imported structural fill soil should consist of a well-graded, granular soil that can achieve a suitable working moisture content. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Structural Fill

Structural fill is defined as compacted soil placed in slab-on-grade, roadway, permanent slope, retaining wall, and utility trench backfill areas. The following recommendations are provided for soils intended for use as structural fill:

- Moisture content — At or slightly above optimum
- Relative compaction (minimum) — 95 percent (Modified Proctor)
- Loose lift thickness (maximum) — 12 inches

The on-site soil may not be suitable for use as structural fill unless a suitable moisture content is achieved at the time of placement and compaction. If the on-site soil cannot achieve the above specifications, use of an imported structural fill material will likely be necessary. With respect to underground utility installations and backfill, local jurisdictions will likely dictate soil type(s) and compaction requirements.

Slope Fill

Structural fill within unregulated sloping areas on this site should be placed on a level bench as depicted on Plate 3 (Slope Fill Detail). Benches must be “keyed” into the slope, and subsequently filled and compacted with suitable structural fill before continuing to the next bench. Sloping finish grades should be “overbuilt” using a bench-style fill and cut to the design gradient to ensure a compacted slope face is maintained. ESNW should review the final grading plans to confirm the recommendations in this report have been incorporated. ESNW should observe structural fill placement to confirm subgrade conditions and provide additional drainage recommendations, as necessary.

Subgrade Preparation

Foundation and slab subgrade surfaces should consist of competent, undisturbed native soil or structural fill placed and compacted directly on a competent native soil subgrade. ESNW should observe subgrade areas prior to placing formwork. Supplementary recommendations for subgrade improvement may be provided at the time of construction; such recommendations would likely include further mechanical compaction effort or overexcavation and replacement with suitable structural fill. It is imperative that all foundation elements associated within previous site structures be removed and any resulting voids be filled in accordance with the *Structural Fill* section of this report.

Wet Season Grading

Earthwork activities that occur during wet weather conditions may require additional measures to protect structural subgrades and soils intended for use as structural fill. Site-specific recommendations can be provided at the time of construction and may include leaving cut areas several inches above design elevations, covering working surfaces with crushed rock, protecting structural fill soils from adverse moisture conditions, and additional TESC recommendations. ESNW can also assist in obtaining a wet season grading permit or extension, where appropriate, if required by the presiding jurisdiction.

Foundations

Based on the conditions encountered during our fieldwork, in our opinion, the proposed residences can be constructed on conventional continuous and spread foundations bearing on competent native soil, recompacted native soil, or new structural fill placed directly on competent native soils. Native soils considered capable for support of the proposed residences are anticipated to be first encountered at depths of about two to four feet bgs. Where loose or otherwise unsuitable soil conditions are encountered at foundation subgrades, additional compaction efforts or overexcavation and restoration with structural fill will likely be necessary.

Provided the foundations will be supported as recommended, the following parameters may be used for foundation design:

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

* *Assumes sides of the foundation will be backfilled with compacted structural fill.*

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

Seismic Design

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

Parameter	Value
Site Class	D*
Mapped short period spectral response acceleration, S_S (*g*)	1.249
Mapped 1-second period spectral response acceleration, S_1 (*g*)	0.430
Short period site coefficient, F_a	1.001
Long period site coefficient, F_v	1.870†
Adjusted short period spectral response acceleration, S_{MS} (*g*)	1.249
Adjusted 1-second period spectral response acceleration, S_{M1} (*g*)	0.804†
Design short period spectral response acceleration, S_{DS} (*g*)	0.833
Design 1-second period spectral response acceleration, S_{D1} (*g*)	0.539†

* *Assumes dense native soil conditions, encountered to a maximum depth of 21.5 feet bgs during the February 2022 field exploration, remain at least medium dense to at least 100 feet bgs.*
† *Values assume F_v may be determined using linear interpolation per Table 11.4-2 in ASCE 7-16.*

As indicated in the table footnote, several of the seismic design values provided above are dependent on the assumption that site-specific ground motion analysis (per Section 11.4.8 of ASCE 7-16) will not be required for the subject project. ESNW recommends the validity of this assumption be confirmed at the earliest available opportunity during the planning and early design stages of the project. Further discussion between the project structural engineer, the project owner, and ESNW may be prudent to determine the possible impacts to the structural design due to increased earthquake load requirements under the 2018 IBC. ESNW can provide additional consulting services to aid with design efforts, including supplementary geotechnical and geophysical investigation, upon request.

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

Slab-on-Grade Floors

Slab-on-grade floors for the proposed structures should be supported on competent, well-compacted, firm, and unyielding subgrades. Unstable or yielding subgrade areas should be recompacted or overexcavated and replaced with suitable structural fill prior to slab construction.

A capillary break consisting of at least four inches of free-draining crushed rock or gravel should be placed below each slab. The free-draining material should have a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. The vapor barrier should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

Retaining Walls

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

- Active earth pressure (unrestrained condition) — 35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 55 pcf
- Traffic surcharge* (passenger vehicles) — 70 psf (rectangular distribution)
- Passive earth pressure — 300 pcf (equivalent fluid)
- Allowable soil bearing capacity — 2,500 psf
- Coefficient of friction — 0.40
- Seismic surcharge — 8H psf**

* *Where applicable.*
** *Where H equals the retained height (in feet).*

Additional surcharge loading from foundations, sloped backfill, or other loading should be included in the retaining wall design, as appropriate. Drainage should be provided behind retaining walls such that hydrostatic pressures do not develop. If drainage is not provided, hydrostatic pressures should be included in the wall design, as appropriate. ESNW should review retaining wall designs to verify that appropriate earth pressure values have been incorporated into the design and to provide additional recommendations, as necessary.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 12 inches behind the wall. The upper one foot of the wall backfill may consist of a less permeable (surface seal) soil, if desired. In lieu of free-draining backfill, use of an approved sheet drain material may also be considered, based on the observed subsurface and groundwater conditions. ESNW should review conditions at the time of construction and provide recommendations for sheet drain material, as appropriate. A perforated drainpipe should be placed along the base of the wall and connected to an appropriate discharge location. A typical retaining wall drainage detail is illustrated on Plate 4.

Drainage

Surface grades must be designed to direct water away from the buildings to the extent practical. The grade adjacent to the buildings should be sloped away at a gradient of at least 2 percent for a horizontal distance of at least 10 feet (or as building and property setbacks allow). In no instance should water be allowed to collect, pond, or flow uncontrolled above and over sloping areas.

Groundwater seepage zones may be encountered during construction, depending on the time of year grading operations take place. Temporary measures to control surface water runoff and groundwater seepage during construction would likely involve interceptor trenches and sumps. ESNW should be consulted during preliminary grading and excavation activities to identify areas of seepage and to provide recommendations to reduce the potential for seepage-related instability. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 5.

Preliminary Stormwater Management Considerations

We understand the project will utilize detention (stormwater pond or stormwater vault) within the north central site area. Preliminary designs suggest a bottom of facility elevation at about 290 feet. As such, minimal to no excavations would be required within the easternmost area of the facility footprint while excavations up to about 20 feet may be required within the central and western half of the facility footprint. From a geotechnical standpoint, construction of a pond or vault in the area is feasible. ESNW should have the opportunity to review grading plans and the site topographic survey once they become available to provide additional recommendations relating to stormwater facility designs.

Given the exposed in-situ conditions, the project must be prepared to install a liner if a stormwater pond will be constructed. The pond liner should consist of a placed and compacted till or clay liner, or geomembrane, in accordance with the governing jurisdictional requirements. ESNW can assist in further evaluating appropriate liner material and construction methods, as requested. Pond berm walls must be placed and compacted to the specifications provided in the *Structural Fill* section of this report. It is possible that onsite soils will not meet the gradation and permeability requirements to use as berm fill. As such, a contingency should be added to the project budge in the case imported material is required for such use. Given the current positioning of the proposed stormwater facility in relation to existing site slope, global slope stability analysis should be considered once grading plans and the site topographic survey has been completed.

Preliminary Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications previously detailed in this report. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions will require remedial measures, such as overexcavation and replacement with crushed rock or structural fill, prior to pavement. If roadway areas will be designed with an inverted crown, additional drainage measures may be recommended at the time of construction to help maintain subgrade stability and pavement performance.

For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

- A minimum of two inches of hot-mix asphalt (HMA) placed over four inches of crushed rock base (CRB).

- A minimum of two inches of HMA placed over three inches of asphalt-treated base (ATB).

Heavier traffic areas generally require thicker pavement sections depending on site usage, pavement life expectancy, and site traffic. For preliminary design purposes, the following pavement sections for occasional truck traffic and access roadways areas may be considered:

- Three inches of HMA placed over six inches of CRB.

- Three inches of HMA placed over four-and-one-half inches of ATB.

The HMA, ATB, and CRB materials should conform to the specifications of the governing jurisdiction. All soil base material should be compacted to at least 95 percent of the maximum dry density. Final pavement design recommendations can be provided once final traffic loading has been determined. Governing jurisdictional standards may supersede the recommendations provided in this report.

Utility Support and Trench Backfill

In our opinion, native soils will generally be competent for support of utilities. In general, native soils may be suitable for use as structural backfill throughout utility trench excavations, provided the soils are at (or slightly above) the optimum moisture content at the time of placement and compaction. Structural trench backfill should not be placed dry of the optimum moisture content. Each section of the site utility lines must be adequately supported in appropriate bedding material. Utility trench backfill should be placed and compacted to the specifications of structural fill (as previously detailed in this report) or to the applicable specifications of the presiding jurisdiction.

LIMITATIONS

This study has been prepared for the exclusive use of RM Homes, LLC and its representatives. No warranty, express or implied, is made. The recommendations and conclusions provided in this geotechnical engineering study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. Variations in the soil and groundwater conditions observed at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this geotechnical engineering study if variations are encountered.

Additional Services

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

Reference:
Pierce County, Washington
OpenStreetMap.org

NORTH

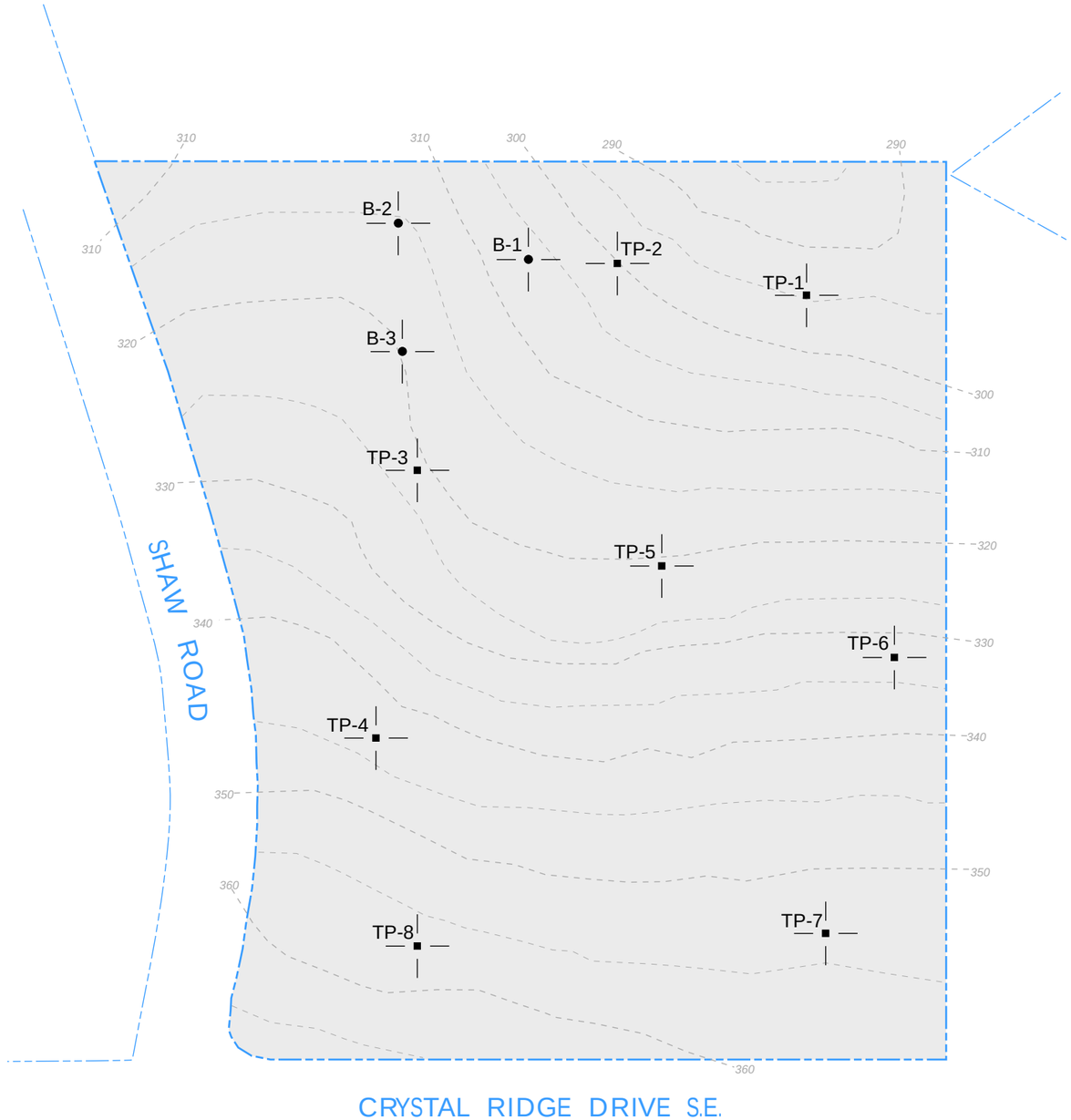
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Normandy Heights
Puyallup, Washington

Drwn. MRS	Date 05/02/2022	Proj. No. 0593
Checked CGH	Date May 2022	Plate 1



LEGEND

B-1 — Approximate Location of ESNW Boring, Proj. No. ES-0593.03, Feb. 2022

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-0593, Oct. 2006

Subject Site

NORTH

0 50 100 200

1"=100'

Scale in Feet

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

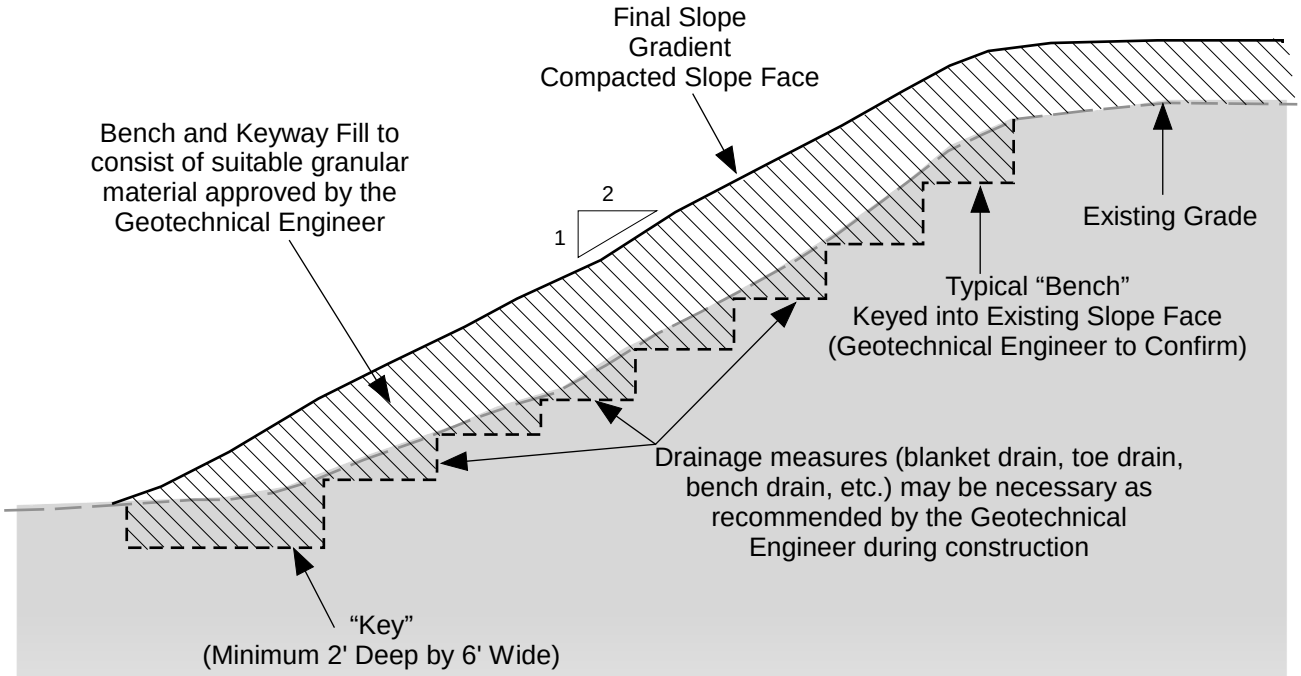
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Subsurface Exploration Plan
Normandy Heights
Puyallup, Washington

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

Drwn. By	MRS
Checked By	CGH
Date	05/02/2022
Proj. No.	0593
Plate	2

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING



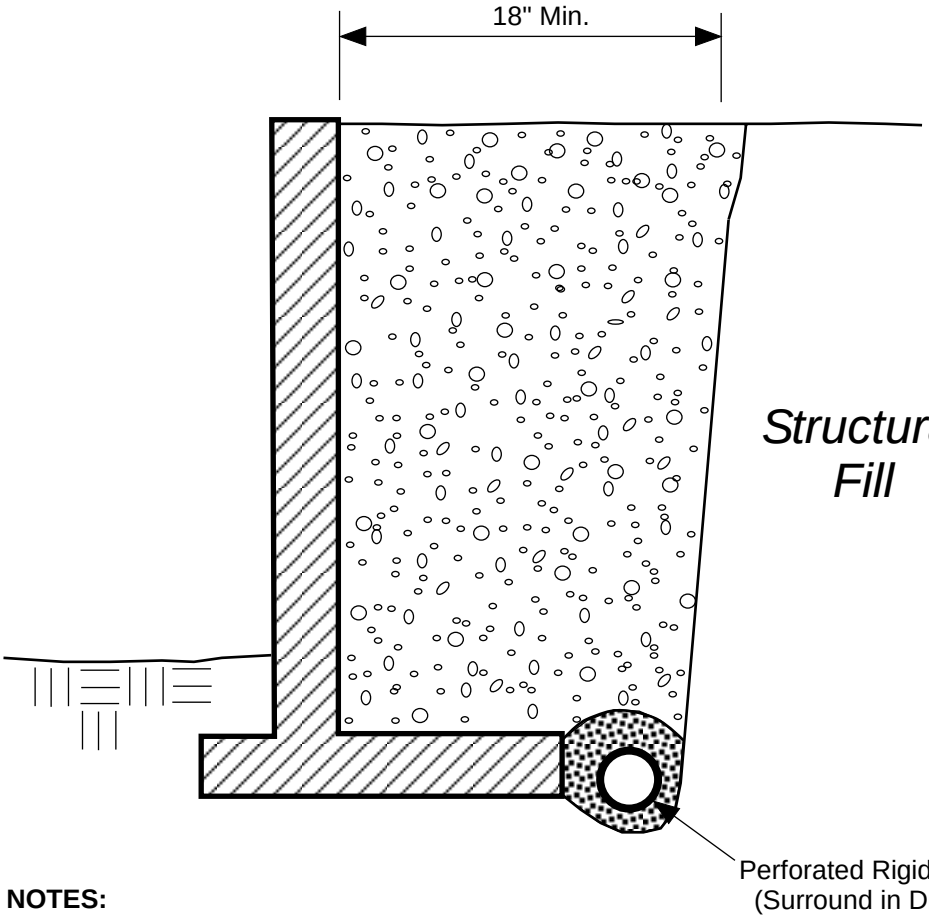
NOTES:

- Slope should be stripped of topsoil and unsuitable materials prior to excavating Keyway or benches.
- Benches will typically be equal to a bulldozer blade width of approximately 8 feet but shall be at least 4 feet.
- Final slope gradient should be 2H : 1V.
- Final slope face should be densified by over-building with compacted fill and trimming back to shape or by compaction with a bulldozer or vibratory drum roller.
- Planting or hydroseeding slope face with a rapid growth deep-rooted vegetative mat will reduce erosion potential of slope area.
- Use of pegged-in-place jute matting or geotechnical fabric will help maintain the seed and mulch in place until the root system has an opportunity to germinate.
- Structural fill should be placed in thin loose lifts not exceeding 12 inches in thickness. Each lift should be compacted to no less than the degree specified in the "Site Preparation and Earthwork" section of this report. No additional lift should be placed until compaction is achieved.

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

Slope Fill Detail
Normandy Heights
Puyallup, Washington

Drwn. MRS	Date 05/02/2022	Proj. No. 0593
Checked SSR	Date May 2022	Plate 3



NOTES:

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

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Free-draining Structural Backfill

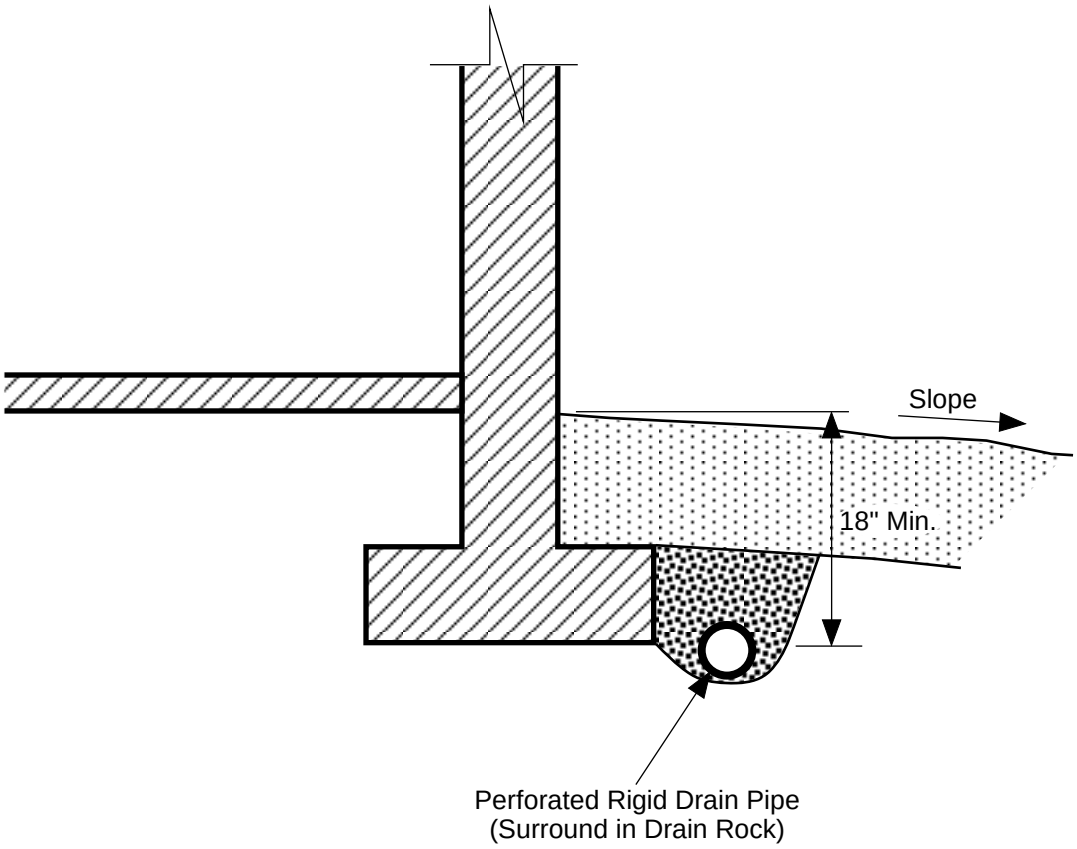
1-inch Drain Rock

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Retaining Wall Drainage Detail
Normandy Heights
Puyallup, Washington

Drwn. MRS	Date 05/02/2022	Proj. No. 0593
Checked SSR	Date May 2022	Plate 4



NOTES:

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

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

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

1-inch Drain Rock

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

Footing Drain Detail
Normandy Heights
Puyallup, Washington

Drwn. MRS	Date 05/02/2022	Proj. No. 0593
Checked SSR	Date May 2022	Plate 5

Appendix A

Subsurface Exploration
Boring and Test Pit Logs

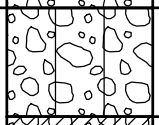
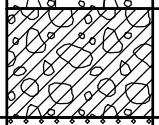
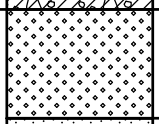
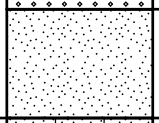
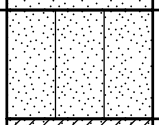
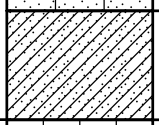
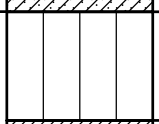
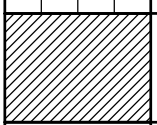
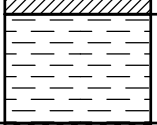
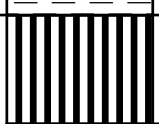
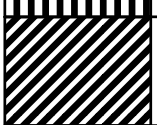
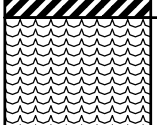
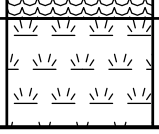
ES-0593

An ESNW representative observed, logged, and sampled eight test pits on October 23, 2006 and three borings on February 8, 2022. The explorations were completed in accessible site areas using exploratory equipment and operators retained by our firm. The test pits were excavated to a maximum exploration depth of about 17 feet bgs and the borings were advanced to a maximum depth of about 21.5 feet bgs. The approximate locations of the test pits and borings are depicted on Plate 2 (Subsurface Exploration Plan). The test pit and boring logs are provided in this Appendix.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

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

DUAL SYMBOLS are used to indicate borderline soil classifications.

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

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BORING NUMBER B-1

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights

DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**

DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17139 **LONGITUDE** -122.25172

DRILLING METHOD HSA **GROUND WATER LEVEL:**

LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**

NOTES Surface Conditions: drill-pad

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0							
					SM		Brown silty SAND, loose, moist (Drill Pad Fill)
2.5							
	SS	67	1-3-5 (8)	MC = 30.5%			
3.5							
							Brown SILT, loose, moist
5.0							
	SS	67	2-4-5 (9)	MC = 30.7% Fines = 85.5%			-trace iron oxide staining
							[USDA Classification: LOAM]
7.5					ML		
	SS	100	5-6-7 (13)	MC = 30.0%			-becomes medium dense, wet
							-~3" sand lens
10.0							
10.0							Gray poorly graded SAND with silt, medium dense, moist
	SS	67	6-8-11 (19)	MC = 12.0%			
12.5					SP-SM		
15.0							
15.0							

(Continued Next Page)

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BORING NUMBER B-1

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights

DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**

DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17139 **LONGITUDE** -122.25172

DRILLING METHOD HSA **GROUND WATER LEVEL:**

LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**

NOTES Surface Conditions: drill-pad

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
15.0							
	SS	67	8-8-12 (20)	MC = 21.8% Fines = 51.7%	ML		Gray sandy SILT, medium dense, moist [USDA Classification: LOAM]
16.5							

Boring terminated at 16.5 feet below existing grade. No groundwater encountered during drilling. 2" PVC standpipe installed to bottom of boring. Lower 10.0 feet slotted. Well ID: B95510. Boring backfilled with sand/bentonite.

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BORING NUMBER B-2

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights
DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17148 **LONGITUDE** -122.25214
DRILLING METHOD HSA **GROUND WATER LEVEL:**
LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**
NOTES Surface Conditions: cleared brush

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0							Brown SILT, loose, moist
2.5							
5.0	SS	100	1-3-4 (7)	MC = 28.5%			-becomes moist to wet
7.5					ML		
10.0	SS	100	1-3-4 (7)	MC = 33.4% Fines = 90.6%			-very minor perched groundwater seepage -zones of heavy iron oxide staining [USDA Classification: slightly gravelly LOAM]
12.5							
15.0							

GENERAL BH / TP / WELL - 0593-3.GPJ - GRAPHICS TEMPLATE WITH LAT AND LONG.GDT - 5/3/22

(Continued Next Page)

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BORING NUMBER B-2

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights
DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17148 **LONGITUDE** -122.25214
DRILLING METHOD HSA **GROUND WATER LEVEL:**
LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**
NOTES Surface Conditions: cleared brush

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
15.0							
	SS	100	3-5-7 (12)	MC = 29.5%	ML		Brown SILT, loose, moist *(continued)* -becomes medium dense, wet -minor perched groundwater seepage
17.5							
20.0							20.0
	SS	67	8-12-15 (27)	MC = 3.7% Fines = 5.4%	SP-SM		Gray poorly graded SAND, medium dense, moist [USDA Classification: slightly gravelly SAND]
							21.5

Boring terminated at 21.5 feet below existing grade. Groundwater seepage encountered at 10.0 and 15.0 feet during drilling. 2" PVC standpipe installed to bottom of boring. Lower 10.0 feet slotted. Well ID: BM5511. Boring backfilled with sand/bentonite.

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BORING NUMBER B-3

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights
DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17121 **LONGITUDE** -122.25216
DRILLING METHOD HSA **GROUND WATER LEVEL:**
LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**
NOTES Surface Conditions: brush

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0							Brown silty SAND, loose, moist
2.5					SM		
5.0							5.0
	SS	100	4-5-6 (11)	MC = 5.0%			Gray poorly graded SAND, medium dense, moist
7.5					SP		
10.0							10.0
	SS	100	4-6-8 (14)	MC = 11.1% Fines = 15.4%			Gray silty SAND, medium dense, moist [USDA Classification: loamy fine SAND]
12.5					SM		
15.0							15.0

(Continued Next Page)

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BORING NUMBER B-3

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights

DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**

DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17121 **LONGITUDE** -122.25216

DRILLING METHOD HSA **GROUND WATER LEVEL:**

LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**

NOTES Surface Conditions: brush

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
15.0	SS	67	6-9-10 (19)	MC = 12.0%	SP-SM		Gray poorly graded SAND with silt and gravel, medium dense, moist
17.5							
20.0	SS	67	18-30-11 (41)	MC = 4.1%			-becomes dense
							21.5

Boring terminated at 21.5 feet below existing grade. No groundwater encountered during drilling. 2" PVC standpipe installed to bottom of boring. Lower 10.0 feet slotted. Well ID: BM5512. Boring backfilled with sand/bentonite.

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TEST PIT NUMBER TP-1

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 295 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 12": forest duff

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Light brown to brown poorly graded GRAVEL with sand, loose to medium dense, moist
2.5		MC = 2.5%			
5.0		MC = 2.0%	GP-GM		
7.5					
					9.0 286.0
10.0		MC = 3.9% Fines = 1.5%	SP		Brown poorly graded SAND with gravel;, medium dense, moist
12.5					
					14.0 281.0
15.0			GP		Brown poorly graded GRAVEL with sand, medium dense, moist

GENERAL BH / TP / WELL - 0593.GPJ - GRAPHICS TEMPLATE WITH LAT AND LONG.GDT - 5/3/22

(Continued Next Page)

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TEST PIT NUMBER TP-1

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 295 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 12": forest duff

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
15.0		MC = 2.6%	GP		Brown poorly graded GRAVEL with sand, medium dense, moist *(continued)*
		MC = 2.9% Fines = 1.3%		17.0	278.0 Test pit terminated at 17.0 feet below existing grade. No groundwater encountered during excavation.

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TEST PIT NUMBER TP-2

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 300 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 8": forest duff

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0						
		MC = 6.9%	SM		Light brown silty SAND, medium dense, moist	
2.5						
					3.0	297.0
		MC = 4.8%			Brown poorly graded SAND with silt, medium dense, moist	
5.0						
			SP-SM			
7.5		MC = 4.8% Fines = 6.1%				
10.0						
		MC = 2.8% Fines = 2.2%			11.0	289.0
			GP		Gray poorly graded GRAVEL with sand, medium dense, moist	
12.5						
					13.0	287.0
			SM		Gray silty SAND, medium dense, moist	
15.0		MC = 9.3% Fines = 34.8%			15.0	285.0

Test pit terminated at 15.0 feet below existing grade. No groundwater encountered during excavation.

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TEST PIT NUMBER TP-3

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 320 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 7"

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Light brown to gray poorly graded SAND, medium dense, moist
2.5		MC = 2.7% Fines = 2.2%	SP		
5.0		MC = 4.8%			
7.5					
10.0		MC = 6.3%		10.0	310.0
					Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation.

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TEST PIT NUMBER TP-4

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 345 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 8"

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Gray poorly graded SAND with gravel, medium dense, moist
2.5		MC = 2.4%			
5.0		MC = 2.9% Fines = 1.6%	SP		
7.5		MC = 2.5%			
10.0		MC = 3.7%		10.0	335.0
					Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation.

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TEST PIT NUMBER TP-5

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 320 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 10"

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Light brown poorly graded SAND with silt, loose to medium dense, moist
2.5		MC = 4.6%	SP		
5.0		MC = 4.7%			
6.0					314.0
7.5		MC = 3.0%	GP		Gray poorly graded GRAVEL with sand, medium dense, moist
10.0		MC = 6.0%			310.0
					Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation.

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TEST PIT NUMBER TP-6

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 335 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 12"

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Gray poorly graded GRAVEL with sand, medium dense, moist
		MC = 1.7%	GP		
2.5					2.0 333.0 Brown poorly graded SAND with gravel, medium dense, moist
		MC = 3.1% Fines = 0.8%			
5.0					
			SP		
7.5		MC = 2.4%			
10.0		MC = 2.3%			10.0 325.0 Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation.

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TEST PIT NUMBER TP-7

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 350 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 6"

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0						
		MC = 2.0%	GP		Light brown to gray poorly graded GRAVEL with sand, loose to medium dense, moist	
2.5						
					3.0	347.0
		MC = 3.6% Fines = 1.0%	SP		Gray poorly graded SAND, medium dense, moist	
5.0		MC = 2.9%			5.0	345.0
			GP		Gray poorly graded GRAVEL with sand, medium dense, moist	
					7.0	343.0
7.5			SP		Gray poorly graded SAND with gravel, medium dense, moist	
		MC = 6.2%			8.0	342.0
					Test pit terminated at 8.0 feet below existing grade. No groundwater encountered during excavation.	

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TEST PIT NUMBER TP-8

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 355 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES _____

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Light brown to gray poorly graded SAND with silt, medium dense, moist
		MC = 8.1%	SP-SM		
2.5					
		MC = 6.1%			
					4.0 351.0
					Gray poorly graded SAND, medium dense, moist
5.0					
7.5		MC = 5.1% Fines = 1.6%	SP		
10.0					
		MC = 4.7%			12.0 343.0
					Test pit terminated at 12.0 feet below existing grade. No groundwater encountered during excavation.

Appendix B

Laboratory Test Results

ES-0593

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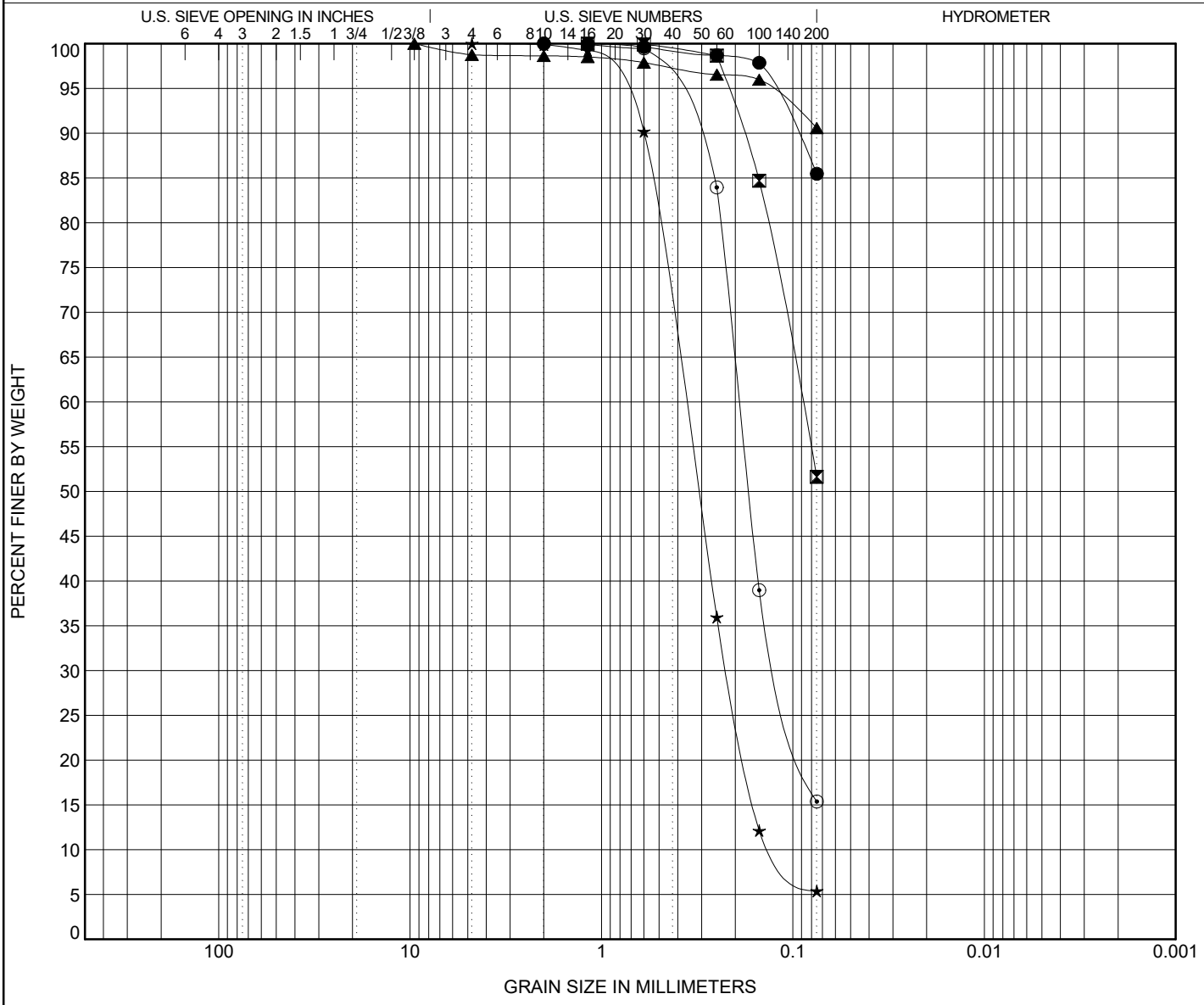
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	B-01	5.00ft.	USDA: Brown Loam. USCS: ML.		
⊠	B-01	15.00ft.	USDA: Gray Loam. USCS: Sandy ML.		
▲	B-02	10.00ft.	USDA: Brown Slightly Gravelly Loam. USCS: ML.		
★	B-02	20.00ft.	USDA: Gray Slightly Gravelly Sand. USCS: SP-SM.	1.09	3.06
⊙	B-03	10.00ft.	USDA: Gray Loamy Fine Sand. USCS: SM.		

Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	B-01	5.0ft.	2							85.5	
⊠	B-01	15.0ft.	1.18	0.089						51.7	
▲	B-02	10.0ft.	9.5							90.6	
★	B-02	20.0ft.	4.75	0.368	0.22	0.12				5.4	
⊙	B-03	10.0ft.	2	0.19	0.115					15.4	

GRAIN SIZE USDA ES-0593.03 NORMANDY HEIGHTS.GPJ GINT US LAB.GDT 3/3/22

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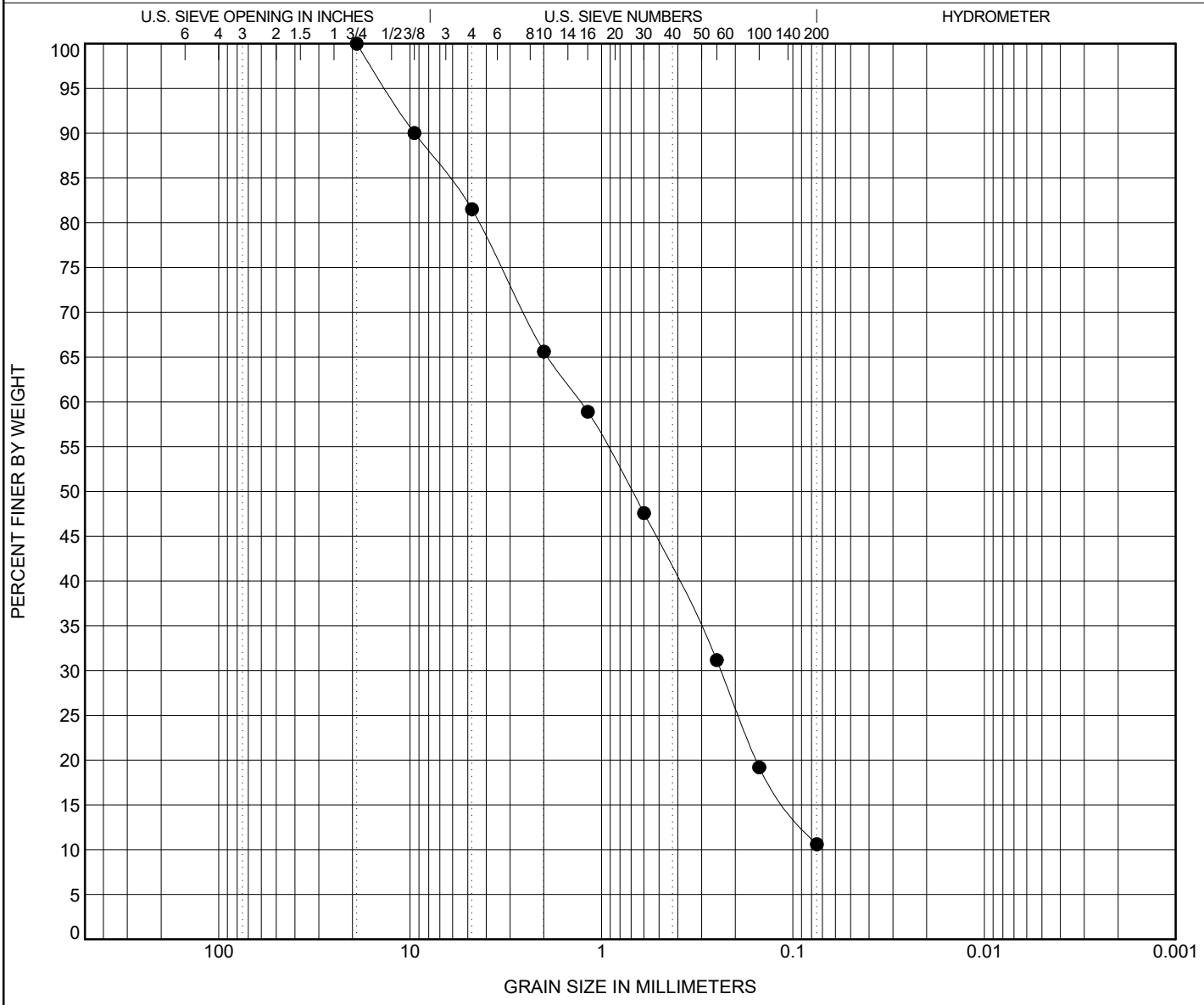
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	**B-03**	**20.00ft.**	**USDA: Gray Gravelly Loamy Coarse Sand. USCS: SP-SM with Gravel.**	**0.62**	**18.02**

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**B-03**	**20.0ft.**	**19**	**1.286**	**0.238**					**10.6**	

GRAIN SIZE USDA ES-0593.03 NORMANDY HEIGHTS.GPJ GINT US LAB.GDT 3/3/22

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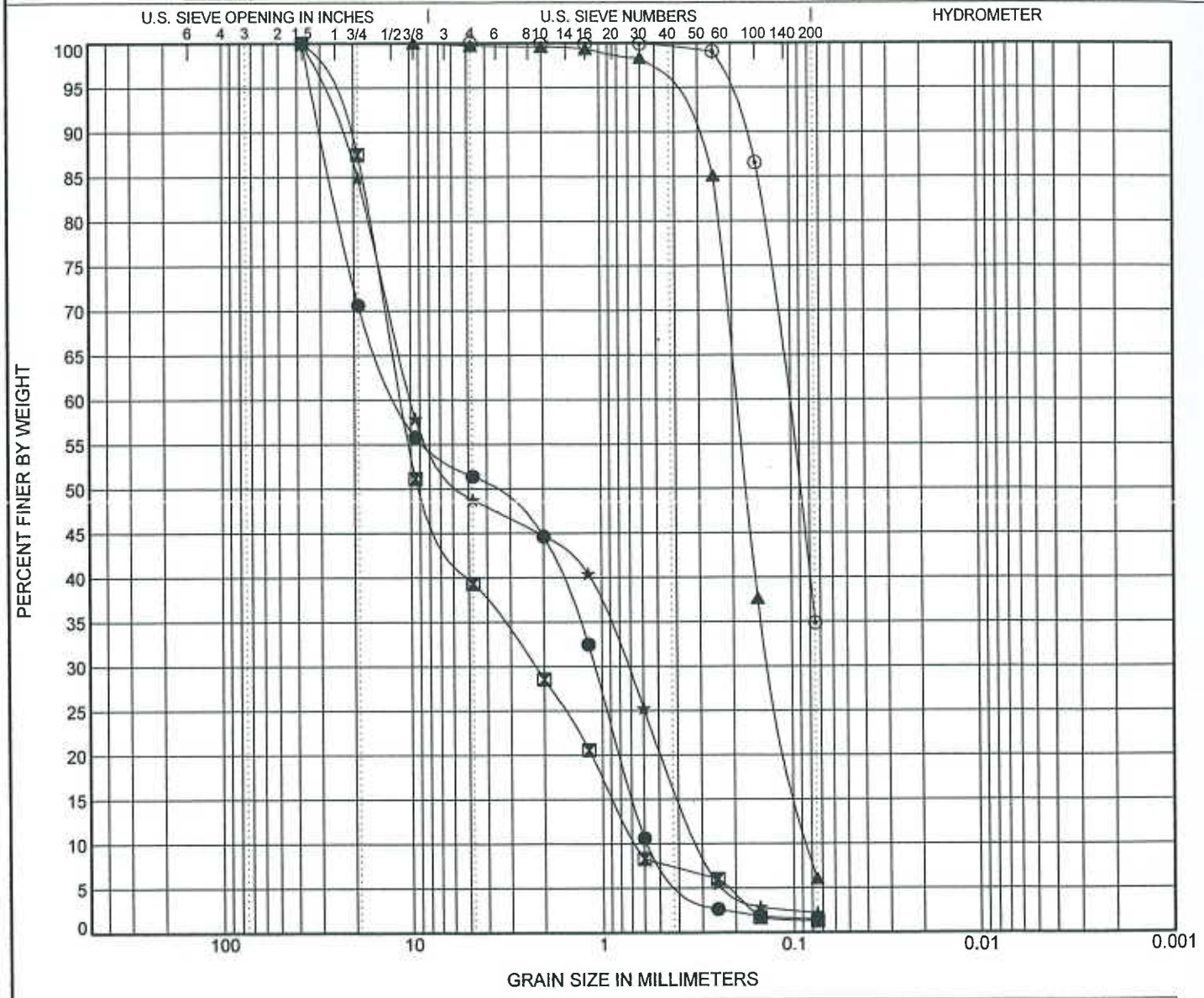
GRAIN SIZE DISTRIBUTION

CLIENT Trinity Land Development **PROJECT NAME** Normandy Heights

PROJECT NUMBER ES-593 **PROJECT LOCATION** Puyallup



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	TP-01	10.0ft.	USDA: Brown very gravelly coarse sand, USCS: SP				0.18	20.63
⊠	TP-01	17.0ft.	USDA: Light brown extremely gravelly coarse sand, USCS: GP				0.68	17.06
▲	TP-02	8.0ft.	USDA: Light brown fine sand, USCS: SP-SM				1.03	2.33
★	TP-02	11.0ft.	USDA: Gray very gravelly coarse sand, USCS: GP				0.18	32.81
⊙	TP-02	15.0ft.	USDA: Gray fine sandy loam, USCS: SM					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-01	10.0ft.	37.5	11.554	1.093	0.56	48.6	49.9	1.5	
⊠	TP-01	17.0ft.	37.5	11.246	2.248	0.659	60.7	38.1	1.3	
▲	TP-02	8.0ft.	9.5	0.191	0.127	0.082	0.3	93.7	6.1	
★	TP-02	11.0ft.	37.5	10.02	0.741	0.305	51.2	46.6	2.2	
⊙	TP-02	15.0ft.	4.75	0.105			0.0	65.2	34.8	

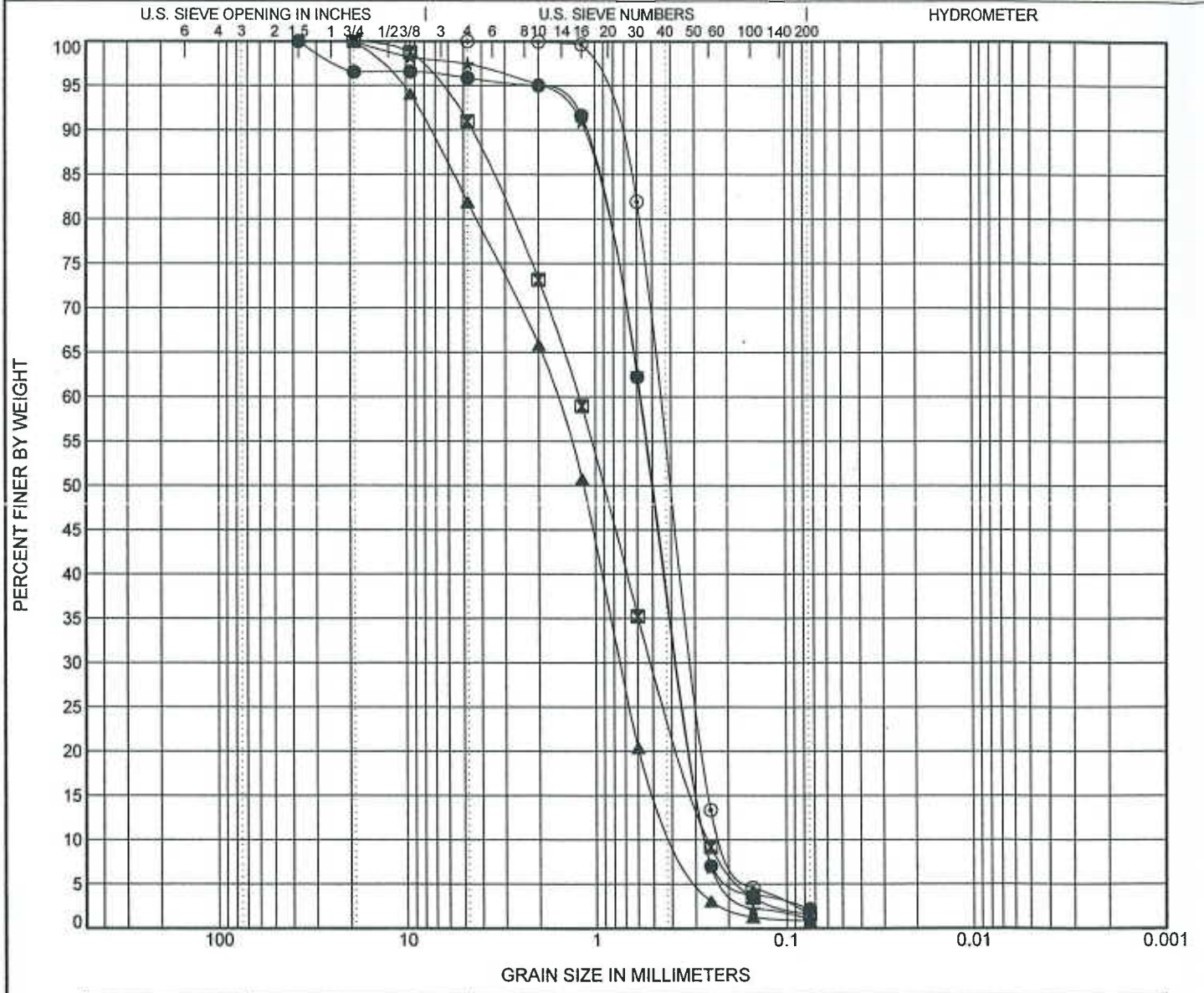
GRAIN SIZE ES-593.GPJ GINT US LAB.GDT 10/30/06

Earth Solutions NW, LLC
2881 152nd Avenue N.E.
Redmond, WA 98052
Telephone: (425) 284-3300
Fax: (425) 284-2855

GRAIN SIZE DISTRIBUTION

CLIENT Trinity Land Development **PROJECT NAME** Normandy Heights

PROJECT NUMBER ES-593 **PROJECT LOCATION** Puyallup



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	TP-03	3.0ft.	USDA: Light brown sand, USCS: SP				0.85	2.21
⊠	TP-04	4.0ft.	USDA: Brown gravelly coarse sand, USCS: SP				0.80	4.77
▲	TP-06	4.0ft.	USDA: Light brown gravelly coarse sand, USCS: SP				0.95	4.59
★	TP-07	4.0ft.	USDA: Brown sand, USCS: SP				0.85	2.19
⊙	TP-08	8.0ft.	USDA: Gray sand, USCS: SP				1.03	2.21

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-03	3.0ft.	37.5	0.579	0.36	0.262	4.1	93.7	2.2	
⊠	TP-04	4.0ft.	19	1.226	0.503	0.257	9.0	89.4	1.6	
▲	TP-06	4.0ft.	19	1.631	0.743	0.355	18.1	81.1	0.8	
★	TP-07	4.0ft.	19	0.575	0.359	0.263	2.6	96.4	1.0	
⊙	TP-08	8.0ft.	4.75	0.453	0.309	0.205	0.0	98.4	1.6	

GRAIN SIZE ES-593.GPJ GINT US LAB.GDT 10/30/06

Report Distribution

ES-0593

EMAIL ONLY

RM Homes, LLC
2913 – 5th Avenue Northeast, Suite 201
Puyallup, Washington 98372

Attention: Mr. James Kerby

7.2 Groundwater Monitoring Program Results by Earth Solutions NW, LLC August 9, 2022.

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

August 9, 2022
ES-0593.03

RM Homes, LLC
2913 – 5th Avenue Northeast, Suite 201
Puyallup, Washington 98372

Attention: Mr. James Kerby

Subject: Groundwater Monitoring Program Results
Proposed Normandy Heights Residential Development
2007 Shaw Road
Puyallup, Washington

Reference: Earth Solutions NW, LLC
Geotechnical Engineering Study
Project No. ES-0593, updated May 3, 2022

Dear Mr. Kerby:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this summary letter to provide the results of the groundwater monitoring program completed for the subject site

Project Description

We understand the project is pursuing the construction of a residential development and associated infrastructure improvements. Stormwater management is currently proposed via a detention facility located within the north-central portion of the site. Current designs suggest that grade cuts up to about 20 feet will be required to achieve design elevations along the west facility edge and will decrease to the east and daylight along the easternmost edge of the system. The proposed stormwater management system will not utilize infiltration; as such, the monitoring was performed to evaluate potential groundwater exfiltration into the system.

Subsurface

Subsequent to initial site subsurface exploration completed on October 23, 2006, associated with preparation of the referenced geotechnical report, three supplementary borings were advanced on February 8, 2022, targeted to the proposed stormwater management Tract F within the north-central site area. The purpose of the borings was to facilitate the installation of observation wells in the area, which would allow us to perform groundwater monitoring for the site. The wells were installed to depths of between 16.5 feet to 21.5 feet below the existing ground surface. The approximate locations of the monitoring wells are illustrated in the attached Exploration Location Plan (Plate 1). Logs of each exploration are also provided as an attachment and can be reviewed for a more detailed description of the subsurface soil conditions.

Groundwater

Groundwater was not exposed within the test pit locations during the October 2006 field exploration; however, discrete perched groundwater seepage was exposed at depths of about 10 feet to 15 feet below the ground surface at B-2 during the February 2022 fieldwork. The seepage was characterized as very minor to minor.

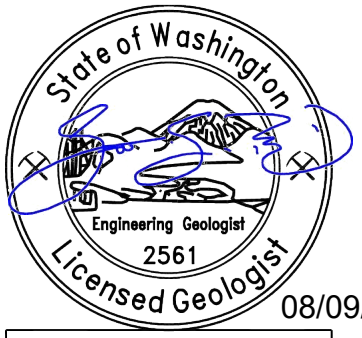
Groundwater Monitoring

Groundwater monitoring was performed at each well location (B-1 to B-3). The observation wells were installed on February 8, 2022, and the monitoring program began immediately thereafter. Groundwater depths and fluctuations were recorded via weekly measurements through April 30, 2022. Groundwater was not observed at any of the observation locations during the monitoring period. Concerning the perched seepage encountered at B-2, it is our opinion that the groundwater represents discrete and discontinuous lenses that produced very little groundwater flows. It should be noted the rainfall received during the winter/spring 2021/2022 season (monitoring period) was higher than average. Based on the results of the groundwater monitoring program, we do not expect groundwater to exfiltrate or otherwise adversely affect the performance of the stormwater facility.

We trust this addendum letter meets your current needs. Should you have questions regarding the content herein, or require additional information, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC



08/09/2022

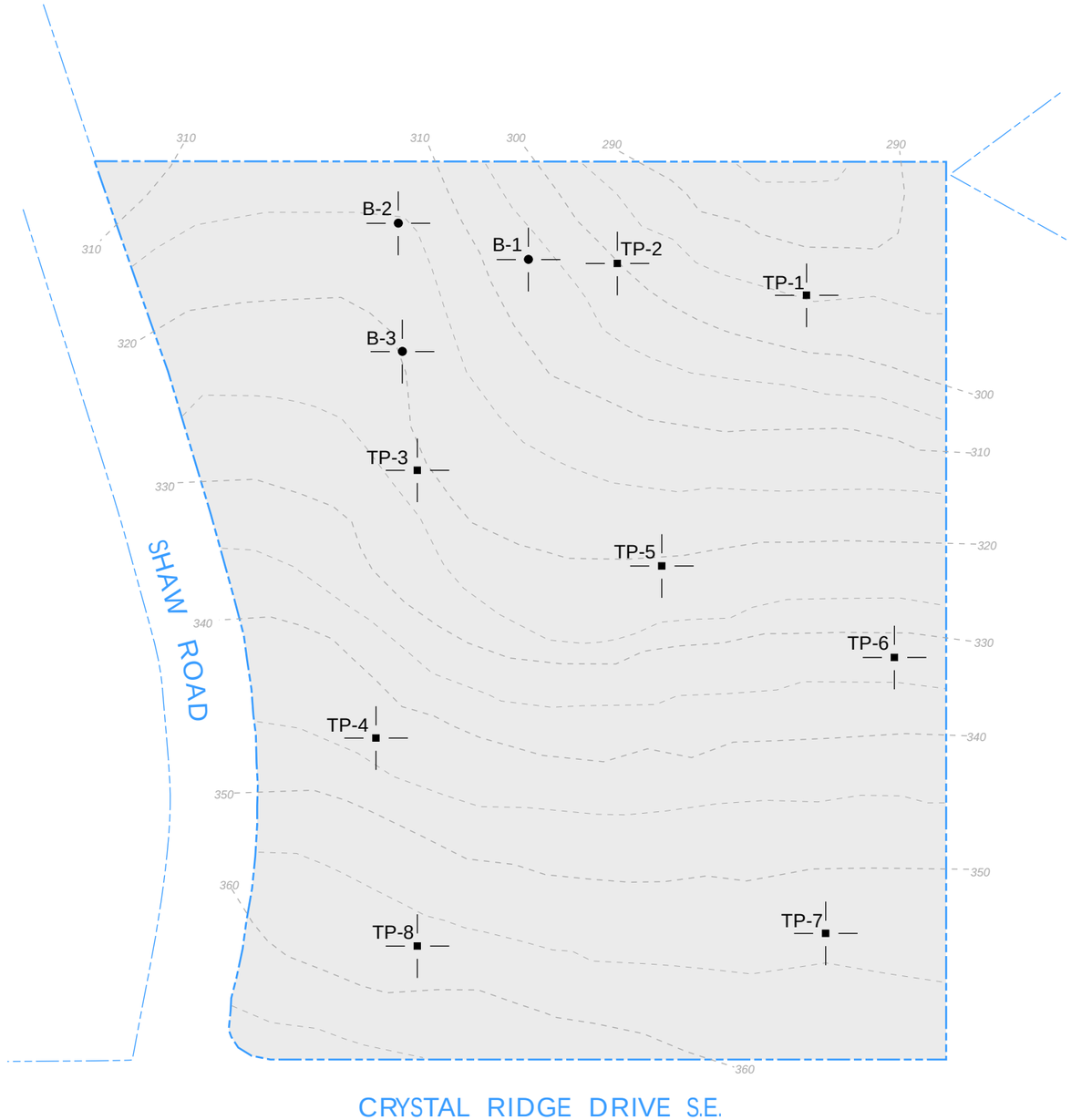
Scott S. Riegel

Chase G. Halsen, L.G.
Senior Project Geologist

Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

Attachments: Plate 1 – Subsurface Exploration Plan
Boring and Test Pit Logs

cc: Barghausen Consulting Engineers, Inc.
Attention: Ms. Cara Visintainer, P.E. (Email only)



LEGEND

B-1 — Approximate Location of ESNW Boring, Proj. No. ES-0593.03, Feb. 2022

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-0593, Oct. 2006

Subject Site

NORTH

0 50 100 200

1"=100'

Scale in Feet

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

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

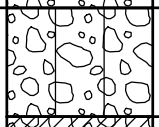
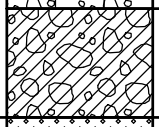
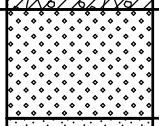
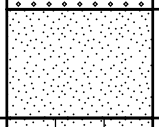
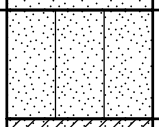
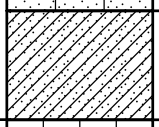
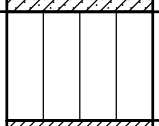
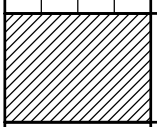
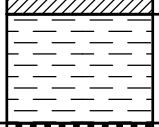
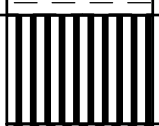
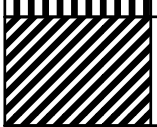
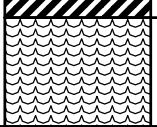
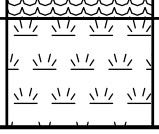
Subsurface Exploration Plan
Normandy Heights
Puyallup, Washington

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

Drwn. By	MRS
Checked By	CGH
Date	08/09/2022
Proj. No.	0593.03
Plate	1

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

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

DUAL SYMBOLS are used to indicate borderline soil classifications.

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

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

BORING NUMBER B-1

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights

DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**

DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17139 **LONGITUDE** -122.25172

DRILLING METHOD HSA **GROUND WATER LEVEL:**

LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**

NOTES Surface Conditions: drill-pad

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0							
					SM		Brown silty SAND, loose, moist (Drill Pad Fill)
2.5							
	SS	67	1-3-5 (8)	MC = 30.5%			
3.5							
							Brown SILT, loose, moist
5.0							
	SS	67	2-4-5 (9)	MC = 30.7% Fines = 85.5%			-trace iron oxide staining
							[USDA Classification: LOAM]
7.5					ML		
	SS	100	5-6-7 (13)	MC = 30.0%			-becomes medium dense, wet
							-~3" sand lens
10.0							
10.0							Gray poorly graded SAND with silt, medium dense, moist
	SS	67	6-8-11 (19)	MC = 12.0%			
12.5					SP-SM		
15.0							
15.0							

(Continued Next Page)

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15365 N.E. 90th Street, Suite 100
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BORING NUMBER B-1

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights

DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**

DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17139 **LONGITUDE** -122.25172

DRILLING METHOD HSA **GROUND WATER LEVEL:**

LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**

NOTES Surface Conditions: drill-pad

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
15.0							
	SS	67	8-8-12 (20)	MC = 21.8% Fines = 51.7%	ML		Gray sandy SILT, medium dense, moist [USDA Classification: LOAM]
16.5							

Boring terminated at 16.5 feet below existing grade. No groundwater encountered during drilling. 2" PVC standpipe installed to bottom of boring. Lower 10.0 feet slotted. Well ID: B95510. Boring backfilled with sand/bentonite.

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

BORING NUMBER B-2

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights
DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17148 **LONGITUDE** -122.25214
DRILLING METHOD HSA **GROUND WATER LEVEL:**
LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**
NOTES Surface Conditions: cleared brush

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0							Brown SILT, loose, moist
2.5							
5.0	SS	100	1-3-4 (7)	MC = 28.5%			-becomes moist to wet
7.5					ML		
10.0	SS	100	1-3-4 (7)	MC = 33.4% Fines = 90.6%			-very minor perched groundwater seepage -zones of heavy iron oxide staining [USDA Classification: slightly gravelly LOAM]
12.5							
15.0							

GENERAL BH / TP / WELL - 0593-3.GPJ - GRAPHICS TEMPLATE WITH LAT AND LONG.GDT - 5/3/22

(Continued Next Page)

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

BORING NUMBER B-2

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights
DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17148 **LONGITUDE** -122.25214
DRILLING METHOD HSA **GROUND WATER LEVEL:**
LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**
NOTES Surface Conditions: cleared brush

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
15.0							
	SS	100	3-5-7 (12)	MC = 29.5%	ML		Brown SILT, loose, moist *(continued)* -becomes medium dense, wet -minor perched groundwater seepage
17.5							
20.0							20.0
	SS	67	8-12-15 (27)	MC = 3.7% Fines = 5.4%	SP-SM		Gray poorly graded SAND, medium dense, moist [USDA Classification: slightly gravelly SAND]
							21.5

Boring terminated at 21.5 feet below existing grade. Groundwater seepage encountered at 10.0 and 15.0 feet during drilling. 2" PVC standpipe installed to bottom of boring. Lower 10.0 feet slotted. Well ID: BM5511. Boring backfilled with sand/bentonite.

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

BORING NUMBER B-3

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights
DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**
DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17121 **LONGITUDE** -122.25216
DRILLING METHOD HSA **GROUND WATER LEVEL:**
LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**
NOTES Surface Conditions: brush

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0							Brown silty SAND, loose, moist
2.5					SM		
5.0							5.0
	SS	100	4-5-6 (11)	MC = 5.0%			Gray poorly graded SAND, medium dense, moist
7.5					SP		
10.0							10.0
	SS	100	4-6-8 (14)	MC = 11.1% Fines = 15.4%			Gray silty SAND, medium dense, moist [USDA Classification: loamy fine SAND]
12.5					SM		
15.0							15.0

(Continued Next Page)

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

BORING NUMBER B-3

PROJECT NUMBER ES-0593.03 **PROJECT NAME** Normandy Heights

DATE STARTED 2/8/22 **COMPLETED** 2/8/22 **GROUND ELEVATION**

DRILLING CONTRACTOR Boretec1, Inc. **LATITUDE** 47.17121 **LONGITUDE** -122.25216

DRILLING METHOD HSA **GROUND WATER LEVEL:**

LOGGED BY CGH **CHECKED BY** SSR ▽ **AT TIME OF DRILLING**

NOTES Surface Conditions: brush

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
15.0	SS	67	6-9-10 (19)	MC = 12.0%	SP-SM		Gray poorly graded SAND with silt and gravel, medium dense, moist
17.5							
20.0	SS	67	18-30-11 (41)	MC = 4.1%			-becomes dense
							21.5

Boring terminated at 21.5 feet below existing grade. No groundwater encountered during drilling. 2" PVC standpipe installed to bottom of boring. Lower 10.0 feet slotted. Well ID: BM5512. Boring backfilled with sand/bentonite.

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

TEST PIT NUMBER TP-1

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 295 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 12": forest duff

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Light brown to brown poorly graded GRAVEL with sand, loose to medium dense, moist
2.5		MC = 2.5%			
5.0		MC = 2.0%	GP-GM		
7.5					
					9.0 286.0
10.0		MC = 3.9% Fines = 1.5%	SP		Brown poorly graded SAND with gravel;, medium dense, moist
12.5					
					14.0 281.0
15.0			GP		Brown poorly graded GRAVEL with sand, medium dense, moist

GENERAL BH / TP / WELL - 0593.GPJ - GRAPHICS TEMPLATE WITH LAT AND LONG.GDT - 5/3/22

(Continued Next Page)

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

TEST PIT NUMBER TP-1

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 295 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 12": forest duff

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
15.0		MC = 2.6%	GP		Brown poorly graded GRAVEL with sand, medium dense, moist *(continued)*
		MC = 2.9% Fines = 1.3%		17.0	278.0 Test pit terminated at 17.0 feet below existing grade. No groundwater encountered during excavation.

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

TEST PIT NUMBER TP-2

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 300 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 8": forest duff

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0						
		MC = 6.9%	SM		Light brown silty SAND, medium dense, moist	
2.5						
					3.0	297.0
		MC = 4.8%			Brown poorly graded SAND with silt, medium dense, moist	
5.0						
			SP-SM			
7.5		MC = 4.8% Fines = 6.1%				
10.0						
		MC = 2.8% Fines = 2.2%			11.0	289.0
			GP		Gray poorly graded GRAVEL with sand, medium dense, moist	
12.5						
					13.0	287.0
			SM		Gray silty SAND, medium dense, moist	
15.0		MC = 9.3% Fines = 34.8%			15.0	285.0

Test pit terminated at 15.0 feet below existing grade. No groundwater encountered during excavation.

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

TEST PIT NUMBER TP-3

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 320 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 7"

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Light brown to gray poorly graded SAND, medium dense, moist
2.5		MC = 2.7% Fines = 2.2%	SP		
5.0		MC = 4.8%			
7.5					
10.0		MC = 6.3%		10.0	310.0
					Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation.

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

TEST PIT NUMBER TP-4

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 345 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 8"

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Gray poorly graded SAND with gravel, medium dense, moist
2.5		MC = 2.4%			
5.0		MC = 2.9% Fines = 1.6%	SP		
7.5		MC = 2.5%			
10.0		MC = 3.7%		10.0	335.0
					Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation.

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

TEST PIT NUMBER TP-5

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 320 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 10"

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Light brown poorly graded SAND with silt, loose to medium dense, moist
2.5		MC = 4.6%	SP		
5.0		MC = 4.7%			
6.0					314.0
7.5		MC = 3.0%	GP		Gray poorly graded GRAVEL with sand, medium dense, moist
10.0		MC = 6.0%			310.0
					Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation.

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

TEST PIT NUMBER TP-6

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 335 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 12"

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Gray poorly graded GRAVEL with sand, medium dense, moist
		MC = 1.7%	GP		
2.5					2.0 333.0 Brown poorly graded SAND with gravel, medium dense, moist
		MC = 3.1% Fines = 0.8%			
5.0					
			SP		
7.5		MC = 2.4%			
10.0		MC = 2.3%			10.0 325.0 Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation.

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

TEST PIT NUMBER TP-7

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 350 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES Depth of Topsoil & Sod 6"

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0						
		MC = 2.0%	GP		Light brown to gray poorly graded GRAVEL with sand, loose to medium dense, moist	
2.5						
					3.0	347.0
		MC = 3.6% Fines = 1.0%	SP		Gray poorly graded SAND, medium dense, moist	
5.0		MC = 2.9%			5.0	345.0
			GP		Gray poorly graded GRAVEL with sand, medium dense, moist	
					7.0	343.0
7.5			SP		Gray poorly graded SAND with gravel, medium dense, moist	
		MC = 6.2%			8.0	342.0
					Test pit terminated at 8.0 feet below existing grade. No groundwater encountered during excavation.	

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

TEST PIT NUMBER TP-8

PROJECT NUMBER 0593 **PROJECT NAME** Normandy Heights

DATE STARTED 10/23/06 **COMPLETED** 10/23/06 **GROUND ELEVATION** 355 ft

EXCAVATION CONTRACTOR Aikins Excavating **LATITUDE** _____ **LONGITUDE** _____

EXCAVATION METHOD _____ **GROUND WATER LEVEL:**

LOGGED BY WLR **CHECKED BY** WLR ▽ **AT TIME OF EXCAVATION** _____

NOTES _____

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					Light brown to gray poorly graded SAND with silt, medium dense, moist
		MC = 8.1%	SP-SM		
2.5					
		MC = 6.1%			
					4.0 351.0
					Gray poorly graded SAND, medium dense, moist
5.0					
7.5		MC = 5.1% Fines = 1.6%	SP		
10.0					
		MC = 4.7%			12.0 343.0
					Test pit terminated at 12.0 feet below existing grade. No groundwater encountered during excavation.

7.3 Response to Comments prepared by Earth Solutions Northwest, LLC March 4, 2024.

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

March 4, 2024
ES-0593.05

RM Homes, LLC
2913 – 5th Avenue Northeast, Suite 201
Puyallup, Washington 98372

Attention: James Kerby

Subject: Response to Comments
Normandy Heights
2007 Shaw Road
Puyallup, Washington

Greetings:

As requested by Barghausen Consulting Engineers, Inc. (BCE), Earth Solutions NW, LLC (ESNW) has prepared this response to comments letter for the proposed Normandy Heights residential project. Since the preparation of our geotechnical engineering study (henceforth referred to as "the study"), supporting documents, and the referenced Development Review Team (DRT) letter, we understand that site layouts have been revised.

Site & Project Description

The property is located at the northeast corner of the intersection between Shaw Road East and Crystal Ridge Drive South, in Puyallup, Washington. The property consists of Piece County parcel number 042035-4039 and totals a gross site area of about 7.35 acres. We understand that current site layouts include the development of 25 homes sites, associated infrastructure improvements, and critical area tract designations. Stormwater management is currently proposed via a stormwater detention vault located within the northeastern site extent of the development. Grading activities will include significant cut and fill operations (on the order of tens of feet in some areas) but will generally maintain a similar northeastern declination, which is current present on site. The building lots will primarily be stepped and grades will be resolved via minor slopes and/or engineered landscape walls.

RESPONSE TO COMMENTS

The following sections provide our response to geotechnically relevant DRT comments issued by the City of Puyallup. The proceeding responses are based on the subsurface soil and groundwater conditions encountered at the time of our excoriations and our understanding of current site layout designs. For the intent of this response letter, comments provided as bullet-points will be numerically ordered in each applicable review section.

Planning Review

Comment 9 (Page 3): The section of the critical areas review in the May 3, 2022 study is incomplete. Please provide revisions and analysis of slopes and critical areas. Please note that areas of sites that exceed 40 percent slopes are critical areas that cannot be modified if those areas are consistent with PMC 21.06.1210(3). Also see PMC 21.06.1230(I) regarding prohibition of 40 percent slope modifications. GIS and topo lines appear to show 40 percent slopes on site.

ESNW Response: We understand that updated topographic and slope delineations have indicated the presence of isolated slope features which exceed a gradient of 40 percent. These features are primarily contained within the proposed Tract C and D site areas, which will not to be modified with the proposed development. Based on our review of the referenced site plan, these slopes are less than 25 feet in height.

Pursuant to PMC 21.06.1240.1a(iii), slopes with a vertical elevation of more than 10 feet but less than 25 feet may utilize a buffer that is equal to the height of the slope divided by two. This provision is contingent on the condition that no other factors that pose a risk to local slope stability are present. Given the relatively isolated extent of the subject slopes and present soil conditions, it is our geotechnical opinion that the project can feasibly pursue the reduced slope buffer, as previously cited, without altering current slope stability characteristics in each respective area.

Engineering Review

Comment 34 (Page 6): Further clarification is needed here. It appears that the geotechnical engineer only investigated the native soils. The existing site is being substantially regraded and fill, up to 32 feet. Is it not possible to construct permeable pavements on the imported fill considered the Ecology Manual allows a minimum feasibility infiltration rate of 0.3 in/hr.? However, there may be other BMP infeasibility criteria outlined in the Ecology Manual that would prevent the use of permeable pavement. For example, downstream impacts associated with lateral flow, or potential erosion hazards, and/or slope stability concerns due to infiltrated stormwater, but the current application materials do not appear sufficient to support a definitive project-wide infeasibility determination for the use of permeable pavement on the imported fill.

ESNW Response: The first part of this comment is confusing, as it is local standard of practice for a geotechnical evaluation to explore native soils on a site. We request clarification from the reviewer if this comment was stated accurately. At the time of our fieldwork, the site was not under active construction and did not appear to have been heavily modified via fill earthwork operations; therefore, our site investigation was appropriate.

From a geotechnical standpoint, utilizing infiltration BMPs is not recommended from the project. Although areas of relatively clean sands and gravels were observed, the overall native soil conditions were generally variable with areas of silt and silty sand dominated soils having also been encountered. Furthermore, the site maintains overall northeasterly declinations with slopes present within and adjacent to the property area. In general, this topographic condition will be maintained with the proposed development. On this basis, it is anticipated that surface and subsurface water flows will drain to the northeast towards slopes and adjacent properties in the post-development condition.

The comment suggests the viability of using fill material for the purpose of LID BMPs. While technically feasible, the process of selectively screening and quality control of any fill (native sourced or imported) is infeasible for practical design and construction, particularly considering the site conditions that prove infiltration into native soils is not recommended. Furthermore, compaction of any fill to the specifications of structural fill would severely reduce the infiltration capacity of that material. On this basis, the focus of any fill activities should be on creating suitable conditions for support of the home sites, infrastructure, and any other structural elements.

Comment 58 (Page 7): Further classification is needed here. It appears that ESNW was simply informed that detention will be used rather than a geotechnical recommendation addressing the feasibility of onsite BMPs per the Ecology Manual, Minimum Requirement 5. This sentence seems to only address the existing native soils. The existing site is being substantially regraded and filled up to 32 feet deep. Is it not possible to construct permeable pavements on the imported fill considering the Ecology Manual allows a minimum feasibility infiltration rate of 0.3 in/hr.? However, there may be other BMP infeasibility criteria outlined in the Ecology Manual that would prevent the use of permeable pavement. For example, downstream impacts associated with lateral flow, or potential erosion hazards, and/or slope stability concerns due to infiltrated stormwater, but the current application materials do not appear sufficient to support a definitive project-wide infeasibility determination for the use of permeable pavement on the imported fill.

ESNW Response: From a geotechnical standpoint, utilizing infiltration BMPs is not recommended from the project. Although areas of relatively clean sands and gravels were observed, the overall native soil conditions were generally variable with areas of silt and silty sand dominated soils having also been encountered. Furthermore, the site maintains overall northeasterly declinations with slopes present within and adjacent to the property area. In general, this topographic condition will be maintained with the proposed development. On this basis, it is anticipated that surface and subsurface water flows will drain to the northeast towards slopes and adjacent properties in the post-development condition.

The comment suggests the viability of using fill material for the purpose of LID BMPs. While technically feasible, the process of selectively screening and quality control of any fill (native sourced or imported) is infeasible for practical design and construction, particularly considering the site conditions that prove infiltration into native soils is not recommended. Furthermore, compaction of any fill to the specifications of structural fill would severely reduce the infiltration capacity of that material. On this basis, the focus of any fill activities should be on creating suitable conditions for support of the home sites, infrastructure, and any other structural elements.

<u>Conditions – Engineering Division (General: Stormwater/Erosion Control)</u>

Comment 12 (Page 13): Upon submission of any geotechnical infiltration testing, appropriate long-term correction factors shall be noted for any areas utilizing infiltration into the underlying native soils in accordance with the Ecology Manual, Volume III, Chapter 3. Provide long-term infiltration rate calculation in the stormwater reports.

ESNW Response: As discussed in Engineering Review Comments 34 and 58, infiltration is not recommended for the project based on the following:

- Existing topography of the site and presence of slope areas.
- Proposed overall stepped and northeasterly descending proposed gradient of the project area.
- Inherent variability associated with fill activities and alteration of innate infiltration characteristics of that material once sufficiently compacted to the specifications of structure fill.

Comment 14 – Item 5 and 6 (Page 13): At the time of civil application, the applicant shall further investigate the feasibility/infeasibility of implementing Minimum Requirement #5 permeable pavement based on the final grading plan (cut/fill areas) for the project. If permeable pavement is deemed feasible, the project shall conduct confirmation infiltration testing of the imported fill at the time of construction.

ESNW Response: As discussed in Comments 34 and 58 above, using placed and compacted fill for infiltration is not recommended for the project. Based on a review of the referenced site plan, fill used in grading operations will originate form the site as there is an estimated excess of cut material. It is anticipated that soils sourced for use as fill will possess a degree of variability, and as such, quality control with respect screening applicable soil for use as fill within infiltration BMPs areas is not feasible for practical construction and design. Furthermore, compaction of fill material will alter the innate infiltration characteristics and will significantly reduce infiltration potential.

Conditions – Engineering Division (General: Grading)

Comment 2 (Page 16): A geotechnical report conforming to all requirements of PMC sections 21.14.150 and 21.14.160 will be required prior to issuance of the first building permit. The report shall be prepared by a civil engineer or engineering geologist licensed in the State of Washington. Prior to final acceptance of this project, the author of the report shall provide certification to the City of the following: The project was constructed in accordance with the recommendations contained within the report, and, any building lot within the site suitable for building up to a maximum safe bearing load expressed in psf.

ESNW Response: The above requirements and documentation are typically provided following the completion of mass earthwork activities on the site. ESNW is available to provide earthwork observations and testing services for the project and the requested documentation at the appropriate stage of construction.

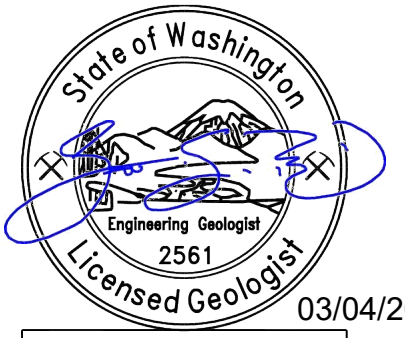
Additional Services

ESNW should have an opportunity to review the final designs concerning the geotechnical recommendations provided in this evaluation. ESNW should also be retained to provide testing and consultation services during the vertical phase of construction.

We trust this letter meets your current needs. Should you have any questions, or if additional information is required, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC



03/04/2024

Scott S. Riegel

Chase G. Halsen, L.G., L.E.G.
Project Manager

Scott S. Riegel, L.G., L.E.G.
Associate Principal Geologist

cc: Barghausen Consulting Engineers, Inc.
Attention: Tyler Murphy
Cara Visintainer

References:

- Geotechnical Engineering Study, prepared by ESNW, ES-0593, updated May 3, 2022
- Geotechnical Addendum, prepared by ESNW, ES-0593.05, dated June 19, 2023
- Preliminary Grading and Utility Layout, prepared by BCE, Job No. 12663, Sheet C3 of 3, dated January 18, 2024
- Development Review Team Letter, prepared by the City of Puyallup Planning Division, dated September 28, 2022

7.4 Wetland and Fish and Wildlife habitat Assessment Report by Soundview Consultants

Wetland and Fish and Wildlife Habitat Assessment Report

Deer Creek

February 2024

Revised September 2025

Trinity Consultants

Soundview Consultants

WETLAND AND FISH AND WILDLIFE HABITAT ASSESSMENT REPORT

DEER CREEK

FEBRUARY 21, 2024

REVISED SEPTEMBER 17, 2025

PROJECT LOCATION
2007 SHAW ROAD
PUYALLUP, WASHINGTON 98372

PREPARED FOR
RM HOMES
2913 5TH AVENUE NORTHEAST, SUITE 201
PUYALLUP, WASHINGTON 98092

PREPARED BY
SOUNDVIEW CONSULTANTS LLC
2907 HARBORVIEW DRIVE
GIG HARBOR, WASHINGTON 98335
(253) 514-8952

Trinity Consultants Soundview Consultants

Executive Summary

Soundview Consultants LLC (SVC) has been supporting RM Homes (Applicant) with a wetland and fish and wildlife habitat assessment for proposed residential plat development of an approximately 28.2-acre property located at 2007 Shaw Road in the City of Puyallup, Washington. The subject property consists of one parcel situated in the Southeast ¼ of Section 35, Township 20 North, Range 04 East, W.M. (Pierce County Tax Parcel Number 0420354039).

SVC investigated the subject property for the presence of potentially regulated wetlands, waterbodies, or other fish and wildlife habitat in November of 2021, January of 2022 and February of 2025. Using current methodology, the site investigations identified one potentially regulated wetland (Wetland A) and one stream (Stream Z, locally known as Upper Deer Creek) on the northeastern portion of the subject property. Additionally, one potential offsite wetland (Wetland 1) was identified offsite to the west of the subject property across Shaw Road East. Wetland A is classified as a Category III wetland with a low habitat score of 5 points, which is subject to a standard 80-foot buffer based on the proposed high intensity land use per Puyallup Municipal Code (PMC) 21.06.930(2)(d). Offsite Wetland 1 is classified as a Category IV wetland with a low habitat score of 4 points, which is subject to a standard 50-foot buffer that does not project onto the subject property. Stream Z is considered a perennial, non-fish bearing (Type II) stream and is subject to a 100-foot buffer per PMC 21.06.1050(2)(b). An additional 10-foot building setback is required from the outer edge of all critical area buffers per PMC 21.06.840(1). No other potentially regulated wetlands, waterbodies, or other fish and wildlife habitat were observed on or within 300 feet of the subject property.

The summary table below identifies the potential regulatory status of the identified critical areas by local, state, and federal agencies.

Feature Name	Size (Onsite)	Category/ Type[1]	Regulated Under PMC 21.06	Regulated Under RCW 90.48	Regulated Under Section 404 of the Clean Water Act
Wetland A	~2,560 SF	III	Yes	Yes	Likely
Wetland 1	N/A - offsite	IV	Yes	Yes	Not Likely
Stream Z	~200 LF	Type II	Yes	Yes	Likely

Notes:

1. Current Washington State Department of Ecology (WSDOE) wetland rating system (Hruby, 2014) per PMC 21.06.910(3) and DNR Water Typing system per PMC 21.06.1010(3)(a).

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Figures

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Appendices

Chapter 1. Introduction

Soundview Consultants LLC (SVC) has been supporting RM Homes (Applicant) with a wetland and fish and wildlife habitat assessment for proposed residential development of an approximately 28.2-acre property located at 2007 Shaw Road in the City of Puyallup, Washington. The subject property consists of one parcel situated in the Southeast ¼ of Section 35, Township 20 North, Range 04 East, W.M. (Pierce County Tax Parcel Number 0420354039).

The purpose of this assessment is to identify the presence of potentially regulated wetlands, waterbodies, or other fish and wildlife habitat located on or near the subject property.

This report provides conclusions and recommendations regarding:

- Site description and area of assessment;
- Background research and identification of potentially-regulated critical areas within the vicinity of the proposed project;
- Identification and assessment of potentially-regulated wetlands and other aquatic features;
- Identification and assessment of potentially-regulated fish and wildlife habitat;
- Existing conditions site map detailing identified critical areas, standard buffers, and setbacks; and
- Supplemental information necessary for local regulatory review.

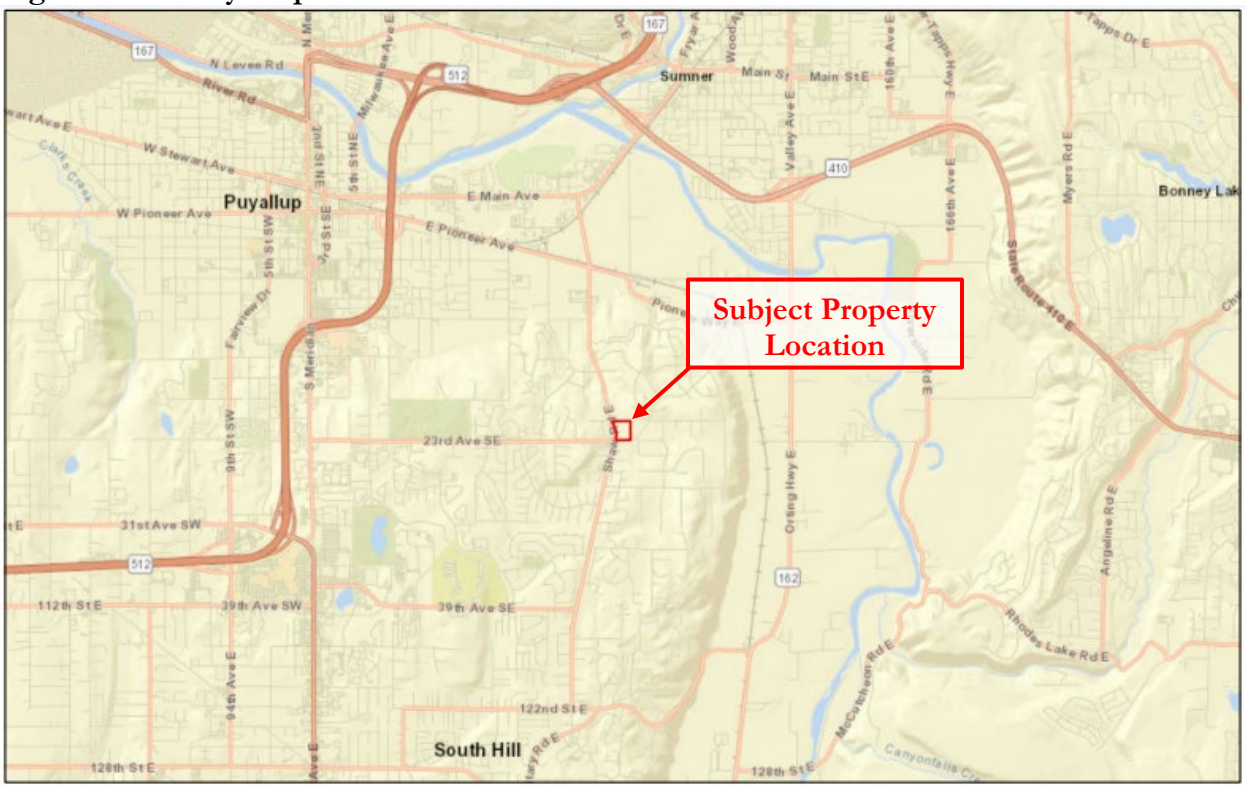
Chapter 2. Proposed Project Location

2.1 Project Location

The subject property consists of an approximately 28.2-acre site located at 2007 Shaw Road in the City of Puyallup, Washington. The subject property consists of one parcel situated in the Southeast ¼ of Section 35, Township 20 North, Range 04 East, W.M. (Pierce County Tax Parcel Number 0420354039).

To access the subject site from Interstate-5 South in the Tacoma area, take exit 127 for Washington-512 East toward Portland and turn left onto Washington-512 East (signs for Puyallup). After 8.5 miles, take the Washington-161 South Exit toward Eatonville and continue onto Washington-161 South/31st Avenue Southwest South for 0.1 mile. Use the left two lanes to turn left onto South Meridian and after 0.7 mile turn right onto 23rd Avenue Southeast. After 1.9 miles, turn left onto Shaw Road East, where the subject property will be located on the right.

Figure 1. Vicinity Map.



Chapter 3. Methods

SVC investigated wetlands, waterbodies, and other potentially-regulated fish and wildlife habitat on and within 300 feet of the subject property in November of 2021 and January of 2022. All determinations were made using observable vegetation, hydrology, and soils in conjunction with data from the U.S. Geological Survey (USGS) topographic map, the Natural Resource Conservation Service (NRCS) Soil Survey, City of Puyallup and Pierce County Geographic Information Systems (GIS) data, U.S. Fish and Wildlife (USFWS) National Wetland Inventory (NWI), Washington Department of Fish and Wildlife (WDFW) Priority Habitats and Species (PHS) and SalmonScape mapping tools, Washington Department of Natural Resources (DNR) Water Typing Map, and various orthophotographic resources. Appendix A contains further details for the methods and tools used to prepare this report.

Wetlands, waterbodies, and select fish and wildlife habitat and species are regulated features per Puyallup Municipal Code (PMC) Title 21.06– Critical Areas, and subject to restricted uses/activities under the same title. Wetland boundaries were determined using the routine approach outlined in the U.S. Army Corps of Engineers' *Wetlands Delineation Manual* (Environmental Laboratory, 1987) and modified according to the guidelines established in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region, Version 2.0* (USACE, 2010) and *Field Indicators of Hydric Soils in the United States* (NRCS, 2018). Qualified wetland scientists marked the boundary of the wetland onsite with orange surveyor's flagging labeled alpha-numerically and tied to 3-foot lath or vegetation along the wetland boundary. Pink surveyor's flagging was labeled numerically and tied to 3-foot lath or vegetation at formal sampling locations to mark the points where detailed data was collected (DP-1 to DP-4). Additional tests pits were excavated at regular intervals inside and outside of the wetland boundary to further confirm the delineation. Offsite critical areas were not flagged but rather estimated based on visual observations, aerial imagery, and topography, and features are labeled numerically beginning with 1. Please refer to Appendix D for site photographs.

Wetlands were classified using both the hydrogeomorphic (Brinson, 1993) and Cowardin (Cowardin, 1979) classification systems. Following classification and assessment, wetlands were rated and categorized using the *Washington State Wetlands Rating System for Western Washington—Washington Department of Ecology, 2014, Publication No. 04-06-029* (Hruby, 2014) and guidelines established in PMC 21.06.910(3).

Ordinary high-water (OHW) mark determinations were made using the WSDOE's method detailed in *Determining the Ordinary High-Water Mark for Shoreline Management Act Compliance in Washington State* (Anderson et al, 2016) and the definitions established in the Shoreline Management Act under the Revised Code of Washington (RCW) 90.58.030(2)(b) and Washington Administrative Code (WAC) 173-22-030(11). Streams were classified using the Washington Department of Natural Resources Water Typing System as outlined in WAC 222-16-030 per PMC 21.06.1010(3)(a).

OHW was originally marked at centerline. On February 11, 2025, a qualified SVC scientist returned to the site to flag the OHWM along either bank of Stream Z. Flags Z-1b through Z-10b mark the right bank, and flags Z-1a through Z-10a mark the left bank. Please refer to Appendix D for site photographs.

The fish and wildlife habitat assessment was conducted during the same site visits by qualified fish and wildlife biologists. The experienced biologists made visual observations using stationary and walking survey methods for both aquatic and upland habitats noting any special habitat features or signs of fish and wildlife activity.

Chapter 4. Existing Conditions

4.1 Landscape Setting

The subject property is located in a residential setting within the City of Puyallup's urban growth area (Figure 2). The subject property is currently developed with a single-family residence and associated infrastructure in the northwest portion of the subject property and a gravel parking area on the southwest corner; the remainder of the site is otherwise undeveloped forest with an unmaintained field located in the central portion of the subject property. The subject property abuts undeveloped forest to the north and east, Shaw Road East to the west, and Crystal Ridge Drive Southeast to the south. Topography onsite slopes moderately downward from the southwest to the to the northeast, with elevations ranging from approximately 280 feet above mean sea level (amsl) to approximately 360 asml. A Pierce County contours map is provided in Appendix B1. The subject property is located within Water Resource Inventory Area (WRIA) 10 – Puyallup-White.

Figure 2. Aerial Photograph of Subject Property.

4.2 Soils

The NRCS Soil Survey of Pierce County, Washington, identifies two soil series present on the subject property: Indianola loamy sand, 5 to 15 percent slopes and Kitsap silt loam, 8 to 15 percent slopes. A soil survey map is provided in Appendix B2.

Indianola loamy sand, 5 to 15 percent slopes (18C)
According to the survey, Indianola loamy sand, 6 to 15 percent slopes, is a somewhat excessively drained soil formed in sandy glacial outwash on broad uplands. In a typical profile, the surface layer is dark brown loamy sand to a depth of 7 inches. The underlying material to a depth of 60 inches is dark yellowish brown, brown, or olive brown sand. Some areas of this soil series are known to rest on unstable lake sediments, and be adjacent to areas of a soil that is deep, loose, and gravelly. Roots extend to a depth of more than 60 inches. Indianola loamy sand, 6 to 15 percent slopes, is listed as non-hydric, but as much as 2 percent of the mapped soil unit may contain hydric inclusions of Norma soils associated with depressions (NRCS, n.d).

Kitsap silt loam, 8 to 15 percent slopes (20C)
According to the survey, Kitsap silt loam, 8 to 15 percent slopes, is moderately well drained soil derived from glaciolacustrine deposits on remnant terraces along Puget Sound and major drainageways. In a typical profile, the surface layer is very dark grayish brown and dark brown ashy silt loam to a depth of 10 inches. The upper layer of the subsoil is brown silty clay loam to a depth of 7 inches. The lower layer is mottled, grayish brown silty clay loam to approximately 15 inches thick. The substratum to a depth of 60 inches is stratified, mottled, light olive brown silt loam and silty clay loam. Kitsap silt loam, 8 to 15 percent slopes is listed as non-hydric, but as much as 2 percent of the mapped soil unit may contain hydric inclusions Bellingham soils associated with depressions (NRCS, n.d.).

4.3 Vegetation

General upland forested vegetation in the southern portion of the subject property consists of a canopy dominated by Douglas fir (*Pseudotsuga menziesii*) and western red cedar (*Thuja plicata*) with an understory of vine maple (*Acer circinatum*), salmonberry (*Rubus spectabilis*), hazelnut (*Corylus cornuta*), non-native invasive Himalayan blackberry (*Rubus armeniacus*), and swordfern (*Polystichum munitum*). The upland forest canopy transitions into a more mixed evergreen/deciduous canopy on the northern portion of the subject property and is dominated by western red cedar, western hemlock (*Tsuga heterophylla*), black cottonwood (*Populus balsamifera*), and bigleaf maple (*Acer macrophyllum*). The unmaintained field on the central portion of the subject property is dominated by non-native invasive scotch broom (*Cytisus scoparius*), bracken fern (*Pteridium aquilinum*), orchards grass (*Dactylus glomerata*), colonial bentgrass (*Agrostis capillaris*), and trailing blackberry (*Rubus ursinus*).

4.4 Critical Area Inventories

The City of Puyallup Stream and Wetland Inventory (Appendix B3), Pierce County Stream and Wetland Inventory (Appendix B4), USFWS NWI map (Appendix B5), and WDFW PHS map (Appendix B6) do not identify any potential wetlands on the subject property but do identify a potential stream feature (Upper Deer Creek) on the northeast portion of the subject property. Additionally, the Puyallup Stream and Wetland Inventory identifies a potential offsite wetland feature to the west across Shaw Road East within 300 feet of the site. The WDFW SalmonScape map (Appendix B7) does not identify any salmonids or fish presence on or near the subject property. The DNR stream typing map (Appendix B8) classifies Upper Deer Creek as a non-fish bearing (Type N) stream. No other potential wetlands, waterbodies, or fish and wildlife habitat areas are documented on or within 300 feet of the subject property.

4.5 Precipitation

Precipitation data was obtained from the National Oceanic and Atmospheric Administration (NOAA) station at Seattle-Tacoma (SeaTac) International Airport in order to obtain percent of normal precipitation for the general Puget Sound region during and preceding site investigations. A summary of data collected is provided in Table 1.

Table 1. Precipitation Summary[1]

Date	Day of	Day Before	1 Week Prior	2 Weeks Prior	30 Days Prior (Observed/Normal)	Year to Date (Observed/Normal)[2]	Percent of Normal[3]
11/16/2021	0.00	0.20	4.67	6.95	11.68/5.60	12.85/7.22	209/178
1/5/2022	0.33	0.22	1.96	3.30	5.33/5.73	21.93/16.90	93/130

Notes:

1. Precipitation levels provided in inches. Data obtained from NOAA (http://w2.weather.gov/climate/xmacis.php?wfo=sew) for SeaTac International Airport. Precipitation data is missing for the following dates and may skew calculations for percent of normal: 12/18, 12/28, and 12/30.
2. Year-to-date precipitation is for the 2021/2022 water year from October 1 to the onsite date(s).
3. Percent of normal is shown for the last 30 days and water year to date.

Precipitation levels during the November 2021 site investigation were elevated above the statistical normal range for both the prior 30 days (209 percent of normal) and the 2021/2022 water year (178 percent of normal). While heavy rainfall is common during the wet season, the abnormally high rainfall for both the 30 days prior and the water year suggest hydrologic conditions onsite may have been exaggerated and areas that are not typically wet may have been saturated or inundated during the November 2021 site investigation. Precipitation levels during the January 2022 site investigation were within the statistical normal range for both the prior 30 days (93 percent of normal) and the 2021/2022 water year (130 percent of normal). This precipitation data suggests that hydrological conditions were relatively normal during the January 2022 site investigation. Such conditions were considered in making professional wetland determinations.

Chapter 5. Results

SVC's site investigations in November of 2021 and January of 2022 identified one potentially regulated wetland (Wetland A) and one stream (Stream Z, locally known as Upper Deer Creek) on the northeastern portion of the subject property. Additionally, one potential offsite wetland (Wetland 1) was identified offsite to the west of the subject property across Shaw Road East. No other potentially regulated wetlands, waterbodies, or other fish and wildlife habitat were observed on or within 300 feet of the subject property.

5.1 Wetlands

5.1.1 Overview

The identified wetlands contained a predominance of hydrophytic vegetation, indicators of hydric soils (assumed for offsite wetland), and wetland hydrology according to current wetland delineation methodology. Data forms are provided in Appendix E; wetland rating forms are provided in Appendix F; and wetland rating maps are provided in Appendix G. Table 2 summarizes the wetlands identified during the site investigations.

Table 2. Wetland Summary Table

Wetland	Predominant Wetland Classification / Rating				Size Onsite (SF)	Buffer Width[5] (feet)
	Cowardin[1]	HGM[2]	WSDOE[3]	City of Puyallup[4]		
A	PSSB	Depressional	III	III	2,560	80
1	PFOB	Slope	IV	IV	N/A	50

Notes:
1. Cowardin et al. (1979); Federal Geographic Data Committee (2013); class based on vegetation: PFO = Palustrine Forested, PSS = Palustrine Scrub-Shrub. Modifiers for Water Regime or Special Situations: B = Seasonally Saturated.
2. Brinson, M. M. (1993).
3. Current WSDOE rating (Hruby, 2014).
4. PMC 21.06.910(3) wetland rating designation.
5. PMC 21.06.930(2) wetland buffer standards based on high intensity land use.

Wetland A

Wetland A is approximately 2,560 square feet (0.06 acre) in size onsite and is located on the northeastern portion of the subject property, extending further offsite to the north. Stream Z flows through the wetland; however, no evidence of overbank flooding was observed. Hydrology for Wetland A is provided primarily by a seasonally high groundwater table, direct precipitation, and surface sheet flow from adjacent uplands. Wetland vegetation is dominated by salmonberry (*Rubus spectabilis*), vine maple, youth on age (*Tolmiea menziesii*) and creeping buttercup (*Ranunculus repens*). Wetland A is a Palustrine Scrub-Shrub, Seasonally Saturated (PSSB) wetland. Per PMC 21.06.930(2)(c)(d), Wetland A is classified as a Category III depressional wetland with a habitat score of 5 points. Table 3 provides a detailed summary of Wetland A.

Table 3. Wetland A Summary

WETLAND A – INFORMATION SUMMARY			
Location:	Located in the northern portion of the subject property.		
		**Local Jurisdiction**	City of Puyallup
		WRIA	10 – Puyallup - White
		WSDOE 2014 Rating	III
		City of Puyallup rating	III
		Standard Buffer Width	80 feet
		Wetland Size	2,560 square feet
		Cowardin Classification	PSSAB
		HGM Classification	Depressional
		Wetland Data Sheet	DP-2W
		Upland Data Sheet	DP-3U
		Boundary Flag color	Orange
Dominant Vegetation	Wetland vegetation is dominated salmonberry, vine maple, youth on age, and buttercup.		
Soils	Hydric soil indicator A11 (Depleted Below Dark Surface) was observed.		
Hydrology	Hydrology for Wetland A is provided primarily by a seasonally high groundwater table, direct precipitation, and surface sheet flow from surrounding uplands. No evidence of overbank flooding from Stream Z was observed.		
Rationale for Delineation	Wetland boundaries were determined by a topographic drop, and the combined presence of hydric soils and hydrophytic vegetation.		
Rationale for Local Rating	Wetland rating based on the current WSDOE wetland rating system for Western Washington (Hruby, 2014) per PMC 21.06.910(3).		
Wetland Functions Summary			
Water Quality	Wetland A has moderate potential to improve water quality due to the presence of persistent, ungrazed plants in 95 percent of the unit., the presence of septic systems within 250 feet of the wetland, and the presence of a TMDL in the watershed. However, water quality functions are limited due to the permanently flowing outlet, lack of seasonal ponding, and the wetland does not discharge into impaired waters. Wetland A's score for Water Quality Functions is moderate (7).		
Hydrologic	Wetland A has low potential to provide hydrologic functions due to its small contribution of storage capacity within the contributing basin, lack of storage during wet periods, and lack of stormwater discharges or sources of runoff. However, the wetland provides some functions due to at least 25 percent intensive land uses within the contributing basin and presence of flooding downgradient. Wetland A's score for Hydrologic Functions is moderate (5).		
Habitat	Wetland A provides limited habitat functions due to the presence of one Cowardin class and hydroperiod, lack of habitat interspersion, and large portions of accessible habitat due to surrounding high intensity land use. Wetland A's score for Habitat Functions is low (5).		
Buffer Condition	The onsite buffer is relatively intact with native vegetation but contains small amounts of non-native invasive Himalayan blackberry and English holly.		

Wetland 1

Wetland 1 is located approximately 90 feet offsite to the west across Shaw Road East. Hydrology for Wetland 1 is provided primarily by a seasonally high groundwater table, direct precipitation, and surface sheet flow from adjacent uplands. Wetland vegetation is dominated by a canopy of Western red cedar, black cottonwood, and red alder (*Alnus rubra*) with an understory dominated by salmonberry and non-native invasive Himalayan blackberry. Wetland 1 is a Palustrine Forested, Seasonally Saturated (PFOB) wetland. Per PMC 21.06.930(2)(e), Wetland 1 is classified as a Category IV slope wetland with a habitat score of 4 points. As Wetland 1 is located entirely offsite, no detailed summary table is provided.

5.2 Stream Z (Upper Deer Creek)

Stream Z was identified on the northeastern corner of the subject property, flowing southwest for approximately 200 linear feet onsite and through Wetland A. The onsite channel of Stream Z was approximately under 2 feet wide on average with areas of pooling approximately 5 feet wide on average. Substrate within the stream consists of an unconsolidated silt bottom with patches of some sand and gravel. Stream Z meets the WAC 222-16-031 definition of fish bearing: streams with an OHWM of 2 feet or greater and a gradient of 16% or less. Due to SCC 21.06.1010(3)(a)(ii) designation of Deer Creek as a Type II stream, all reaches of the creek are required to meet a 100-foot buffer. Therefore, Stream Z is classified as a Type II stream per PMC 21.06.1010(2). Table 4 provides a detailed summary of Stream Z.

Table 4. Stream Z Summary

STREAM Z – INFORMATION SUMMARY		
	**Feature Name**	Stream Z
	WRIA	10 – Puyallup - White
	Local Jurisdiction	City of Puyallup
	DNR Stream Type	Type N
	City of Puyallup Stream Rating	Type II
	Standard Buffer Width	100 feet
	Documented Fish Use	None
Location of Feature	Stream Z is located on the northeast corner of the subject property.	
Connectivity (where water flows from/to)	Based on local mapping inventories, Stream Z appears to begin approximately 0.5 linear mile upgradient of the site, to the south of 27th Avenue Southeast. The stream flows in a southwesterly direction on the northeast portion of the site for approximately 200 linear feet and through Wetland A. The stream continues offsite to the north through several documented fish passage barriers before discharging into the Puyallup River 1.95 miles northwest of the site.	
Riparian/Buffer Condition	The onsite buffer is relatively intact with native vegetation but contains small amounts of non-native invasive Himalayan blackberry and English holly.	

Chapter 6. Regulatory Considerations

SVC's site investigations in November of 2021 and January of 2022 identified one potentially regulated wetland (Wetland A) and one stream (Stream Z) on the northeastern portion of the subject property. Additionally, one potential offsite wetland (Wetland 1) was identified offsite to the west of the subject property across Shaw Road East. No other potentially regulated wetlands, waterbodies, or other fish and wildlife habitat were observed on or within 300 feet of the subject property.

6.1 Local Considerations

6.1.1 Standard Buffer Requirements

PMC 19.37.090.C has adopted the current wetland rating system used by WSDOE (Hruby, 2014). Category III wetlands generally provide a moderate level of function, have usually been disturbed in some way, and are often less diverse and/or more isolated in the landscape than Category II wetlands. Category III wetlands score between 16 and 19 points on the *Revised Washington State Wetland Rating System for Western Washington* (Hruby, 2014). Category IV wetlands generally provide low levels of function; they are often heavily disturbed, smaller, and/or more isolated in the landscape than Category I, II, or III wetlands. Category IV wetlands provide low levels of functions and score less than 16 points.

Wetland A is classified as a Category III wetland with a low habitat score of 5 points, which is subject to a standard 80-foot buffer based on the proposed high intensity land use per PMC 21.06.930(2)(d). Offsite Wetland 1 is classified as a Category IV wetland with a low habitat score of 4 points, which is subject to a standard 50-foot buffer that does not project onsite, especially given the functional interruption from Shaw Road East. Stream Z is considered a perennial, non-fish bearing (Type II) stream and is subject to a 100-foot buffer per PMC 21.06.1050(2)(b). An additional 10-foot building setback is required from the outer edge of all critical area buffers per PMC 21.06.840(1).

6.2 State and Federal Considerations

On January 18, 2023, USACE and EPA published a revised definition of "Waters of the United States" (USACE and EPA, 2023a). The revised rule became effective on March 20, 2023. On May 25, 2023, the U.S. Supreme Court issued a decision affecting the definition of Waters of the United States, or "WOTUS", in *Sackett Et Ux. V Environmental Protection Agency Et Al.* On August 29, 2023, the US EPA and USACE issued a final rule to amend the final "Revised Definition of 'Waters of the United States'" rule. The amendment conforms the definition of "Waters of the United States" to the U.S. Supreme Court's decision in the Sackett Et Ux. V Environmental Protection Agency Et Al case. The revised and amended definition of "Waters of the United States" is as follows:

(a) Waters of the United States means:

(1) Waters which are: (i) Currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; (ii) The territorial seas; or (iii) Interstate waters;

(2) Impoundments of waters otherwise defined as waters of the United States under this definition, other than impoundments of waters identified under paragraph (a)(5) of this section;

(3) Tributaries of waters identified in paragraph (a)(1) or (2) of this section: that are relatively permanent, standing or continuously flowing bodies of water;

(4) Wetlands adjacent to the following waters: (i) Waters identified in paragraph (a)(1) of this section; or (ii) Relatively permanent, standing or continuously flowing bodies of water identified in paragraph (a)(2) or (a)(3) of this section and with a continuous surface connection to those waters;

(5) Intrastate lakes and ponds not identified in paragraphs (a)(1) through (4) of this section that are relatively permanent, standing or continuously flowing bodies of water with a continuous surface connection to the waters identified in paragraph (a)(1) or (a)(3) of this section;

(b) The following are not "waters of the United States" even where they otherwise meet the terms of paragraphs (a)(2) through (5) of this section:

(1) Waste treatment systems, including treatment ponds or lagoons, designed to meet the requirements of the Clean Water Act;

(2) Prior converted cropland designated by the Secretary of Agriculture. The exclusion would cease upon a change of use, which means that the area is no longer available for the production of agricultural commodities. Notwithstanding the determination of an area's status as prior converted cropland by any other Federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA;

(3) Ditches (including roadside ditches) excavated wholly in and draining only dry land and that do not carry a relatively permanent flow of water;

(4) Artificially irrigated areas that would revert to dry land if the irrigation ceased;

(5) Artificial lakes or ponds created by excavating or diking dry land to collect and retain water and which are used exclusively for such purposes as stock watering, irrigation, settling basins, or rice growing;

(6) Artificial reflecting or swimming pools or other small ornamental bodies of water created by excavating or diking dry land to retain water for primarily aesthetic reasons;

(7) Waterfilled depressions created in dry land incidental to construction activity and pits excavated in dry land for the purpose of obtaining fill, sand, or gravel unless and until the construction or excavation operation is abandoned and the resulting body of water meets the definition of waters of the United States; and

(8) Swales and erosional features (e.g., gullies, small washes) characterized by low volume, infrequent, or short duration flow.

The 2023 revised and amended definition of Waters of the United States defines "adjacent" as "having a continuous surface connection."

Stream Z is likely a tributary to the Puyallup River, a traditionally navigable water; as such, Stream Z is likely regulated by USACE under Section 404 of the CWA. Wetland A is likely a jurisdictional water due to its direct hydrological connection to Stream Z. Offsite Wetland 1 appears isolated in upland areas with no surface water connections and/or potential connection to jurisdictional waters; as such, Wetland 1 is likely not regulated by the USACE. However, the identified wetlands and stream are considered natural waters that are regulated by the WSDOE through the Revised Code of Washington (RCW) 90.48.

Chapter 7. Closure

The findings and conclusions documented in this report have been prepared for specific application to this project. They have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science profession currently practicing under similar conditions in the area. Our work was also performed in accordance with the terms and conditions set forth in our proposal. The conclusions and recommendations presented in this report are professional opinions based on an interpretation of information currently available to us and are made within the operation scope, budget, and schedule of this project. No warranty, expressed or implied, is made. In addition, changes in government codes, regulations, or laws may occur. Due to such changes, our observations and conclusions applicable to this project may need to be revised wholly or in part.

Wetland and OHW status and boundaries identified by SVC are based on conditions present at the time of the site visit and considered preliminary until the flagged wetland and OHW boundaries are validated by the jurisdictional agencies. Validation of the wetland and OHW boundaries and jurisdictional status of such features by the regulatory agencies provides a certification, usually written, that the wetland determination and boundaries verified are the units that will be regulated by the agencies until a specific date or until the regulations are modified. Only the regulatory agencies can provide this certification.

As wetlands and waterbodies are dynamic communities affected by both natural and human activities, changes in boundaries may be expected; therefore, delineations cannot remain valid for an indefinite period of time. Regulatory agencies typically recognize the validity of wetland and OHW delineations for a period of 5 years after completion of an assessment report. Development activities on a site five years after the completion of this assessment report may require reassessment of the wetland and OHW boundaries. In addition, changes in government codes, regulations, or laws may occur. Due to such changes, our observations and conclusions applicable to this site may need to be revised wholly or in part.

Chapter 8. References

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Appendix A — Methods and Tools

Table A1. Methods and tools used to prepare the report.

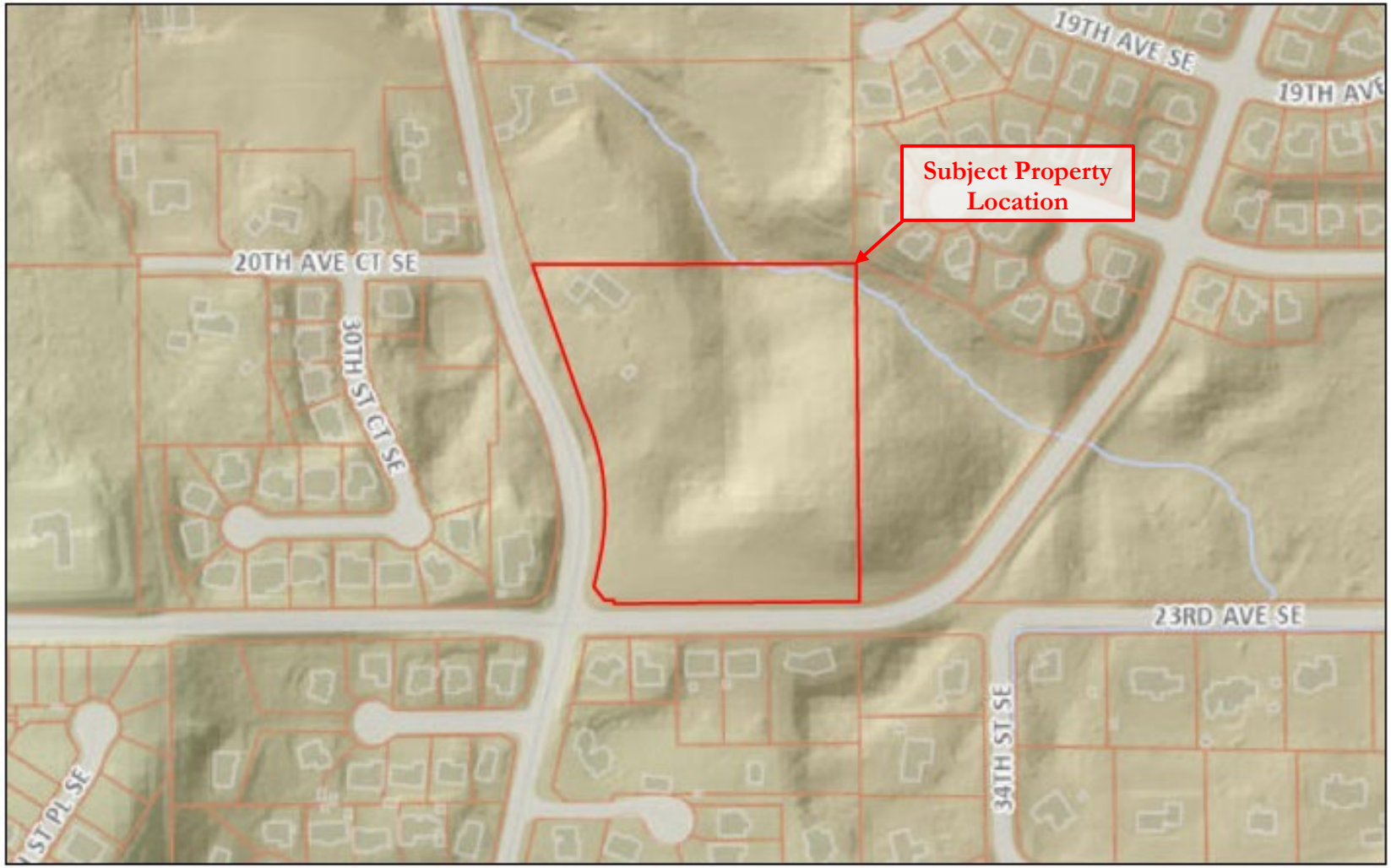
Parameter	Method or Tool	Website	Reference
Wetland Delineation	USACE 1987 Wetland Delineation Manual	http://el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf	**Environmental Laboratory.** 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.
	Western Mountains, Valleys, and Coast Region Regional Supplement	http://www.usace.army.mil/Portals/2/docs/civilworks/regulatory/reg_supp/west_mt_finalsupp.pdf	**U.S. Army Corps of Engineers.** 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)*, ed. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-10-3. Vicksburg, MS: U.S. Army Engineer Research and Development Center.
Wetland Classification	USFWS / Cowardin Classification System	http://www.fws.gov/wetlands/Documents/Classification-of-Wetlands-and-Deepwater-Habitats-of-the-United-States.pdf https://www.fgdc.gov/standards/projects/wetlands/nvcs-2013	**Cowardin**, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. Government Printing Office, Washington, D.C. **Federal Geographic Data Committee.** 2013. Classification of Wetlands and Deepwater Habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, DC.
	Hydrogeomorphic Classification (HGM) System	http://el.erdc.usace.army.mil/wetlands/pdfs/wrpde4.pdf	**Brinson**, M. M. (1993). "A hydrogeomorphic classification for wetlands," Technical Report WRP-DE-4, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
Wetland Rating	Washington State Wetland Rating System	http://www.ecy.wa.gov/biblio/0406025.html	**Hruby, T**. 2014. Washington State wetland rating system for western Washington –Revised. Publication # 04-06-025.
Wetland Indicator Status	2016 National Wetland Plant List	https://www.fws.gov/wetlands/documents/National-Wetland-Plant-List-2016-Wetland-Ratings.pdf	**U.S. Army Corps of Engineers.** 2018. National Wetland Plant List, version 3.4**.**
Stream Classification	Department of Natural Resources (DNR) Water Typing System	http://www.stage.dnr.wa.gov/forestpractices/watertyping/	Washington Administrative Code (WAC) 222-16-030. DNR Water typing system.
Stream Delineation	Determining the OHW	https://fortress.wa.gov/ecy/publications/documents/1606029.pdf	**Anderson**, P.S., S. Meyer, P. Olson, and E. Stockdale. 2016. Determining the Ordinary High Water Mark for Shoreline Management Act Compliance in Washington State. Publication No. 16-06-029. Final Review Draft. Shorelands and Environmental Assistance Program, Washington State Department of Ecology. Olympia, Washington.
Plant Names and Identification	USDA Plant Database	http://plants.usda.gov/	Website.
	Flora of the Pacific Northwest	http://www.pnwherbaria.org/florapnw.php	**Hitchcock**, C.L. & A. Cronquist, Ed. by D. Giblin, B. Ledger, P. Zika, and R. Olmstead. 2018. Flora of the Pacific Northwest, 2nd Edition. U.W. Press and Burke Museum. Seattle, Washington.

Parameter	Method or Tool	Website	Reference
Soils Data	NRCS Soil Survey	http://websoilsurvey.nrcs.usda.gov/app/	Website GIS data based upon: **Debose A., and Klungland, M.W.** 1983. Soil Survey of Snohomish County Area, Washington. United States Department of Agriculture, Soil Conservation Service in cooperation with Washington State Department of Natural Resources, and Washington State University, Agriculture Research Center. Washington, D.C.
	Soil Data Access Hydric Soils List	https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1316620.html	**Natural Resources Conservation Service.** N.d. Soil Data Access Hydric Soils List (Soil Data Access Live).
	Soil Color Charts		**Munsell®** Color. 2000. Munsell® Soil Color Charts. New Windsor, New York.
	Field Indicators of Hydric Soils	https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053171.pdf	**NRCS.** 2018. *Field Indictors of Hydric Soils in the United States, Version 8.2. L.M. Vasialas, G.W. Hurt, and C.V. Noble (eds.).* USDA, NRCS, in cooperation with the National Technical Committee for Hydric Soils.
Threatened and Endangered Species	Washington Natural Heritage Program	http://data-wadnr.opendata.arcgis.com/datasets/wnhp-current-element-occurrences	**Washington Natural Heritage Program**. Endangered, threatened, and sensitive plants of Washington. Washington State Department of Natural Resources, Washington Natural Heritage Program, Olympia, WA
	Washington Priority Habitats and Species	http://wdfw.wa.gov/hab/phspage.htm	**Priority Habitats and Species (PHS) Program** Map of priority habitats and species in project vicinity. Washington Department of Fish and Wildlife.
Species of Local Importance	WDFW GIS Data	http://wdfw.wa.gov/mapping/salmonscape/	Website
Report Preparation	Puyallup Municipal Code	http://www.codepublishing.com/WA/Puyallup/	PMC Chapter 21.06 – Critical Areas

Appendix B — Background Information

This appendix includes a Pierce County Contours Map (B1); NRCS Soil Survey Map (B2); City of Puyallup Stream and Wetland Inventory (B3); Pierce County Stream and Wetland Inventory (B4); USFWS NWI Map (B5); WDFW PHS Map (B6); WDFW SalmonScape Map (B7); and DNR Stream Typing Map (B8).

Appendix B1 — Pierce County Contours Map



Appendix B2 — NRCS Soil Survey Map

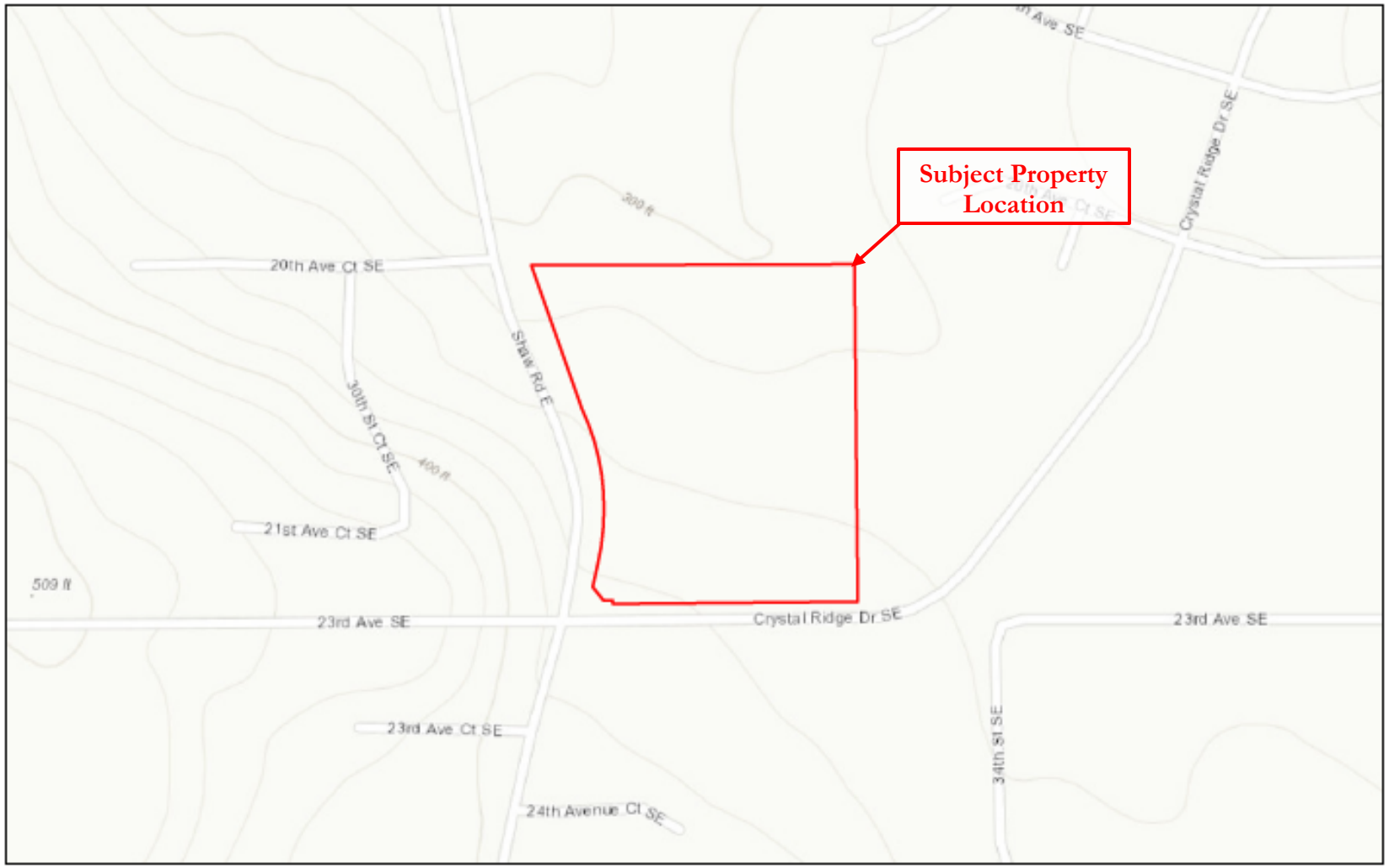
Appendix B3 — City of Puyallup Stream and Wetland Inventory

Appendix B4 — Pierce County Stream and Wetland Inventory

Appendix B5 — USFWS NWI Map

Appendix B6 — WDFW PHS Map

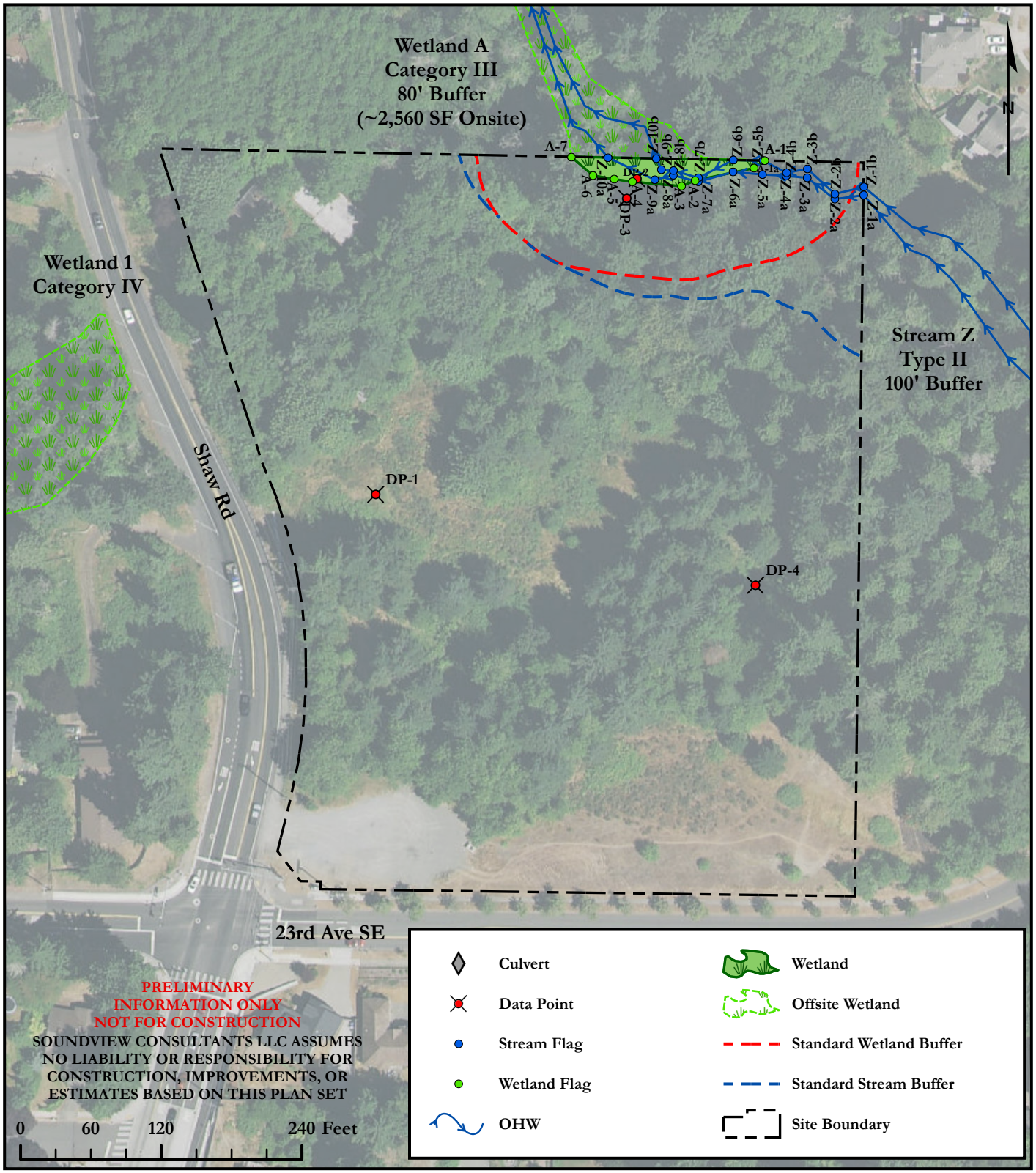
Appendix B7 — WDFW SalmonScape Map



Appendix B8 — DNR Stream Typing Map

Appendix C — Existing Conditions Exhibit

EXISTING CONDITIONS



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DEER CREEK

2007 SHAW RD
PUYALLUP, WA 98372

PIERCE COUNTY PARCEL NUMBER:
0420354039

DATE:	9/16/2025
JOB:	1273.0009
BY:	DDS
SCALE:	1" = 120'
FIGURE NO.	1

Appendix D — Site Photographs

Photo 1: General upland conditions on the central portion of the subject property, facing north.

Photo 2: General upland conditions on the northern portion of the subject property, facing east.

Photo 3: Wetland A, facing north.

Photo 4: Stream Z, facing west.

Photo 5: Soil profile at DP-1.

Photo 6: Soil profile at DP-2.

Photo 7: Soil profile at DP-3

Photo 8: Soil profile at DP-4.

Photo 9: New flag A1-a.

Photo 10: New location of Flag A-1

Photo 10: Example of OHWM flag (Z-1a)

Photo 11: OHWM on either side of Stream Z

Photo 12: OHWM Z-4a and Z-4b

Photo 13: OHWM Z-5a and Z-5b

Photo 14: OHWM Z-6a and Z-6b

Photo 15: OHWM Z-7a and Z-7b

Appendix E — Data Forms

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: 1273.0009 - Deer Creek City/County: Puyallup/Pierce Sampling Date: 1/5/22

Applicant/Owner: RM Homes State: WA Sampling Point: DP-1U

Investigator(s): Ryan Krapp and Mae Ancheta Section, Township, Range: 35, 20 North, 04 East

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 2

Subregion (LRR): A2 Lat: 47.170783 Long: -122.25236993 Datum: WGS 84

Soil Map Unit Name: Indianola loamy sand, 5 to 15 percent slopes NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☒ No ☐ Hydric Soil Present? Yes ☐ No ☒ Wetland Hydrology Present? Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** Yes ☐ No ☒

Remarks:
Not all three wetland criteria met; only hydrophytic vegetation present. Data was collected in the west-central portion of the subject property in a low topographic depression.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0	= Total Cover	
Sapling/Shrub Stratum (Plot size: 30 ft)			
1. Cytisus scoparius	10	Yes	FAC
2. Rubus armeniacus	5	Yes	FAC
3.			
4.			
5.			
	15	= Total Cover	
Herb Stratum (Plot size: 10 ft)			
1. Agrostis capillaris	70	Yes	FAC
2. Rubus ursinus	15	No	FACU
3. Dactylis glomerata	10	No	FACU
4. Cirsium arvense	3	No	FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	98	= Total Cover	
Woody Vine Stratum (Plot size: 30 ft)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 2

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 =
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks:
Hydrophytic vegetation criteria met through the Dominance Test due to the presence of FAC species typical of upland areas.

SOIL

Sampling Point: DP-1U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 10	10YR 3/2	100	-	-	-	-	SaLo	Sandy loam
10 - 15+	10YR 3/3	100	-	-	-	-	SaLo	Sandy loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: None

Depth (inches): --

Hydric Soil Present? Yes ☐ No ☒

Remarks:

No hydric soil criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): None

Water Table Present? Yes ☐ No ☒ Depth (inches): None

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): None

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No wetland hydrology criteria met. Soil pit left open for 20 minutes.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: 1273.0009 - Deer Creek City/County: Puyallup/Pierce Sampling Date: 1/5/22

Applicant/Owner: RM Homes State: WA Sampling Point: DP-2W

Investigator(s): Ryan Krapp and Mae Ancheta Section, Township, Range: 35, 20 North, 04 East

Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 2

Subregion (LRR): A2 Lat: 47.171534 Long: -122.25149739 Datum: WGS 84

Soil Map Unit Name: Indianola loamy sand, 5 to 15 percent slopes NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☒ No ☐ Hydric Soil Present? Yes ☒ No ☐ Wetland Hydrology Present? Yes ☒ No ☐	**Is the Sampled Area within a Wetland?** Yes ☒ No ☐

Remarks:
All three wetland criteria met. Data was collected in Wetland A.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	0 = Total Cover		
Sapling/Shrub Stratum (Plot size: 30 ft)			
1. Acer circinatum	40	Yes	FAC
2. Rubus armeniacus	30	Yes	FAC
3. Rubus spectabilis	10	No	FAC
4.			
5.			
	80 = Total Cover		
Herb Stratum (Plot size: 10 ft)			
1. Ranunculus repens	10	Yes	FAC
2. Tolmiea menziesii	10	Yes	FAC
3. Equisetum arvense	5	Yes	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	25 = Total Cover		
Woody Vine Stratum (Plot size: 30 ft)			
1.			
2.			
	0 = Total Cover		

% Bare Ground in Herb Stratum 75

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species	x 1 =
FACW species	x 2 =
FAC species	x 3 =
FACU species	x 4 =
UPL species	x 5 =
Column Totals: (A)	(B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☒ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☒ No ☐

Remarks:
Hydrophytic vegetation criteria met through the Dominance Test.

SOIL

Sampling Point: DP-2W

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 10	10YR 2/2	100	-	-	-	-	SaLo	Sandy loam
10 - 16+	2.5YR 4/1	97	7.5YR 4/4	3	C	M/PL	Sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☒ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: None

Depth (inches): --

Hydric Soil Present? Yes ☒ No ☐

Remarks:

Hydric soil criteria met through indicator A11.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): None

Water Table Present? Yes ☒ No ☐ Depth (inches): 1

Saturation Present? (includes capillary fringe) Yes ☒ No ☐ Depth (inches): Surface

Wetland Hydrology Present? Yes ☒ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Wetland hydrology criteria met through primary indicators A2 and A3.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: 1273.0009 - Deer Creek City/County: Puyallup/Pierce Sampling Date: 1/5/22

Applicant/Owner: RM Homes State: WA Sampling Point: DP-3U

Investigator(s): Ryan Krapp and Mae Ancheta Section, Township, Range: 35, 20 North, 04 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): None Slope (%): 5

Subregion (LRR): A2 Lat: 47.171488 Long: -122.25153126 Datum: WGS 84

Soil Map Unit Name: Indianola loamy sand, 5 to 15 percent slopes NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☐ No ☒ Hydric Soil Present? Yes ☐ No ☒ Wetland Hydrology Present? Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** Yes ☐ No ☒

Remarks:
No wetland criteria met. Data was collected approximately 15 feet upslope to the south of Wetland A.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Tsuga heterophylla	70	Yes	FACU
2. Alnus rubra	10	No	FAC
3. Thuja plicata	10	No	FAC
4.			
	90	= Total Cover	
Sapling/Shrub Stratum (Plot size: 30 ft)			
1. Acer circinatum	20	Yes	FAC
2. Ilex aquifolium	5	No	FACU
3. Rubus spectabilis	5	No	FAC
4.			
5.			
	30	= Total Cover	
Herb Stratum (Plot size: 10 ft)			
1. Polystichum munitum	10	Yes	FACU
2. Rubus ursinus	5	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	15	= Total Cover	
Woody Vine Stratum (Plot size: 30 ft)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 85

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☐ No ☒

Remarks:
No hydrophytic vegetation present; did not meet the dominance test. Prevalence index not warranted due to combined lack of hydric soils and wetland hydrology.

SOIL

Sampling Point: DP-3U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 3	10YR 3/1	100	-	-	-	-	SaLo	Sandy loam
3 - 7	10YR 3/2	100	-	-	-	-	SaLo	Sandy loam
7 - 14	10YR 4/3	100	-	-	-	-	SaLo	Sandy loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: None

Depth (inches): --

Hydric Soil Present? Yes ☐ No ☒

Remarks:

No hydric soil criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): None

Water Table Present? Yes ☐ No ☒ Depth (inches): None

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): None

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No wetland hydrology criteria met. Soil pit left open for 20 minutes.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: 1273.0009 - Deer Creek City/County: Puyallup/Pierce Sampling Date: 1/5/22

Applicant/Owner: RM Homes State: WA Sampling Point: DP-4U

Investigator(s): Ryan Krapp and Mae Ancheta Section, Township, Range: 35, 20 North, 04 East

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 8

Subregion (LRR): A2 Lat: 47.170590 Long: -122.25106019 Datum: WGS 84

Soil Map Unit Name: Indianola loamy sand, 5 to 15 percent slopes NWI classification: N//A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☒ No ☐ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes ☒ No ☐

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ☐ No ☒ Hydric Soil Present? Yes ☐ No ☒ Wetland Hydrology Present? Yes ☐ No ☒	**Is the Sampled Area within a Wetland?** Yes ☐ No ☒

Remarks:
No wetland criteria met. Data was collected in the east-central portion of the subject property.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus rubra	30	Yes	FAC
2. Pseudotsuga menziesii	10	No	FACU
3.			
4.			
	40	= Total Cover	
Sapling/Shrub Stratum (Plot size: 30 ft)			
1. Rubus armeniacus	70	Yes	FAC
2. Acer macrophyllum	20	Yes	FACU
3. Holodiscus discolor	10	No	FACU
4.			
5.			
	100	= Total Cover	
Herb Stratum (Plot size: 10 ft)			
1. Rubus ursinus	70	Yes	FACU
2. Polystichum munitum	10	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80	= Total Cover	
Woody Vine Stratum (Plot size: 30 ft)			
1.			
2.			
	0	= Total Cover	

% Bare Ground in Herb Stratum 20

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

- ☐ Rapid Test for Hydrophytic Vegetation
- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Wetland Non-Vascular Plants[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☐ No ☒

Remarks:
No hydrophytic vegetation present; did not meet the dominance test. Prevalence index not warranted due to combined lack of hydric soils and wetland hydrology.

SOIL

Sampling Point: DP-4U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0 - 5	10YR 3/1	100	-	-	-	-	SaLo	Sandy loam w/ gravel
5 - 14+	10YR 4/4	100	-	-	-	-	SaLo	Sandy loam w/ gravel

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10)
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: None

Depth (inches): --

Hydric Soil Present? Yes ☐ No ☒

Remarks:

No hydric soil criteria met.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ☐ Salt Crust (B11)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Stunted or Stressed Plants (D1) (**LRR A**)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ☐ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Raised Ant Mounds (D6) (**LRR A**)
- ☐ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes ☐ No ☒ Depth (inches): None

Water Table Present? Yes ☐ No ☒ Depth (inches): None

Saturation Present? (includes capillary fringe) Yes ☐ No ☒ Depth (inches): None

Wetland Hydrology Present? Yes ☐ No ☒

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No wetland hydrology criteria met. Soil pit left open for 20 minutes.

Appendix F — Wetland Rating Forms

Wetland name or number Off

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Offsite 1 Date of site visit: 1/5/22

Rated by Ryan Krapp Trained by Ecology? ✔ Yes ___No Date of training 10/18

HGM Class used for rating Slope Wetland has multiple HGM classes? ___Y ✔ N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.

Source of base aerial photo/map ESRI ArcGIS

OVERALL WETLAND CATEGORY IV (based on functions ✔ or special characteristics___)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 - 27

_____**Category II** – Total score = 20 - 22

_____**Category III** – Total score = 16 - 19

__X__**Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
		Circle the appropriate ratings		
Site Potential	L	L	L	
Landscape Potential	M	M	L	
Value	H	M	M	TOTAL
Score Based on Ratings	6	5	4	15

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	**I II**
Wetland of High Conservation Value	**I**
Bog	**I**
Mature Forest	**I**
Old Growth Forest	**I**
Coastal Lagoon	**I II**
Interdunal	**I II III IV**
None of the above	N/A

Wetland name or number Off

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number Off

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

☒ NO – go to 2 ☐ **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

☐ **NO – Saltwater Tidal Fringe (Estuarine)** ☐ **YES – Freshwater Tidal Fringe**

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

☒ NO – go to 3 ☐ **YES** – The wetland class is **Flats**

*If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?

☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;

☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

☒ NO – go to 4 ☐ **YES –** The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?

☒ The wetland is on a slope (*slope can be very gradual*),

☒ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,

☒ The water leaves the wetland **without being impounded**.

☐ NO – go to 5 ☒ **YES –** The wetland class is **Slope**

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?

☐ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,

☐ The overbank flooding occurs at least once every 2 years.

Wetland name or number Off

☐ NO – go to 6 ☐ **YES** – The wetland class is **Riverine**
NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*

☐ NO – go to 7 ☐ **YES** – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

☐ NO – go to 8 ☐ **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

   NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

*If you are still unable to determine which of the above criteria apply to your wetland, or if you have **more than 2 HGM classes** within a wetland boundary, classify the wetland as Depressional for the rating.*

Wetland name or number Off

SLOPE WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

S 1.0. Does the site have the potential to improve water quality?	
S 1.1. Characteristics of the average slope of the wetland: *(a 1% slope has a 1 ft vertical drop in elevation for every 100 ft of horizontal distance*) Slope is 1% or less points = 3 Slope is > 1%-2% points = 2 Slope is > 2%-5% points = 1 Slope is greater than 5% points = 0	0
S 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions)*: Yes = 3 No = 0	0
S 1.3. Characteristics of the plants in the wetland that trap sediments and pollutants: Choose the points appropriate for the description that best fits the plants in the wetland. *Dense means you have trouble seeing the soil surface (>75% cover), and uncut means not grazed or mowed and plants are higher than 6 in.* Dense, uncut, herbaceous plants > 90% of the wetland area points = 6 Dense, uncut, herbaceous plants > ½ of area points = 3 Dense, woody, plants > ½ of area points = 2 Dense, uncut, herbaceous plants > ¼ of area points = 1 Does not meet any of the criteria above for plants points = 0	2
Total for S 1 Add the points in the boxes above	2

Rating of Site Potential If score is: ___ **12 = H** ___ **6-11 = M** X **0-5 = L** *Record the rating on the first page*

S 2.0. Does the landscape have the potential to support the water quality function of the site?	
S 2.1. Is > 10% of the area within 150 ft on the uphill side of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
S 2.2. Are there other sources of pollutants coming into the wetland that are not listed in question S 2.1? Other sources _____ Yes = 1 No = 0	0
Total for S 2 Add the points in the boxes above	1

Rating of Landscape Potential If score is: X **1-2 = M** **0 = L** *Record the rating on the first page*

S 3.0. Is the water quality improvement provided by the site valuable to society?	
S 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	0
S 3.2. Is the wetland in a basin or sub-basin where water quality is an issue? *At least one aquatic resource in the basin is on the 303(d) list*. Yes = 1 No = 0	1
S 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality? *Answer YES if there is a TMDL for the basin in which unit is found.* Yes = 2 No = 0	2
Total for S 3 Add the points in the boxes above	3

Rating of Value If score is: X **2-4 = H** ___ **1 = M** ___ **0 = L** *Record the rating on the first page*

Wetland name or number Off

SLOPE WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream erosion

S 4.0. Does the site have the potential to reduce flooding and stream erosion?	
S 4.1. Characteristics of plants that reduce the velocity of surface flows during storms: Choose the points appropriate for the description that best fits conditions in the wetland. *Stems of plants should be thick enough (usually > 1/8 in), or dense enough, to remain erect during surface flows.* Dense, uncut, **rigid** plants cover > 90% of the area of the wetland points = 1 All other conditions points = 0	0

Rating of Site Potential If score is: ___ **1 = M** X **0 = L** *Record the rating on the first page*

S 5.0. Does the landscape have the potential to support the hydrologic functions of the site?	
S 5.1. Is more than 25% of the area within 150 ft upslope of wetland in land uses or cover that generate excess surface runoff? Yes = 1 No = 0	1

Rating of Landscape Potential If score is: X **1 = M** ___ **0 = L** *Record the rating on the first page*

S 6.0. Are the hydrologic functions provided by the site valuable to society?	
S 6.1. Distance to the nearest areas downstream that have flooding problems: The sub-basin immediately down-gradient of site has flooding problems that result in damage to human or natural resources (e.g., houses or salmon redds) points = 2 Surface flooding problems are in a sub-basin farther down-gradient points = 1 No flooding problems anywhere downstream points = 0	1
S 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for S 6 Add the points in the boxes above	1

Rating of Value If score is: ___ **2-4 = H** X **1 = M** ___ **0 = L** *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

Wetland name or number Offsi

These questions apply to wetlands of all HGM classes.

HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

H 1.0. Does the site have the potential to provide habitat?

H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.*

____Aquatic bed	4 structures or more: points = 4
____Emergent	3 structures: points = 2
____Scrub-shrub (areas where shrubs have > 30% cover)	2 structures: points = 1
_×_Forested (areas where trees have > 30% cover)	1 structure: points = 0

If the unit has a Forested class, check if:

_×_The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon

1

H 1.2. Hydroperiods

Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*).

____Permanently flooded or inundated	4 or more types present: points = 3
____Seasonally flooded or inundated	3 types present: points = 2
____Occasionally flooded or inundated	2 types present: points = 1
_×_Saturated only	1 type present: points = 0
____Permanently flowing stream or river in, or adjacent to, the wetland	
____Seasonally flowing stream in, or adjacent to, the wetland	
____**Lake Fringe wetland**	**2 points**
____**Freshwater tidal wetland**	**2 points**

0

H 1.3. Richness of plant species

Count the number of plant species in the wetland that cover at least 10 ft^2.

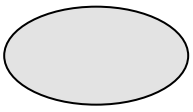
Different patches of the same species can be combined to meet the size threshold and you do not have to name the species. ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle***

If you counted: > 19 species	points = 2
5 - 19 species	points = 1
< 5 species	points = 0

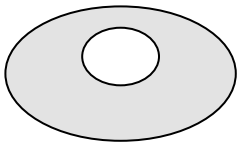
1

H 1.4. Interspersion of habitats

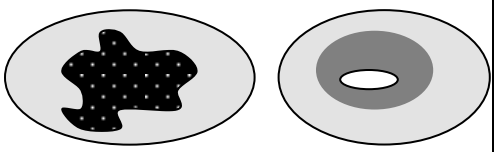
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*



None = 0 points

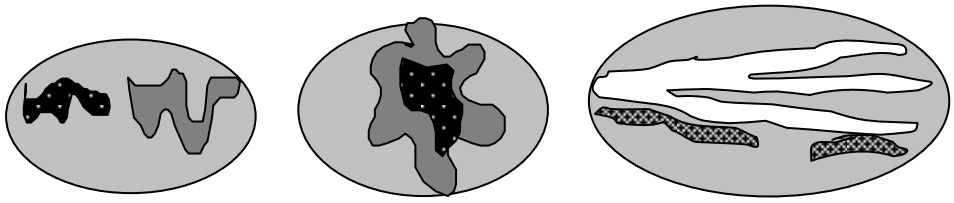


Low = 1 point



Moderate = 2 points

All three diagrams in this row are **HIGH** = 3points



0

Wetland name or number Offsite 1

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* __×__Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). __×__Standing snags (dbh > 4 in) within the wetland ____Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	2
Total for H 1 Add the points in the boxes above	4

Rating of Site Potential If score is:___**15-18 = H** ___**7-14 = M** _X_**0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* [0.00] % undisturbed habitat **+** [(% moderate and low intensity land uses) [0.00] /2] **=** 0 % If total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon points = 3 20-33% of 1 km Polygon points = 2 10-19% of 1 km Polygon points = 1 < 10% of 1 km Polygon points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* [4.24] % undisturbed habitat **+** [(% moderate and low intensity land uses) [25.15] /2] **=** 16.81 % Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10-50% and in 1-3 patches points = 2 Undisturbed habitat 10-50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (- 2) ≤ 50% of 1 km Polygon is high intensity points = 0	-2
Total for H 2 Add the points in the boxes above	-1

Rating of Landscape Potential If score is:___**4-6 = H** ___**1-3 = M** _X_**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: points = 2 — It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan × Site has 1 or 2 priority habitats (listed on next page) within 100 m points = 1 Site does not meet any of the criteria above points = 0	1

Rating of Value If score is:___**2 = H** _X_**1 = M** ___**0 = L** *Record the rating on the first page*

Wetland name or number Off

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

— **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

— **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

— **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

— **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

— **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

X **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number Off

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt ☐ Yes –Go to **SC 1.1** ☒ No= **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? ☐ Yes = **Category I** ☐ No - Go to **SC 1.2**	
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ☐ Yes = **Category I** ☐ No = **Category II**	
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ☐ Yes **– Go to SC 2.2** ☒ No **– Go to SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ☐ Yes **= Category I** ☒ No **= Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ☐ Yes **– Contact WNHP/WDNR and go to SC 2.4** ☒ No **= Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ☐ Yes **= Category I** ☒ No **= Not a WHCV**	
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ☐ Yes – Go to **SC 3.3** ☒ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ☐ Yes – Go to **SC 3.3** ☒ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ☐ Yes = **Is a Category I bog** ☐ No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ☐ Yes = **Is a Category I bog** ☐ No **= Is not a bog**	

Wetland name or number Off

SC 4.0. Forested Wetlands

Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.***

- **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more.
- **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm).

☐Yes **= Category I** ☒No **= Not a forested wetland for this section**

SC 5.0. Wetlands in Coastal Lagoons

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

- The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks
- The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

☐Yes – Go to **SC 5.1** ☒No = **Not a wetland in a coastal lagoon**

SC 5.1. Does the wetland meet all of the following three conditions?

- The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100).
- At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.
- The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2)

☐Yes = **Category I** ☐No = **Category II**

SC 6.0. Interdunal Wetlands

Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.***

In practical terms that means the following geographic areas:

- Long Beach Peninsula: Lands west of SR 103
- Grayland-Westport: Lands west of SR 105
- Ocean Shores-Copalis: Lands west of SR 115 and SR 109

☐Yes – Go to **SC 6.1** ☒No = **not an interdunal wetland for rating**

SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ☐Yes = **Category I** ☐No – Go to **SC 6.2**

SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger?

☐Yes = **Category II** ☐No – Go to **SC 6.3**

SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac?

☐Yes = **Category III** ☐No = **Category IV**

Category of wetland based on Special Characteristics

If you answered No for all types, enter "Not Applicable" on Summary Form

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Wetland name or number Wetland A

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland A Date of site visit: 11/16/21, 1/5/2.

Rated by Kyla Caddey/Ryan Krapp Trained by Ecology? ✔ Yes ___No Date of training 11/16 & 10/18

HGM Class used for rating Depressional Wetland has multiple HGM classes? ✔ Y ____N

NOTE: **Form is not complete without the figures requested** *(figures can be combined)*.
Source of base aerial photo/map ESRI ArcGIS

OVERALL WETLAND CATEGORY ____ III____ (based on functions ✔ or special characteristics___)

1. Category of wetland based on FUNCTIONS

_____**Category I** – Total score = 23 - 27

_____**Category II** – Total score = 20 - 22

__X__**Category III** – Total score = 16 - 19

_____**Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
		Circle the appropriate ratings		
Site Potential	M	L	M	
Landscape Potential	M	M	L	
Value	H	M	M	TOTAL
Score Based on Ratings	7	5	5	17

Score for each function based on three ratings *(order of ratings is not important)*

9 = H,H,H
8 = H,H,M
7 = H,H,L
7 = H,M,M
6 = H,M,L
6 = M,M,M
5 = H,L,L
5 = M,M,L
4 = M,L,L
3 = L,L,L

2. Category based on SPECIAL CHARACTERISTICS of wetland

CHARACTERISTIC	CATEGORY
Estuarine	**I II**
Wetland of High Conservation Value	**I**
Bog	**I**
Mature Forest	**I**
Old Growth Forest	**I**
Coastal Lagoon	**I II**
Interdunal	**I II III IV**
None of the above	N/A

Wetland name or number Wetland A

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	D 1.3, H 1.1, H 1.4	
Hydroperiods	D 1.4, H 1.2	
Location of outlet (*can be added to map of hydroperiods)*	D 1.1, D 4.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	D 2.2, D 5.2	
Map of the contributing basin	D 4.3, D 5.3	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	D 3.1, D 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	D 3.3	

Riverine Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Ponded depressions	R 1.1	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	R 2.4	
Plant cover of trees, shrubs, and herbaceous plants	R 1.2, R 4.2	
Width of unit vs. width of stream *(can be added to another figure)*	R 4.1	
Map of the contributing basin	R 2.2, R 2.3, R 5.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	R 3.1	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	R 3.2, R 3.3	

Lake Fringe Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	L 1.1, L 4.1, H 1.1, H 1.4	
Plant cover of trees, shrubs, and herbaceous plants	L 1.2	
Boundary of area within 150 ft of the wetland *(can be added to another figure)*	L 2.2	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	L 3.1, L 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	L 3.3	

Slope Wetlands

Map of:	To answer questions:	Figure #
Cowardin plant classes	H 1.1, H 1.4	
Hydroperiods	H 1.2	
Plant cover of **dense** trees, shrubs, and herbaceous plants	S 1.3	
Plant cover of **dense, rigid** trees, shrubs, and herbaceous plants (*can be added to figure above)*	S 4.1	
Boundary of 150 ft buffer (can be added to another figure)	S 2.1, S 5.1	
1 km Polygon: Area that extends 1 km from entire wetland edge - including polygons for accessible habitat and undisturbed habitat	H 2.1, H 2.2, H 2.3	
Screen capture of map of 303(d) listed waters in basin (from Ecology website)	S 3.1, S 3.2	
Screen capture of list of TMDLs for WRIA in which unit is found (from web)	S 3.3	

Wetland name or number Wetland A

HGM Classification of Wetlands in Western Washington

For questions 1-7, the criteria described must apply to the entire unit being rated.

If the hydrologic criteria listed in each question do not apply to the entire unit being rated, you probably have a unit with multiple HGM classes. In this case, identify which hydrologic criteria in questions 1-7 apply, and go to Question 8.

1. Are the water levels in the entire unit usually controlled by tides except during floods?

☒ NO – go to 2 ☐ **YES** – the wetland class is **Tidal Fringe** – go to 1.1

1.1 Is the salinity of the water during periods of annual low flow below 0.5 ppt (parts per thousand)?

☐ **NO – Saltwater Tidal Fringe (Estuarine)** ☐ **YES – Freshwater Tidal Fringe**

*If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

2. The entire wetland unit is flat and precipitation is the only source (>90%) of water to it. Groundwater and surface water runoff are NOT sources of water to the unit.

☒ NO – go to 3 ☐ **YES** – The wetland class is **Flats**

*If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?

☐ The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;

☐ At least 30% of the open water area is deeper than 6.6 ft (2 m).

☒ NO – go to 4 ☐ **YES –** The wetland class is **Lake Fringe** (Lacustrine Fringe)

4. Does the entire wetland unit **meet all** of the following criteria?

☒ The wetland is on a slope (*slope can be very gradual*),

☒ The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,

☒ The water leaves the wetland **without being impounded**.

☐ NO – go to 5 ☒ **YES –** The wetland class is **Slope**

NOTE: Surface water does not pond in these type of wetlands except occasionally in very small and shallow depressions or behind hummocks (depressions are usually <3 ft diameter and less than 1 ft deep).

5. Does the entire wetland unit **meet all** of the following criteria?

☐ The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,

☐ The overbank flooding occurs at least once every 2 years.

Wetland name or number Wetland A

☒ NO – go to 6 ☐ **YES** – The wetland class is **Riverine**

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

6. Is the entire wetland unit in a topographic depression in which water ponds, or is saturated to the surface, at some time during the year? *This means that any outlet, if present, is higher than the interior of the wetland.*

☐ NO – go to 7 ☒ **YES** – The wetland class is **Depressional**

7. Is the entire wetland unit located in a very flat area with no obvious depression and no overbank flooding? The unit does not pond surface water more than a few inches. The unit seems to be maintained by high groundwater in the area. The wetland may be ditched, but has no obvious natural outlet.

☐ NO – go to 8 ☐ **YES** – The wetland class is **Depressional**

8. Your wetland unit seems to be difficult to classify and probably contains several different HGM classes. For example, seeps at the base of a slope may grade into a riverine floodplain, or a small stream within a Depressional wetland has a zone of flooding along its sides. GO BACK AND IDENTIFY WHICH OF THE HYDROLOGIC REGIMES DESCRIBED IN QUESTIONS 1-7 APPLY TO DIFFERENT AREAS IN THE UNIT (make a rough sketch to help you decide). Use the following table to identify the appropriate class to use for the rating system if you have several HGM classes present within the wetland unit being scored.

   NOTE: Use this table only if the class that is recommended in the second column represents 10% or more of the total area of the wetland unit being rated. If the area of the HGM class listed in column 2 is less than 10% of the unit; classify the wetland using the class that represents more than 90% of the total area.

HGM classes within the wetland unit being rated	HGM class to use in rating
Slope + Riverine	Riverine
Slope + Depressional	Depressional
Slope + Lake Fringe	Lake Fringe
Depressional + Riverine along stream within boundary of depression	Depressional
Depressional + Lake Fringe	Depressional
Riverine + Lake Fringe	Riverine
Salt Water Tidal Fringe and any other class of freshwater wetland	Treat as ESTUARINE

*If you are still unable to determine which of the above criteria apply to your wetland, or if you have **more than 2 HGM classes** within a wetland boundary, classify the wetland as Depressional for the rating.*

Wetland name or number Wetland A

DEPRESSIONAL AND FLATS WETLANDS

Water Quality Functions - Indicators that the site functions to improve water quality

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1	1
D 1.2. The soil 2 in below the surface (or duff layer) is true clay or true organic *(use NRCS definitions).* Yes = 4 No = 0	0
D 1.3. Characteristics and distribution of persistent plants (Emergent, Scrub-shrub, and/or Forested Cowardin classes): Wetland has persistent, ungrazed, plants > 95% of area points = 5 Wetland has persistent, ungrazed, plants > ½ of area points = 3 Wetland has persistent, ungrazed plants > $^1/_{10}$ of area points = 1 Wetland has persistent, ungrazed plants < $^1/_{10}$ of area points = 0	5
D 1.4. Characteristics of seasonal ponding or inundation: *This is the area that is ponded for at least 2 months. See description in manual.* Area seasonally ponded is > ½ total area of wetland points = 4 Area seasonally ponded is > ¼ total area of wetland points = 2 Area seasonally ponded is < ¼ total area of wetland points = 0	0
Total for D 1 Add the points in the boxes above	6

Rating of Site Potential If score is: ___ **12-16 = H** _X_ **6-11 = M** ___ **0-5 = L** *Record the rating on the first page*

D 2.0. Does the landscape have the potential to support the water quality function of the site?	
D 2.1. Does the wetland unit receive stormwater discharges? Yes = 1 No = 0	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	0
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	1
D 2.4. Are there other sources of pollutants coming into the wetland that are not listed in questions D 2.1-D 2.3? Source_____ Yes = 1 No = 0	0
Total for D 2 Add the points in the boxes above	1

Rating of Landscape Potential If score is: ___ **3 or 4 = H** _X_ **1 or 2 = M** ___ **0 = L** *Record the rating on the first page*

D 3.0. Is the water quality improvement provided by the site valuable to society?	
D 3.1. Does the wetland discharge directly (i.e., within 1 mi) to a stream, river, lake, or marine water that is on the 303(d) list? Yes = 1 No = 0	0
D 3.2. Is the wetland in a basin or sub-basin where an aquatic resource is on the 303(d) list? Yes = 1 No = 0	1
D 3.3. Has the site been identified in a watershed or local plan as important for maintaining water quality (*answer YES if there is a TMDL for the basin in which the unit is found*)? Yes = 2 No = 0	2
Total for D 3 Add the points in the boxes above	3

Rating of Value If score is: _X_ **2-4 = H** ___ **1 = M** ___ **0 = L** *Record the rating on the first page*

NOTES and FIELD OBSERVATIONS:

Wetland name or number Wetland A

DEPRESSIONAL AND FLATS WETLANDS

Hydrologic Functions - Indicators that the site functions to reduce flooding and stream degradation

D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	1
D 4.2. Depth of storage during wet periods: *Estimate the height of ponding above the bottom of the outlet. For wetlands with no outlet, measure from the surface of permanent water or if dry, the deepest part.* Marks of ponding are 3 ft or more above the surface or bottom of outlet points = 7 Marks of ponding between 2 ft to < 3 ft from surface or bottom of outlet points = 5 Marks are at least 0.5 ft to < 2 ft from surface or bottom of outlet points = 3 The wetland is a "headwater" wetland points = 3 Wetland is flat but has small depressions on the surface that trap water points = 1 Marks of ponding less than 0.5 ft (6 in) points = 0	0
D 4.3. Contribution of the wetland to storage in the watershed: *Estimate the ratio of the area of upstream basin contributing surface water to the wetland to the area of the wetland unit itself.* The area of the basin is less than 10 times the area of the unit points = 5 The area of the basin is 10 to 100 times the area of the unit points = 3 The area of the basin is more than 100 times the area of the unit points = 0 Entire wetland is in the Flats class points = 5	0
Total for D 4 Add the points in the boxes above	1

Rating of Site Potential If score is: ___ **12-16 = H** ___ **6-11 = M** X **0-5 = L** *Record the rating on the first page*

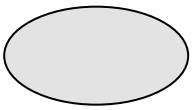
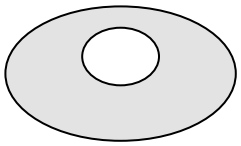
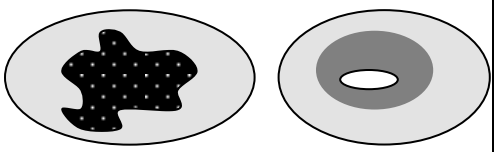
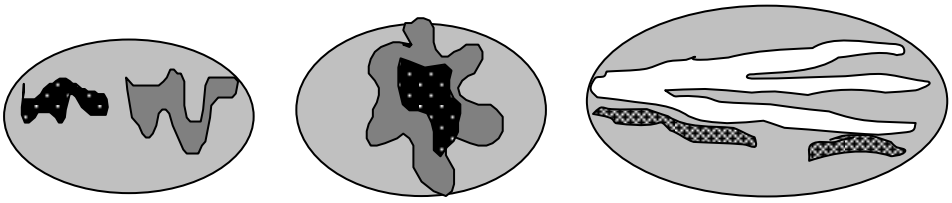
D 5.0. Does the landscape have the potential to support hydrologic functions of the site?	
D 5.1. Does the wetland receive stormwater discharges? Yes = 1 No = 0	0
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	0
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	1
Total for D 5 Add the points in the boxes above	1

Rating of Landscape Potential If score is: ___ **3 = H** X **1 or 2 = M** ___ **0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): • Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 • Surface flooding problems are in a sub-basin farther down-gradient. points = 1 Flooding from groundwater is an issue in the sub-basin. points = 1 The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ points = 0 _____ There are no problems with flooding downstream of the wetland. points = 0	1
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	1

Rating of Value If score is: ___ **2-4 = H** X **1 = M** ___ **0 = L** *Record the rating on the first page*

Wetland name or number Wetland A

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	
H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ____Aquatic bed — 4 structures or more: points = 4 ____Emergent — 3 structures: points = 2 __×__Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1 __×__Forested (areas where trees have > 30% cover) — 1 structure: points = 0 *If the unit has a Forested class, check if:* __×__The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon	2
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ____Permanently flooded or inundated — 4 or more types present: points = 3 ____Seasonally flooded or inundated — 3 types present: points = 2 ____Occasionally flooded or inundated — 2 types present: points = 1 __×__Saturated only — 1 type present: points = 0 __×__Permanently flowing stream or river in, or adjacent to, the wetland ____Seasonally flowing stream in, or adjacent to, the wetland ____**Lake Fringe wetland** — **2 points** ____**Freshwater tidal wetland** — **2 points**	1
H 1.3. Richness of plant species Count the number of plant species in the wetland that cover at least 10 ft^2. *Different patches of the same species can be combined to meet the size threshold and you do not have to name the species.* ***Do not include Eurasian milfoil, reed canarygrass, purple loosestrife, Canadian thistle*** If you counted: > 19 species — points = 2 5 - 19 species — points = 1 < 5 species — points = 0	1
H 1.4. Interspersion of habitats Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always high.*  **None** = 0 points  **Low** = 1 point  **Moderate** = 2 points All three diagrams in this row are **HIGH** = 3points 	1

Wetland name or number Wetland A

H 1.5. Special habitat features: Check the habitat features that are present in the wetland. *The number of checks is the number of points.* __×__Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long). __×__Standing snags (dbh > 4 in) within the wetland __×__Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m) ____Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)* ____At least ¼ ac of thin-stemmed persistent plants or woody branches are present in areas that are permanently or seasonally inundated *(structures for egg-laying by amphibians)* ____Invasive plants cover less than 25% of the wetland area in every stratum of plants (*see H 1.1 for list of strata*)	3
Total for H 1 Add the points in the boxes above	8

Rating of Site Potential If score is:___**15-18 = H** __X__**7-14 = M** ___**0-6 = L** *Record the rating on the first page*

H 2.0. Does the landscape have the potential to support the habitat functions of the site?	
H 2.1. Accessible habitat (include *only habitat that directly abuts wetland unit*). *Calculate:* [0.42] % undisturbed habitat **+** [(% moderate and low intensity land uses) [4.55] /2] **=** 2.695 % If total accessible habitat is: > 1/3 (33.3%) of 1 km Polygon points = 3 20-33% of 1 km Polygon points = 2 10-19% of 1 km Polygon points = 1 < 10% of 1 km Polygon points = 0	0
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* [4.24] % undisturbed habitat **+** [(% moderate and low intensity land uses) [25.15] /2] **=** 16.81 % Undisturbed habitat > 50% of Polygon points = 3 Undisturbed habitat 10-50% and in 1-3 patches points = 2 Undisturbed habitat 10-50% and > 3 patches points = 1 Undisturbed habitat < 10% of 1 km Polygon points = 0	1
H 2.3. Land use intensity in 1 km Polygon: If > 50% of 1 km Polygon is high intensity land use points = (- 2) ≤ 50% of 1 km Polygon is high intensity points = 0	-2
Total for H 2 Add the points in the boxes above	-1

Rating of Landscape Potential If score is:___**4-6 = H** ___**1-3 = M** __X__**< 1 = L** *Record the rating on the first page*

H 3.0. Is the habitat provided by the site valuable to society?	
H 3.1. Does the site provide habitat for species valued in laws, regulations, or policies? *Choose only the highest score that applies to the wetland being rated.* Site meets ANY of the following criteria: points = 2 — It has 3 or more priority habitats within 100 m (see next page) — It provides habitat for Threatened or Endangered species (any plant or animal on the state or federal lists) — It is mapped as a location for an individual WDFW priority species — It is a Wetland of High Conservation Value as determined by the Department of Natural Resources — It has been categorized as an important habitat site in a local or regional comprehensive plan, in a Shoreline Master Plan, or in a watershed plan × Site has 1 or 2 priority habitats (listed on next page) within 100 m points = 1 Site does not meet any of the criteria above points = 0	1

Rating of Value If score is:___**2 = H** __X__**1 = M** ___**0 = L** *Record the rating on the first page*

Wetland name or number Wetland A

WDFW Priority Habitats

Priority habitats listed by WDFW (see complete descriptions of WDFW priority habitats, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008. Priority Habitat and Species List. Olympia, Washington. 177 pp. http://wdfw.wa.gov/publications/00165/wdfw00165.pdf or access the list from here: http://wdfw.wa.gov/conservation/phs/list/)

Count how many of the following priority habitats are within 330 ft (100 m) of the wetland unit: ***NOTE:*** *This question is independent of the land use between the wetland unit and the priority habitat.*

— **Aspen Stands:** Pure or mixed stands of aspen greater than 1 ac (0.4 ha).

— **Biodiversity Areas and Corridors**: Areas of habitat that are relatively important to various species of native fish and wildlife (*full descriptions in WDFW PHS report*).

— **Herbaceous Balds:** Variable size patches of grass and forbs on shallow soils over bedrock.

— **Old-growth/Mature forests:** Old-growth west of Cascade crest – Stands of at least 2 tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) > 32 in (81 cm) dbh or > 200 years of age. Mature forests – Stands with average diameters exceeding 21 in (53 cm) dbh; crown cover may be less than 100%; decay, decadence, numbers of snags, and quantity of large downed material is generally less than that found in old-growth; 80-200 years old west of the Cascade crest.

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important (*full descriptions in WDFW PHS report p. 158 – see web link above*).

X **Riparian**: The area adjacent to aquatic systems with flowing water that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie (*full descriptions in WDFW PHS report p. 161 – see web link above*).

X **Instream:** The combination of physical, biological, and chemical processes and conditions that interact to provide functional life history requirements for instream fish and wildlife resources.

— **Nearshore**: Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore. (*full descriptions of habitats and the definition of relatively undisturbed are in WDFW report – see web link on previous page).*

— **Caves:** A naturally occurring cavity, recess, void, or system of interconnected passages under the earth in soils, rock, ice, or other geological formations and is large enough to contain a human.

— **Cliffs:** Greater than 25 ft (7.6 m) high and occurring below 5000 ft elevation.

— **Talus:** Homogenous areas of rock rubble ranging in average size 0.5 - 6.5 ft (0.15 - 2.0 m), composed of basalt, andesite, and/or sedimentary rock, including riprap slides and mine tailings. May be associated with cliffs.

— **Snags and Logs:** Trees are considered snags if they are dead or dying and exhibit sufficient decay characteristics to enable cavity excavation/use by wildlife. Priority snags have a diameter at breast height of > 20 in (51 cm) in western Washington and are > 6.5 ft (2 m) in height. Priority logs are > 12 in (30 cm) in diameter at the largest end, and > 20 ft (6 m) long.

Note: All vegetated wetlands are by definition a priority habitat but are not included in this list because they are addressed elsewhere.

Wetland name or number Wetland A

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? ☐ The dominant water regime is tidal, ☐ Vegetated, and ☐ With a salinity greater than 0.5 ppt ☐ Yes –Go to **SC 1.1** ☒ No= **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? ☐ Yes = **Category I** ☐ No - Go to **SC 1.2**	
SC 1.2. Is the wetland unit at least 1 ac in size and meets at least two of the following three conditions? ☐ The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing, and has less than 10% cover of non-native plant species. (If non-native species are *Spartina*, see page 25) ☐ At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland. ☐ The wetland has at least two of the following features: tidal channels, depressions with open water, or contiguous freshwater wetlands. ☐ Yes = **Category I** ☐ No = **Category II**	
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Has the WA Department of Natural Resources updated their website to include the list of Wetlands of High Conservation Value? ☐ Yes **– Go to SC 2.2** ☒ No **– Go to SC 2.3** SC 2.2. Is the wetland listed on the WDNR database as a Wetland of High Conservation Value? ☐ Yes **= Category I** ☒ No **= Not a WHCV** SC 2.3. Is the wetland in a Section/Township/Range that contains a Natural Heritage wetland? http://www1.dnr.wa.gov/nhp/refdesk/datasearch/wnhpwetlands.pdf ☐ Yes **– Contact WNHP/WDNR and go to SC 2.4** ☒ No **= Not a WHCV** SC 2.4. Has WDNR identified the wetland within the S/T/R as a Wetland of High Conservation Value and listed it on their website? ☐ Yes **= Category I** ☒ No **= Not a WHCV**	
SC 3.0. Bogs Does the wetland (or any part of the unit) meet both the criteria for soils and vegetation in bogs? *Use the key below.* ***If you answer YES you will still need to rate the wetland based on its functions.*** SC 3.1. Does an area within the wetland unit have organic soil horizons, either peats or mucks, that compose 16 in or more of the first 32 in of the soil profile? ☐ Yes – Go to **SC 3.3** ☒ No – Go to **SC 3.2** SC 3.2. Does an area within the wetland unit have organic soils, either peats or mucks, that are less than 16 in deep over bedrock, or an impermeable hardpan such as clay or volcanic ash, or that are floating on top of a lake or pond? ☐ Yes – Go to **SC 3.3** ☒ No = **Is not a bog** SC 3.3. Does an area with peats or mucks have more than 70% cover of mosses at ground level, AND at least a 30% cover of plant species listed in Table 4? ☐ Yes = **Is a Category I bog** ☐ No – Go to **SC 3.4** **NOTE:** If you are uncertain about the extent of mosses in the understory, you may substitute that criterion by measuring the pH of the water that seeps into a hole dug at least 16 in deep. If the pH is less than 5.0 and the plant species in Table 4 are present, the wetland is a bog. SC 3.4. Is an area with peats or mucks forested (> 30% cover) with Sitka spruce, subalpine fir, western red cedar, western hemlock, lodgepole pine, quaking aspen, Engelmann spruce, or western white pine, AND any of the species (or combination of species) listed in Table 4 provide more than 30% of the cover under the canopy? ☐ Yes = **Is a Category I bog** ☐ No **= Is not a bog**	

Wetland name or number Wetland A

SC 4.0. Forested Wetlands

Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.***

- **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more.
- **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm).

☐Yes **= Category I** ☒No **= Not a forested wetland for this section**

SC 5.0. Wetlands in Coastal Lagoons

Does the wetland meet all of the following criteria of a wetland in a coastal lagoon?

- The wetland lies in a depression adjacent to marine waters that is wholly or partially separated from marine waters by sandbanks, gravel banks, shingle, or, less frequently, rocks
- The lagoon in which the wetland is located contains ponded water that is saline or brackish (> 0.5 ppt) during most of the year in at least a portion of the lagoon *(needs to be measured near the bottom)*

☐Yes – Go to **SC 5.1** ☒No = **Not a wetland in a coastal lagoon**

SC 5.1. Does the wetland meet all of the following three conditions?

- The wetland is relatively undisturbed (has no diking, ditching, filling, cultivation, grazing), and has less than 20% cover of aggressive, opportunistic plant species (see list of species on p. 100).
- At least ¾ of the landward edge of the wetland has a 100 ft buffer of shrub, forest, or un-grazed or un-mowed grassland.
- The wetland is larger than $^{1}/_{10}$ ac (4350 ft^2)

☐Yes = **Category I** ☐No = **Category II**

SC 6.0. Interdunal Wetlands

Is the wetland west of the 1889 line (also called the Western Boundary of Upland Ownership or WBUO)? ***If you answer yes you will still need to rate the wetland based on its habitat functions.***

In practical terms that means the following geographic areas:

- Long Beach Peninsula: Lands west of SR 103
- Grayland-Westport: Lands west of SR 105
- Ocean Shores-Copalis: Lands west of SR 115 and SR 109

☐Yes – Go to **SC 6.1** ☒No = **not an interdunal wetland for rating**

SC 6.1. Is the wetland 1 ac or larger and scores an 8 or 9 for the habitat functions on the form (rates H,H,H or H,H,M for the three aspects of function)? ☐Yes = **Category I** ☐No – Go to **SC 6.2**

SC 6.2. Is the wetland 1 ac or larger, or is it in a mosaic of wetlands that is 1 ac or larger?

☐Yes = **Category II** ☐No – Go to **SC 6.3**

SC 6.3. Is the unit between 0.1 and 1 ac, or is it in a mosaic of wetlands that is between 0.1 and 1 ac?

☐Yes = **Category III** ☐No = **Category IV**

Category of wetland based on Special Characteristics

If you answered No for all types, enter "Not Applicable" on Summary Form

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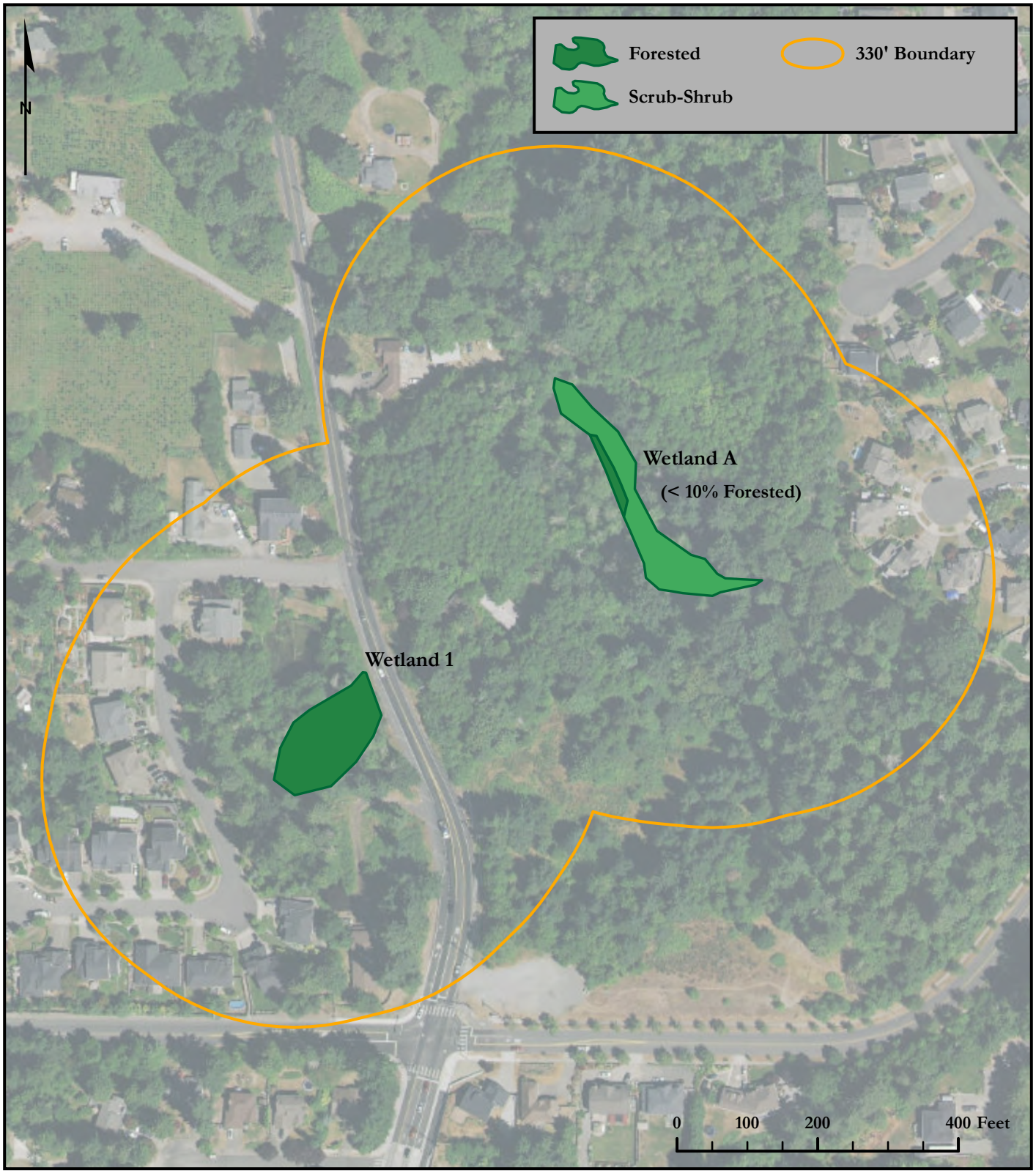
Appendix G — Wetland Rating Maps

COWARDIN MAP



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www.soundviewconsultants.com

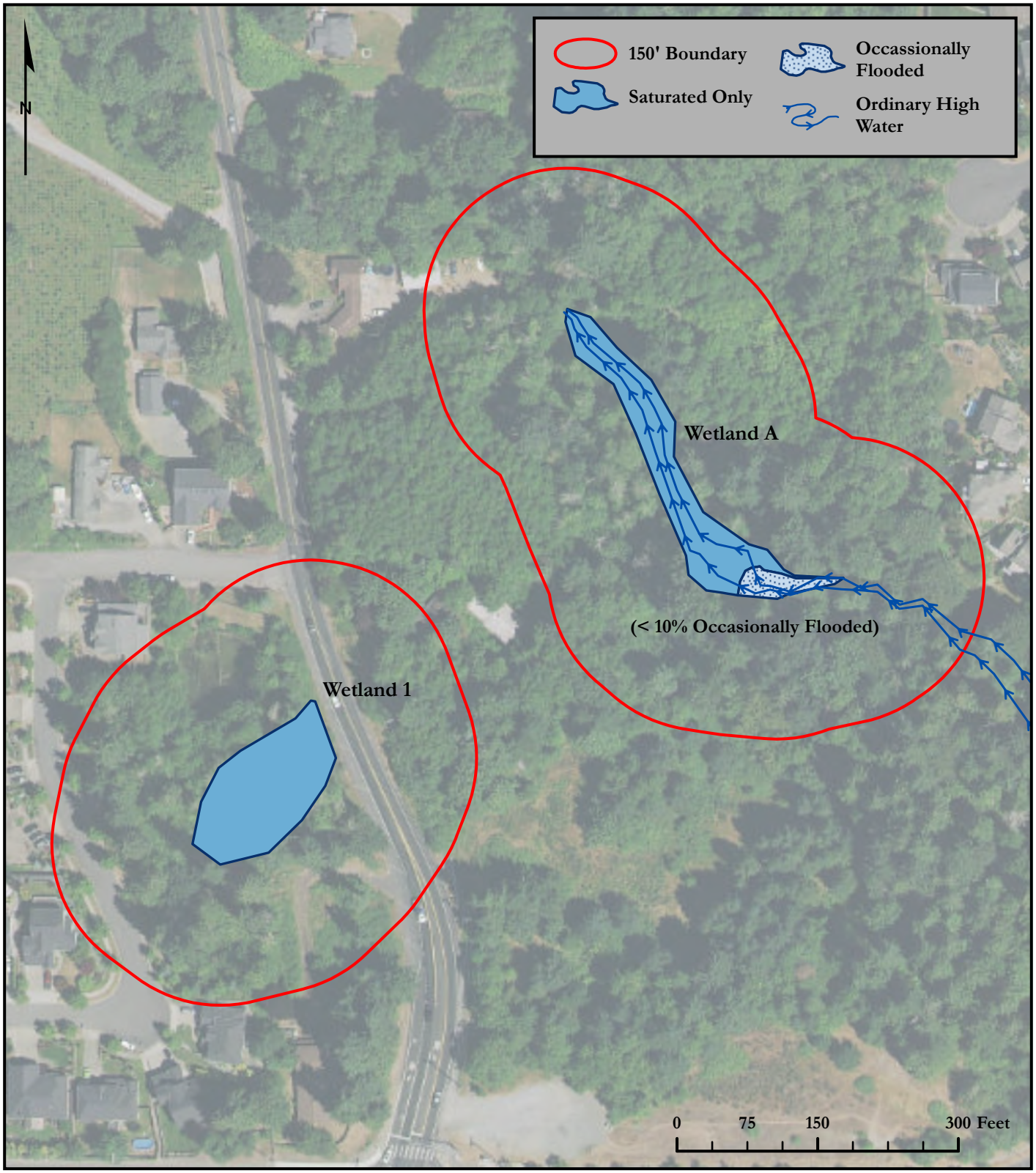
DEER CREEK

2007 SHAW RD
PUYALLUP, WA 98372

PIERCE COUNTY PARCEL NUMBER:
0420354039

DATE:	3/6/2025
JOB:	1273.0009
BY:	DDS
SCALE:	1"=200'
FIGURE NO.	1 of 6

HYDROPERIOD MAP



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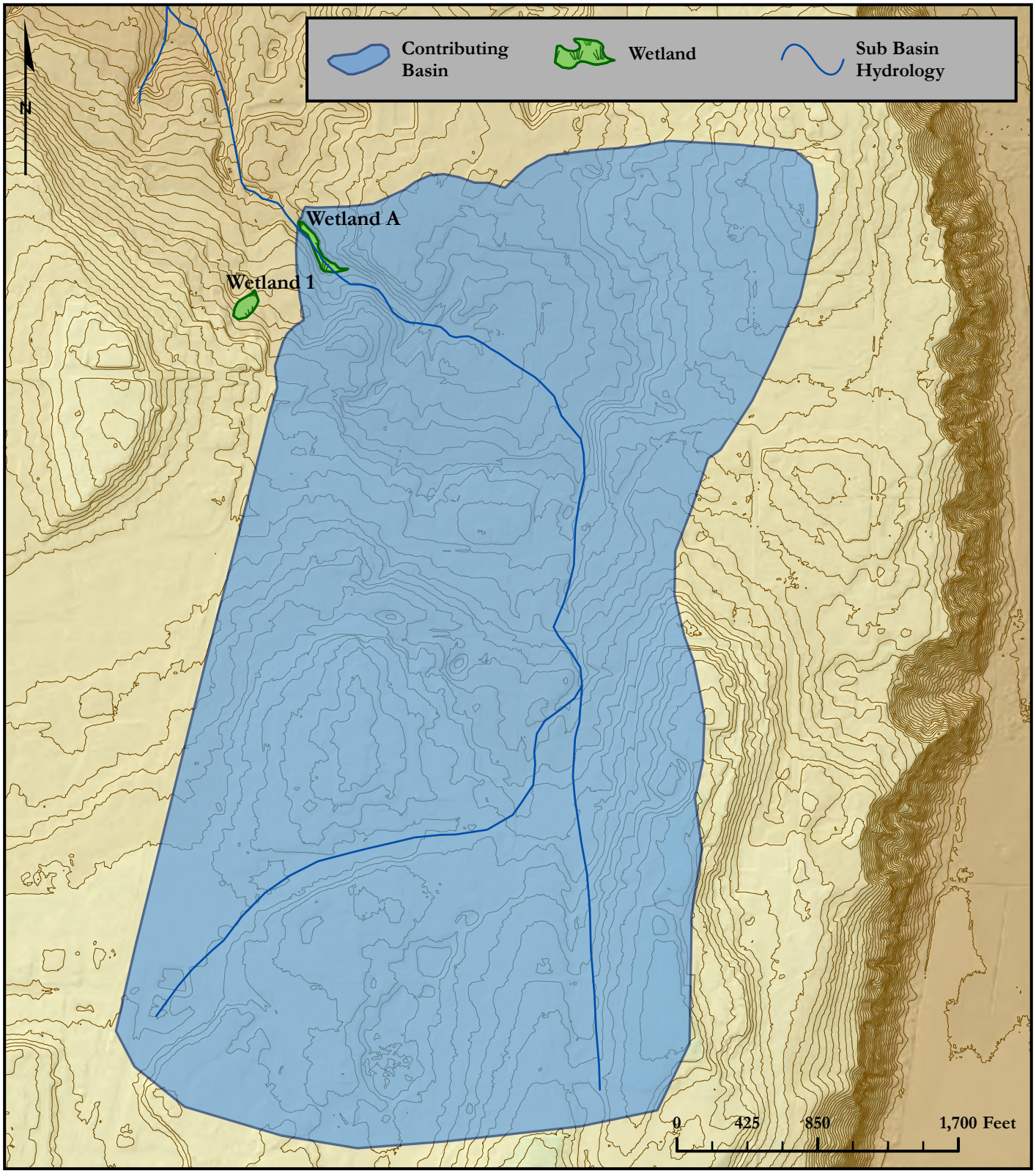
2007 SHAW RD
PUYALLUP, WA 98372

PIERCE COUNTY PARCEL NUMBER:
0420354039

DATE:	3/6/2025
JOB:	1273.0009
BY:	DDS
SCALE:	1"=150'
FIGURE NO.	2 of 6

CONTRIBUTING BASIN MAP



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2007 SHAW RD
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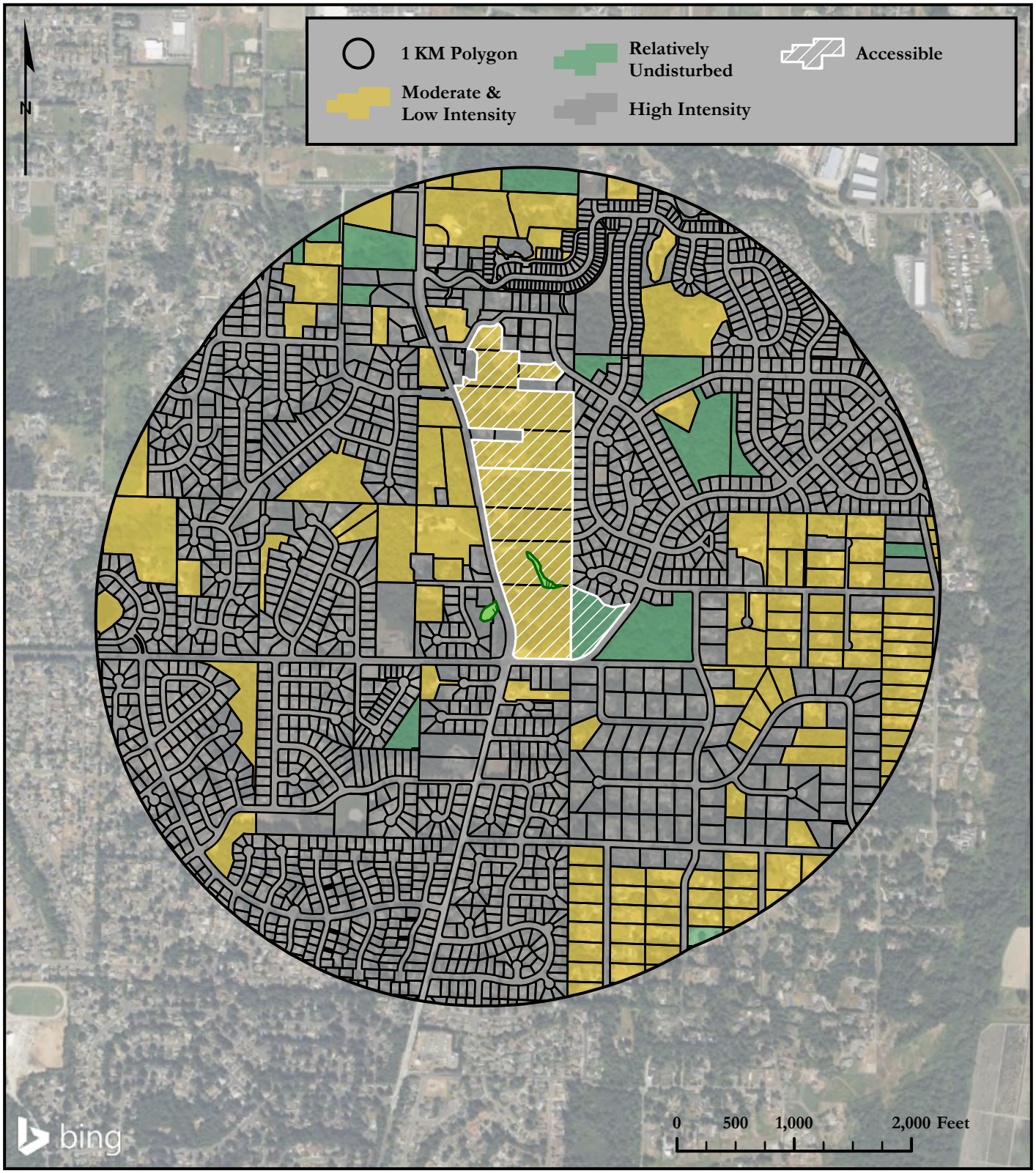
PIERCE COUNTY PARCEL NUMBER:
0420354039

DATE:	3/6/2025
JOB:	1273.0009
BY:	DDS
SCALE:	1"=850'
FIGURE NO.	3 of 6

HABITAT MAP



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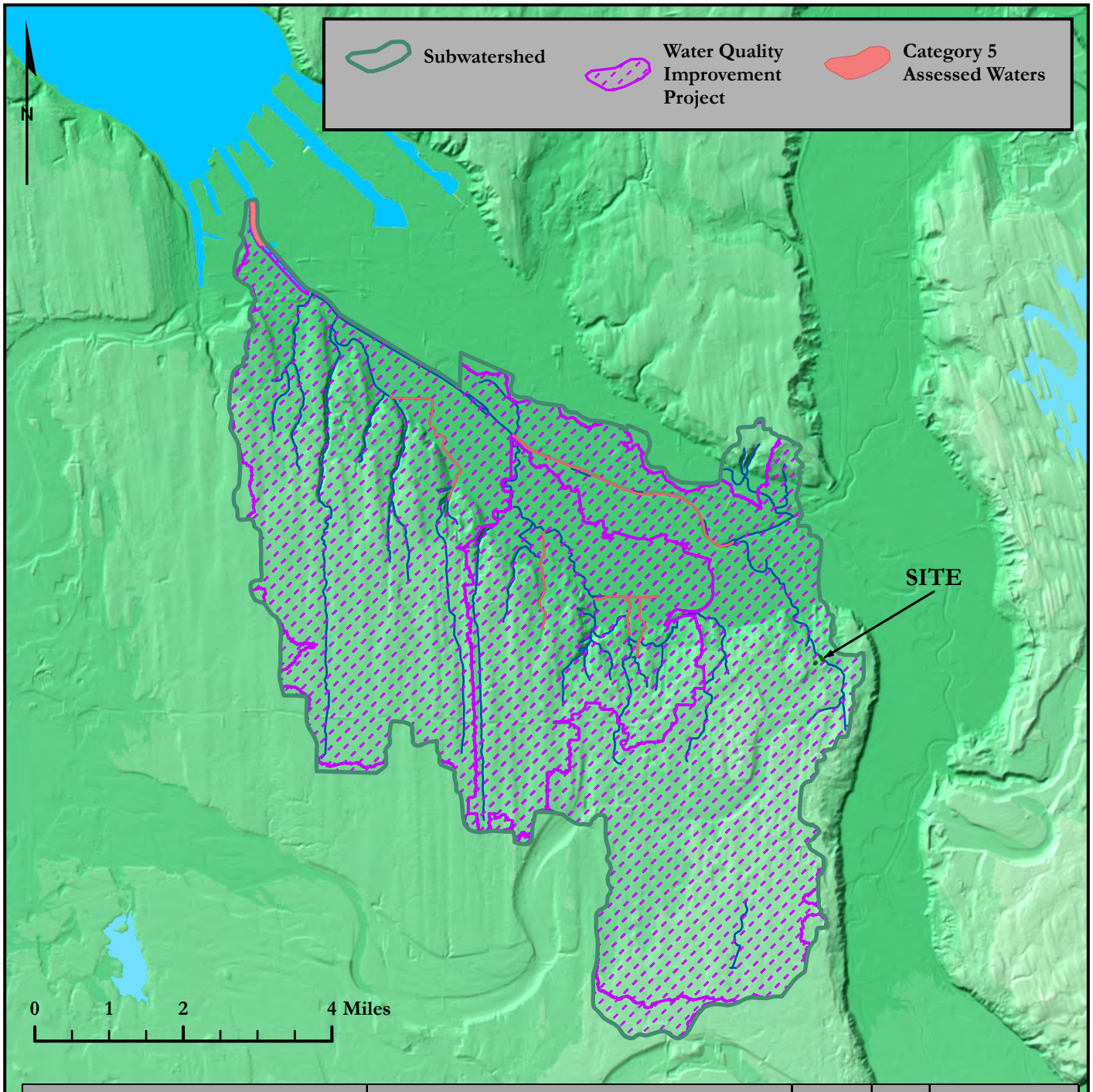
2007 SHAW RD
PUYALLUP, WA 98372

PIERCE COUNTY PARCEL NUMBER:
0420354039

DATE:	3/6/2025
JOB:	1273.0009
BY:	DDS
SCALE:	1"=1,200'
FIGURE NO.	4 of 6

303(D) MAP



Name	Pollutants	TMDL ID	WRIA	Year Approved
Puyallup River Bacteria TMDL	Bacteria	109	10	2011
Puyallup River Multiparameter TMDL	BOD5, Ammonia-N, Chlorine, Dissolved Oxygen	19	10	1994
Clarks Creek Watershed Bacteria TMDL	Bacteria	88	10	2008
Clarks Creek Watershed DO TMDL	Dissolved Oxygen	136	10	In Development

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DEER CREEK

2007 SHAW RD
PUYALLUP, WA 98372

PIERCE COUNTY PARCEL NUMBER:
0420354039

DATE: 3/6/2025
JOB: 1273.0009
BY: DDS
SCALE: 1"=2 Miles
FIGURE NO. 5 of 6

CONTRIBUTING BASIN & HABITAT DATA MAP

D.4		
D.4.3		
	Area of Contributing Basin (SF)	17,784,895
	Area of Wetland A (SF)	16,328
	Percent of Wetland A within Contributing Basin	**0.092%**
D.5.0		
D.5.3		
	Is more than 25% of the Contributing Basin covered in Intensive Land Use?	**YES**

H.2.0 Wetland A		
H.2.1		
	Abutting Undisturbed Habitat	0.42%
	Abutting Moderate & Low Intensity Land Uses	4.55%
	Accessible Habitat	**2.69%**
H.2.0 Wetland 1		
H.2.1		
	Abutting Undisturbed Habitat	0.00%
	Abutting Moderate & Low Intensity Land Uses	0.00%
	Accessible Habitat	**0.00%**
H.2.2		
	Undisturbed Habitat	4.24%
	Moderate & Low Intensity Land Uses	25.15%
	Undisturbed Habitat in 1 KM Polygon	**16.82%**
H.2.3		
	High Intensity Land Use in 1 KM Polygon	**70.61%**

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DEER CREEK

2007 SHAW RD
PUYALLUP, WA 98372

PIERCE COUNTY PARCEL NUMBER:
0420354039

DATE: 3/6/2025
JOB: 1273.0009
BY: DDS
SCALE: NONE
FIGURE NO. 6 of 6

Appendix H — Qualifications

All field inspections, habitat assessments, wetland and OHW delineations, and supporting documentation, including this ***Wetland and Fish and Wildlife Habitat Assessment Report*** prepared for the ***Deer Creek*** property were prepared by, or under the direction of Jon Pickett of SVC. In addition, the field investigations were performed primarily by Ryan Krapp, Kyla Caddey and Mae Ancheta, report preparation was completed by Mae Ancheta, and additional project oversight and final quality assurance/quality control was completed by Kyla Caddey.

Jon Pickett

Principal
Professional Experience: 10+ years

Jon Pickett is an Associate Principal and Senior Scientist with a diverse background in environmental and shoreline compliance and permitting, wetland and stream ecology, fish and wildlife biology, mitigation compliance and design, and environmental planning and land use due diligence. Jon oversees a wide range of large-scale industrial, commercial, and multi-family residential projects throughout Western Washington, providing environmental permitting and regulatory compliance assistance for land use entitlement projects from feasibility through mitigation compliance. Jon performs wetland, stream, and shoreline delineations and fish & wildlife habitat assessments; conducts code and regulation analysis and review; prepares reports and permit applications and documents; provides environmental compliance recommendation; and provides restoration and mitigation design.

Jon earned a Bachelor of Science degree in Natural Resource Sciences from Washington State University and Bachelor of Science and Minor in Forestry from Washington State University. Jon has received 40-hour wetland delineation training (Western Mountains, Valleys, & Coast and Arid West Regional Supplements) and regularly performs wetland, stream, and shoreline delineations. Jon is a Whatcom County Qualified Wetland Specialist and Wildlife Biologist and is a Pierce County Qualified Wetland Specialist. He has been formally trained by WSDOE in the use of the Washington State Wetland Rating System 2014, How to Determine the Ordinary High-Water Mark (Freshwater and Marine), Using Field Indicators for Hydric Soils, and the Using the Credit-Debit Method for Estimating Mitigation Needs.

Ryan Krapp

Environmental Scientist / Field Lead
Professional Experience: 10+ years

Ryan Krapp is an Environmental Scientist and Field Lead with a background in conducting wetland delineations, habitat assessments, botanical surveys, avian surveys, threatened & endangered species surveys, and fisheries studies. He has considerable experience in production of Environmental Assessments and Biological Assessments and Evaluations under NEPA guidelines for projects regulated by the U.S. Forest Service, U.S. Army Corps of Engineers, and Bureau of Indian Affairs as well as leading Section 7 ESA consultation with the U.S. Fish and Wildlife Service. Project planning, permitting, and compliance are all part of his professional experiences and practices at SVC.

Ryan has managed environmental investigation projects including wetlands, streams, and critical habitats data collection on large pipeline corridors, overhead electrical transmission corridors, and oil/natural gas drilling development. He has extensive experience in utilizing GIS to collect, manage, and analyze large volumes of spatial and temporal field data to aide in project management,

monitoring, analysis, and mapping. In addition, he is a FAA trained recreational pilot and a PADI certified SCUBA diver with fresh and saltwater diving experience. Ryan is a USFWS-approved Mazama pocket gopher survey biologist.

Kyla Caddey, PWS, Certified Ecologist

Senior Environmental Scientist
Professional Experience: 7 years

Kyla Caddey is a Senior Environmental Scientist with a diverse background in stream and wetland ecology, wildlife ecology and conservation, wildlife and natural resource assessments and monitoring, and riparian habitat restoration at various public and private entities. Kyla has field experience performing in-depth studies in both the Pacific Northwest and Central American ecosystems which included various environmental science research and statistical analysis. Kyla has advanced expertise in federal- and state-listed endangered, threatened, and sensitive species surveys and assessment of aquatic and terrestrial systems throughout the Puget Sound region. She has completed hundreds of wetland delineations and has extensive knowledge and interest in hydric soil identification. As the senior writer, she provides informed project oversight and performs final quality assurance / quality control on various types of scientific reports for agency submittal, including: Biological Assessments/Evaluations; Wetland, Shoreline, and Fish and Wildlife Habitat Assessments; Mitigation Plans, and Mitigation Monitoring Reports. She currently performs wetland, stream, and shoreline delineations and fish and wildlife habitat assessments; prepares scientific reports; and provides environmental permitting and regulatory compliance assistance to support a wide range of commercial, industrial, and multi-family residential land use projects.

Kyla earned a Bachelor of Science degree in Environmental Science and Resource Management from the University of Washington, Seattle with a focus in Wildlife Conservation and a minor in Quantitative Science. She has also completed additional coursework in Comprehensive Bird Biology from Cornell University. Ms. Caddey is a Certified Professional Wetland Scientist (PWS #3479) through the Society of Wetland Scientists and Certified Ecologist through the Ecological Society of America. She has received 40-hour wetland delineation training (Western Mtns, Valleys, & Coast and Arid West Regional Supplement), is a Pierce County Qualified Wetland Specialist and Wildlife Biologist, and is a USFWS-approved Mazama pocket gopher survey biologist. Kyla has been formally trained through the Washington State Department of Ecology, Coastal Training Program, and the Washington Native Plant Society in winter twig and grass, sedge, and rush identification for Western WA; Using the Credit-Debit Method in Estimating Wetland Mitigation Needs; How to Determine the Ordinary High Water Mark; Using Field Indicators for Hydric Soils; How to Administer Development Permits in Washington Shorelines; Puget Sound Coastal Processes; and Forage Fish Survey Techniques. Additionally, she has received formal training in preparing WSDOT Biological Assessments.

Megan Mae Ancheta

Staff Scientist
Professional Experience: 2 years

Megan (Mae) Ancheta is a Staff Scientist with a background in wildlife and conservation biology in Washington state. Mae earned her Bachelor of Science degree in Environmental Science with a focus in Conservation Biology and Ecology and a certificate in Restoration Ecology from University of Washington, Tacoma. There she gained extensive, hands-on experience working in lab and field

settings, and studying socio-ecological restoration and wildlife conservation in old growth forests, historic Puget lowland prairies, and wetland and riparian areas. Mae has applied her studies working in the local government at the city and county level as well as within federal entities conducting wetland mitigation planning, stream habitat monitoring, habitat restoration for federally listed species, and thorough site analyses for natural resource management utilizing ArcGIS and model analyses.

Mae currently assists in wetland, stream, and shoreline delineations and fish and wildlife habitat assessments; conducts environmental code analysis; and prepares environmental assessment and mitigation reports, biological evaluations, and permit applications to support clients through the regulatory and planning process for various land use projects.

7.5 Normandy Retention Tree Assessment by Sound Urban Forestry, LLC May 16, 2022.

SUF

S O U N D U R B A N F O R E S T R Y, LLC

Appraisals ~ Site Planning ~ Urban Landscape Design and Management
Environmental Education ~ Environmental Restoration

5/16/2022

RM Homes
C/o: James Kerby
2913 5th Ave NE, Ste. 201
Puyallup, WA 98372

Re: Normandy Retention Tree Assessment

Mr. Kerby:

Upon your request and as a requirement of the City of Puyallup, I have conducted an assessment of the trees marked for retention within and adjacent to the site of the proposed Normandy residential project at 2007 Shaw Road. I visited the site on April 26, 2022. The following presents my findings and recommendations.

Retain Trees

A total of 31 trees were assessed as identified on the boundary and topographic survey provided by Cara Visintainer with Barghausen Consulting Engineers, Inc. Please reference the attached diagram for the numbered locations marked in green.

Table 1. Trees Identified for Retention

ID#	Species	DBH	Height	Live Canopy Ratio	Condition/ Risk Rating	Comments
1	Douglas Fir	36”	130’	25%	Good/Low	
2	Western Hemlock	12”	40’	20%	Fair/Low	
3	Western Hemlock	16”	45’	20%	Good/Low	
4	Western Red Cedar	38”	100’	25%	Good/Low	
5	Western Hemlock	24”	110’	25%	Good/Low	
6	Western Red Cedar	36”	105’	30%	Good/Low	
7	Western Red Cedar	34”	100’	30%	Good/Low	
8	Western Red Cedar	41”	110’	35%	Good/Low	
9	Western Red Cedar	34”	105’	37%	Good/Low	
10	Western Red Cedar	12”	30’	10%	Fair/Low	
11	Douglas Fir	22”	105’	20%	Good/Low	
12	Douglas Fir	37”	125’	25%	Good/Low	
13	Douglas Fir	24”	105’	15%	Fair/Low	
14	Cottonwood	55”	160’	30%	Fair/High	Dead & damaged limbs overhanging wetland edge. Risk will reduce to moderate if pruned.
15	Western Hemlock	30”	105’	25”	Fair/Low	
16	Douglas Fir	40”	155’	30%	Good/Low	
17	Red Alder	10”	50’	0	Dead/Moderate	
18	Western Hemlock	30”	110’	20%	Fair/Low	
19	Western Hemlock	21”	100’	25%	Good/Low	
20	Douglas Fir	29”	115’	20%	Good/Low	

ID#	Species	DBH	Height	Live Canopy Ratio	Condition/ Risk Rating	Comments
21	Western Hemlock	21”	80’	35%	Fair/Low	
22	Western Hemlock	16”	35’	40%	Fair/Low	
23	Cottonwood	45”	175’	30%	Good/Low	Remove ivy.
24	Cottonwood	45”	170’	30%	Fair/Low	
25	Purple Plum	24”	27’	40%	Poor/Moderate	Previously topped.
26	Red Alder	12”	40’	25%	Fair/Low	
27	Red Alder	10”	30’	20”	Fair/Low	
28	Japanese Umbrella Pine	10”	18’	20%	Fair/Low	
29	Red Alder	11”	30’	20%	Poor/Moderate	Previously topped for line clearance.
30	Red Alder	9”	25’	10%	Poor/Moderate	Previously topped for line clearance.
31	Giant Sequoia	55”	160’	50%	Good/Low	

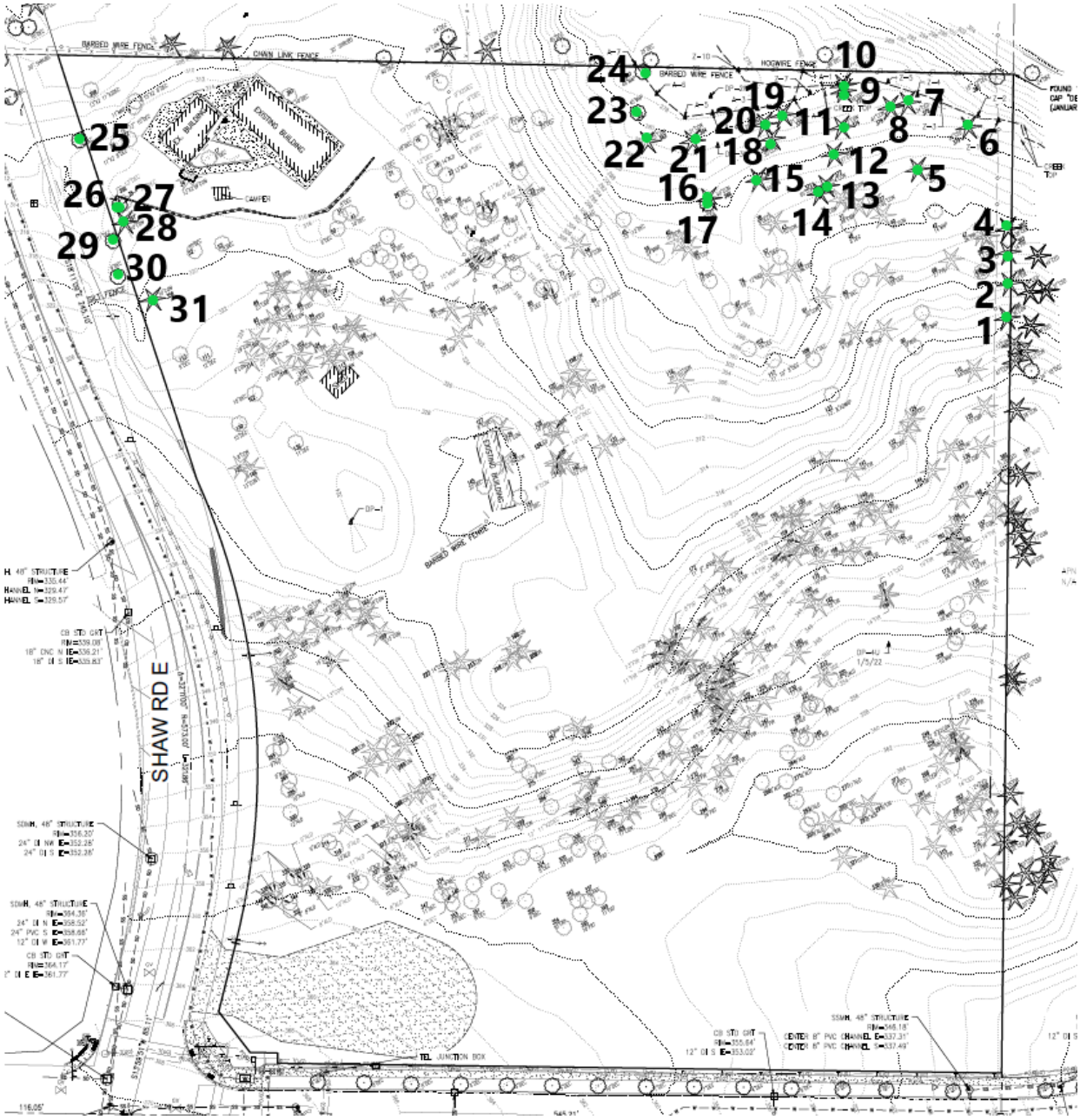
Adjacent Trees

There are many off-site trees along the eastern perimeter that may potentially be impacted by the project. Based on my assessments, I have concluded that these trees are windfirm and the removal of the nearby trees within the project site will not result in sudden exposure or associated instability.

Please contact me should you have any questions.
Professionally Submitted,

Kevin M. McFarland, Principal
Consulting Urban Forester
ISA Certified Arborist PN-0373 & ISA Tree Risk Assessment Qualified
Sound Urban Forestry, LLC
P.O. Box 489
Tahuya, WA 98588
360-870-2511

Locations of Assessed Retain Trees



Tab 8.0

Tab 9.0

MAINTENANCE LOG SHEET

Location: _____

Checked by: _____ **Date Checked:** ___ /___ /_____

Address: _____

City: _____ **Zip:**_____ **Phone:** (_____) _____ - _____

Facility and Component Checked	Observations	Follow-up Actions Taken	Date Action Taken

Access Road/Easement			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
General	Erosion	Soils are bare or eroded.	Erosion repaired and soils have been protected (through seeding/matting/etc.).
	Road Surface	Condition of road surface may lead to erosion of the facility or limit access.	Road repaired, repaved, or resurfaced to restore access.
	Erosion of Ground Surface	Noticeable rills are seen in landscaped areas.	Eroded areas are filled, contoured, and seeded. Affected areas regraded as necessary. Steps have been taken to eliminate source of erosion (dispersing flows, energy dissipation, etc.).
	Trash & Debris / Litter	Litter accumulation exceeds 1 cubic foot per 1,000 square feet.	No trash or debris present.
	Poisonous Plants and Noxious weeds	Any poisonous plants or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations.	Eradication of Class A weeds as required by State law. Control of other listed weeds as directed by local policy. Apply requirements of adopted IMP plan for use of herbicides.
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vacuuming, or equipment movements). If trees are not interfering with access or maintenance, do not remove. If dead, diseased, or dying trees are identified. (Use a certified Arborist to determine health of tree or removal requirements.)	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard trees.
		Trees or shrubs that have been blown down or knocked over.	Tree and shrub debris has been removed and disposed of.
	Weeds (Nonpoisonous)	Weeds growing in more than 20% of the landscaped area (trees and shrubs only).	Weeds present in less than 5% of the landscaped area.
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM Plan.

Catch Basin

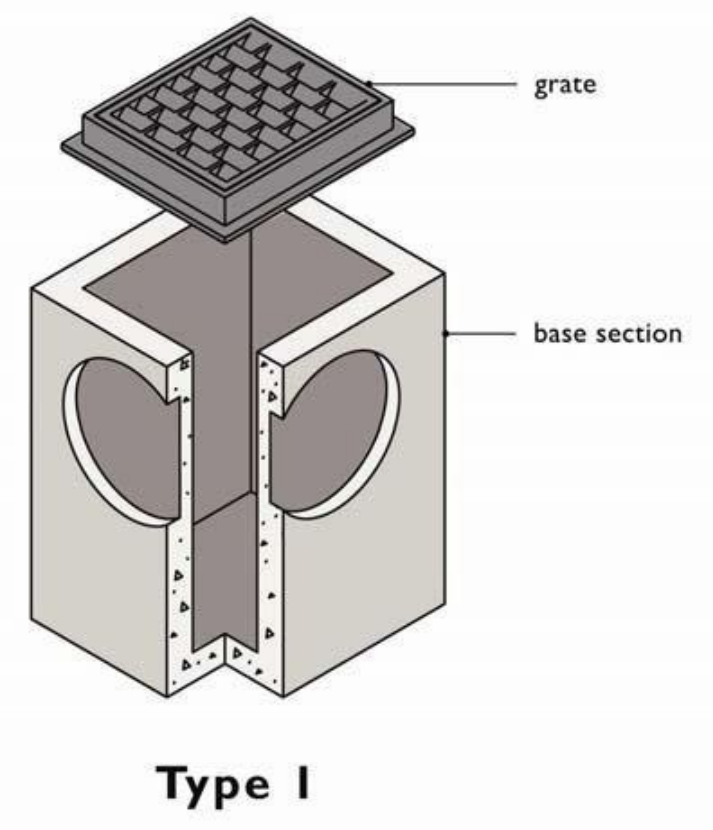
A catch basin is an underground concrete structure typically fitted with a slotted grate to collect stormwater runoff and route it through underground pipes. Catch basins can also be used as a junction in a pipe system and may have a solid lid. There are two types.

A Type 1 catch basin is a rectangular box with approximate dimensions of 3'x2'x5'. Type 1 catch basins are utilized when the connected conveyance pipes are less than 18 inches in diameter and the depth from the gate to the bottom of the pipe is less than 5 feet.

A Type 2 catch basin, also commonly referred to as a storm manhole, is listed separately under "Manhole" in this book.

Catch basins typically provide a storage volume (sump) below the outlet pipe to allow sediments and debris to settle out of the stormwater runoff. Some catch basins are also fitted with a spill control device (inverted elbow on outlet pipe) intended to contain large quantities of grease or debris.

Catch basins are frequently associated with all stormwater facilities.



Key Operations and Maintenance Considerations

- The most common tool for cleaning catch basins is an industrial vacuum truck with a tank and vacuum hose (e.g. Vactor® truck) to remove sediment and debris from the sump.
- A catch basin may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a catch basin, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

Catch Basin			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Trash and Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No trash or debris located immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin.
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin.)	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.

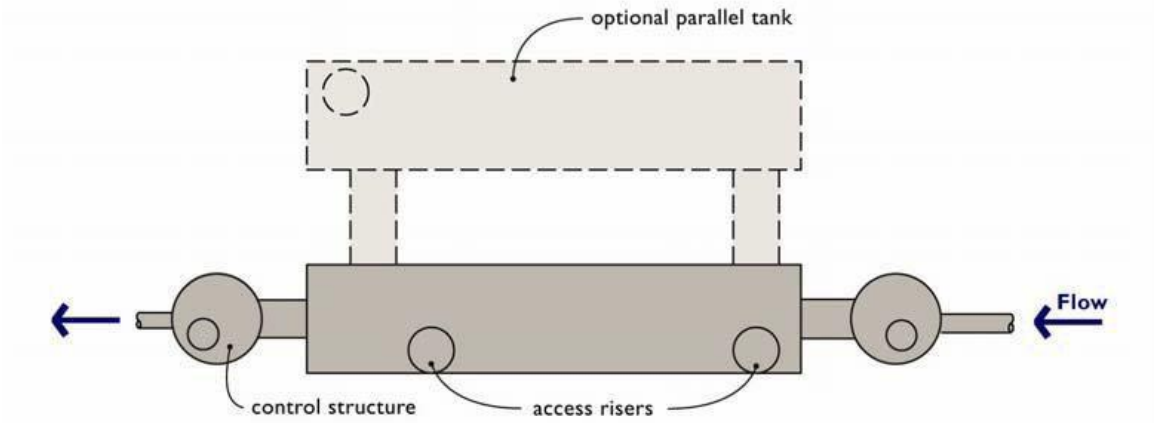
	Basin Walls/ Bottom	Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	Catch basin has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Vegetation Inhibiting System	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source	No contaminants or pollutants present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread. One or more bolts are missing.	Mechanism opens with proper tools. All bolts are seated and no bolts are missing. Cover is secure.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure (Intent is to keep cover from sealing off access to maintenance).	Cover can be removed by one maintenance person.
Metal Grates (If Applicable)	Grate Opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.
Oil/Debris Trap (If Applicable)	Dislodged	Oil or debris trap is misaligned with or dislodged from the outlet pipe.	Trap is connected to and aligned with outlet pipe.

Closed Detention System (Tank/Vault)

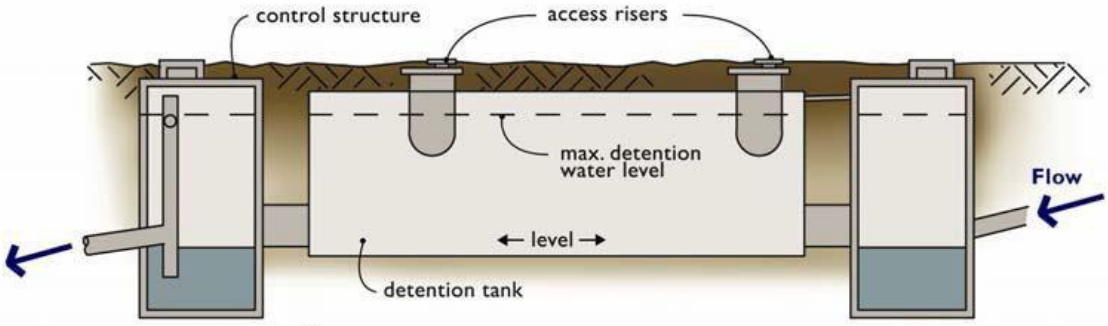
A closed detention system functions similarly to a detention pond with the temporary storage volume provided by an underground structure to regulate the storm discharge rate from the site. The structure is typically constructed of large diameter pipe (48 inch diameter or greater) or a concrete box (vault). These systems are typically utilized for sites that do not have space available for an above-ground system and are more commonly associated with commercial sites.

Facility objects that are typically associated with a closed detention system include:

- access road or easement
- control structure/flow restrictor
- conveyance stormwater pipe



BIRD'S-EYE VIEW



Note:
Closed detention systems will contain water during rainfall events, bus should be empty during dry periods.

SIDE PROFILE

Key Operations and Maintenance Considerations

- The most common tool for cleaning closed detention systems is a truck with a tank and vacuum hose (Vactor® truck) to remove sediment and debris from the vault/tank.
- A closed detention system is an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a closed detention system, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

Closed Detention System (Tanks/Vaults)			
Drainage System Feature	**Potential Defect**	**Conditions When Maintenance Is Needed**	**Minimum Performance Standard**
			Note: table spans multiple pages
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	Storage area free of sediment and debris.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability.)	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability.)	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound.	Vault replaced or repaired to design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.
	Vegetation Encroachment	Root encroachment of tree or shrub have impacted function or integrity of wetvault.	Roots are found in vault to be removed and repair vault.
Access Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.

Closed Detention System (Tanks/Vaults)			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design specifications. Allows maintenance person safe access.
Frame and Top Slab	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin.)	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.

Compost-Amended Soil

Naturally occurring (undisturbed) soil and vegetation provide important stormwater functions including: water infiltration; nutrient, sediment, and pollutant adsorption; sediment and pollutant biofiltration; water interflow storage and transmission; and pollutant decomposition.

Compaction from construction can reduce the soil's natural ability to provide these functions. Compost-amended soils are intended to replace these lost functions by establishing a minimum soil quality and depth in the post-development landscape.

Sufficient organic content is a key to soil quality. Soil organic matter can be attained through numerous amendments such as compost, composted woody material, biosolids, and forest product residuals. The full benefits of compost-amended soils are realized when desired soil media depths are maintained and soil compaction is minimized.

Key Operations and Maintenance Considerations

- Replenish soil media as needed (as a result of erosion) and address compacted, poorly draining soils.
- Site uses should protect vegetation and avoid soil compaction. Care should be taken to prevent compaction of soils via vehicular loads and/or excessive foot traffic, especially during wet conditions.
- The table below provides the recommended maintenance frequencies, standards, and procedures for compost-amended soils. The level of routine maintenance required and the frequency of corrective maintenance actions may increase for facilities prone to erosion due to site conditions such as steep slopes or topography tending to concentrate flows.

Compost-Amended Soil			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
Soil Media	Soils Waterlogged or Not Infiltrating	Soils become waterlogged, or otherwise do not appear to be infiltrating.	Soils have been aerated or amended such that infiltration occurs and soils to not remain completely saturated, per design specifications.
	Erosion/Scouring	Areas of potential erosion are visible, such as gullies or scouring.	Any eroded areas have been repaired, and sources of erosion addressed to prevent further soil erosion.
Vegetation	Vegetation in Poor Health	Less than 75% of planted vegetation is healthy with a generally good appearance.	At least 75% of planted vegetation is healthy with generally good appearance. Any conditions found that were deleterious to plant health have been corrected where possible. Routine maintenance schedule has been updated as necessary to ensure continued plant health and satisfactory appearance.
	Poisonous Plants and Noxious Weeds	Any poisonous plants or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations.	No danger of poisonous vegetation where maintenance personnel or the public might normally be. Eradication of Class A weeds as required by State law. Control of other listed weeds as directed by local policies. Apply requirements of adopted IPM policy for the use of herbicides.
	Other Weeds Present	Other weeds (not listed on City/State noxious weed lists) are present on site.	Weeds have been removed per the routine maintenance schedule, following IPM protocols.

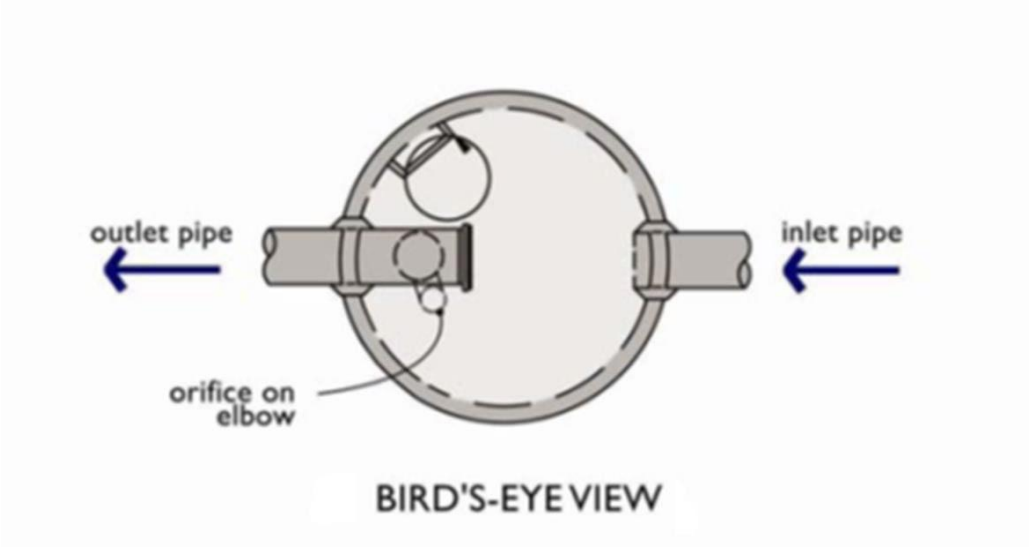
Control Structure/Flow Restrictor

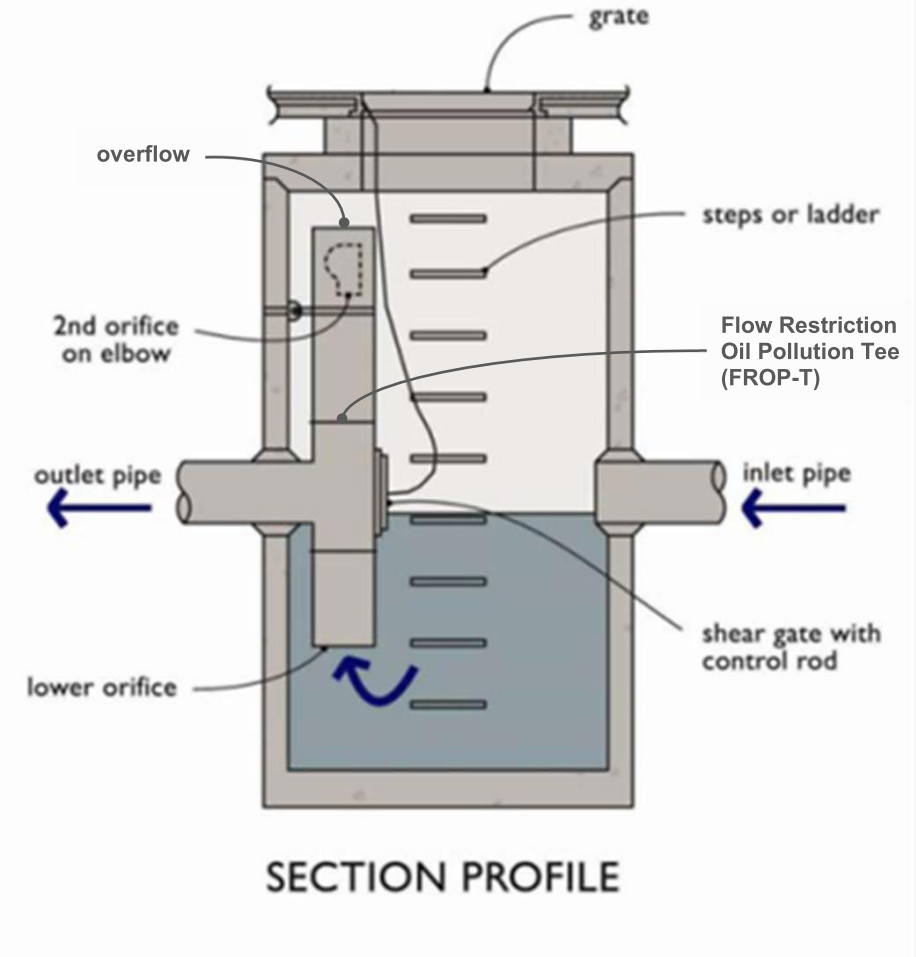
Flow control structures and flow restrictors direct or restrict flow in or out of facility components. Outflow controls on detention facilities are a common example where flow control structures slowly release stormwater at a specific rate. The flow is regulated by a combination of orifices (holes with specifically sized diameters) and weirs (plates with rectangular or "V" shaped notch). Lack of maintenance of the control structure can result in the plugging of an orifice. If these flow controls are damaged, plugged, bypassed, or not working properly, the facility could overtop or release water too quickly.

Control structures have a history of maintenance-related problems and it is imperative to establish a good maintenance program for them to function properly. Sediment typically builds up inside the structure, which blocks or restricts flow to the outlet. To prevent this problem, routinely clean out these structures and conduct regular inspections to detect the need for non-routine cleanout.

Facility objects that are typically associated with a control structure/flow restrictor include:

- detention ponds
- media cartridge filters
- closed detention system
- conveyance stormwater pipe





Key Operations and Maintenance Considerations

- Conduct regular inspections of control structures to detect the need for non-routine cleanout, especially if construction or land-disturbing activities occur in the contributing drainage area.
- The most common tool for cleaning control structures/flow restrictors is a truck with a tank and vacuum hose (Vactor® truck) to remove sediment and debris from the sump.
- A control structure is an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a control structure, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

Control Structure/Flow Restrictor			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
Structure	Trash and debris	Trash or debris of more than ½ cubic foot which is located immediately in front of the structure opening or is blocking capacity of the structure by more than 10%.	No Trash or debris blocking or potentially blocking entrance to structure.
		Trash or debris in the structure that exceeds 1/3 the depth from the bottom of basin to invert the lowest pipe into or out of the basin.	No trash or debris in the structure.
		Deposits of garbage exceeding 1 cubic foot in volume.	No condition present which would attract or support the breeding of insects or rodents.
	Sediment	Sediment exceeds 60% of the depth from the bottom of the structure to the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section or is within 6 inches of the invert of the lowest pipe into or out of the structure or the bottom of the FROP-T section.	Sump of structure contains no sediment.
	Damage to frame and/or top slab	Top slab has holes larger than 2 square inches or cracks wider than ¼ inch.	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than ¾ inch of the frame from the top slab.	Frame is sitting flush on top slab.
	Cracks in walls or bottom	Cracks wider than ½ inch and longer than 3 feet, any evidence of soil particles entering structure through cracks, or maintenance person judges that structure is unsound.	Structure is sealed and structurally sound.
		Cracks wider than ½ inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering structure through cracks.	No cracks more than 1/4 inch wide at the joint of inlet/outlet pipe.
	Settlement/ misalignment	Structure has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Basin replaced or repaired to design standards.
	Damaged pipe joints	Cracks wider than ½-inch at the joint of the inlet/outlet pipes or any evidence of soil entering the structure at the joint of the inlet/outlet pipes.	No cracks more than ¼-inch wide at the joint of inlet/outlet pipes.
	Contaminants and pollution	Any evidence of contaminants or pollution such as oil, gasoline, concrete slurries or paint.	Materials removed and disposed of according to applicable regulations. Source control BMPs implemented if appropriate. No contaminants present other than a surface oil film.
	Ladder rungs missing or unsafe	Ladder is unsafe due to missing rungs, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
FROP-T Section	Damage	T section is not securely attached to structure wall and outlet pipe structure should support at least 1,000 lbs of up or down pressure.	T section securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight or show signs of deteriorated grout.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes—other than designed holes—in the structure.	Structure has no holes other than designed holes.
Shear Gate	Damaged or missing	Shear gate is missing.	Replace shear gate.
		Shear gate is not watertight.	Gate is watertight and works as designed.

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

Conveyance Pipe

Storm sewer pipes convey stormwater. Inlet and outlet stormwater pipes convey stormwater in, through, and out of stormwater facilities.

Pipes are built from many materials. Pipes are cleaned to remove sediment or blockages when problems are identified. Stormwater pipes must be clear of obstructions and breaks to prevent localized flooding. All stormwater pipes should be in proper working order and free of the possible defects listed below.

Key Operations and Maintenance Considerations

- The most common tool for cleaning stormwater conveyance pipes is a truck with a tank, vacuum hose, and a jet hose (Vactor® truck) to flush sediment and debris from the pipes.

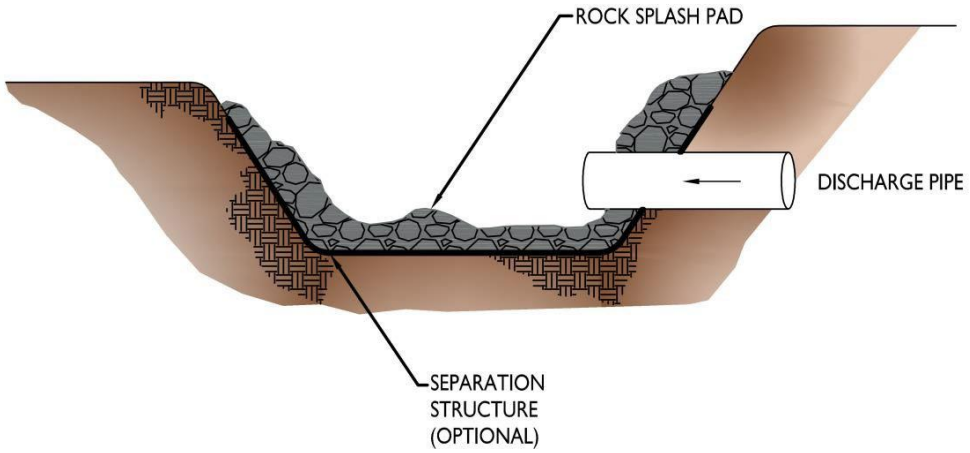
Conveyance Pipe			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
General	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source.	No contaminants or pollutants present.
	Obstructions, Including Roots	Root enters or deforms pipe, reducing flow.	Roots have been removed from pipe (using mechanical methods; do not put root-dissolving chemicals in storm sewer pipes). If necessary, vegetation over the line removed.
	Sediment and Debris	Sediment depth is greater than 20% of pipe diameter.	Pipe has been cleaned and is free of sediment/ debris. (Upstream debris traps installed where applicable.)
	Debris Barrier or Trash Rack Missing	Stormwater pipes > than 18 inches need debris barrier.	Debris barrier present on all stormwater pipes 18 inches and greater.
	Damage to protective coating or corrosion	Protective coating is damaged; rust or corrosion is weakening the structural integrity of any part of pipe.	Pipe repaired or replaced.
	Damaged	Any dent that decreases the cross section area of pipe by more than 20% or is determined to have weakened structural integrity of the pipe.	Pipe repaired or replaced.

Energy Dissipater / Outfall Protection

An energy dissipater is installed on or near the inlet or outlet to a closed pipe system to prevent erosion at these locations. There are a variety of designs, including wire gabion baskets, rock splash pads, trenches, and specially designed pools or manholes. The rock splash pad is typically constructed of 4- to 12-inch diameter rocks a minimum of 12 inches thick and is often lined with filter fabric. The rock pad should extend above the top of the pipe a minimum of 1 foot.

Facility features that are typically associated with energy dissipaters include:

- detention ponds
- infiltration basin
- wetponds
- treatment wetlands



Key Operations and Maintenance Considerations

- The most common tools for maintenance are hand tools such as rakes to redistribute rocks as necessary.
- Periodic removal of sediment or debris may be necessary.

Energy Dissipaters			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
External:			
Rock Pad	Missing or Moved Rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.	Rock pad has been replaced to design function.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad has been replaced to design function.
	Sediment	Sediment on top of rock pad exceeds 10% of the surface.	Rock pad has been cleared of sediment.
	Poisonous Plants and Noxious Weeds	Any poisonous plants or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations.	No danger of poisonous vegetation where maintenance personnel or the public might normally be. Eradication of Class A weeds as required by State law. Control of other listed weeds as directed by local policies. Apply requirements of adopted IPM policy for the use of herbicides.
	Other Weeds	Other weeds (not listed on State noxious weed lists) are present on the rock pad.	Weeds have been removed per the routine maintenance schedule, following IPM protocols.
Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe is free of sediment and meets design specifications.
	Not Discharging Water Properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a “sheet flow” of water along trench). Intent is to prevent erosion damage.	Trench has been repaired or modified such that it does not discharge at concentrated points and meets design function.
	Perforations Plugged	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe has been cleaned or replaced and <25% of perforations are plugged.
	Water Flows Out Top of “Distributor” Catch Basin	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage.	Facility rebuilt per design specifications or redesigned to meet approved City standards.
	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
Gabions	Damaged Mesh	Mesh of gabion broken, twisted or deformed so structure is weakened or rock may fall out.	Mesh is intact, no rock missing.
	Corrosion	Gabion mesh shows corrosion through more than 1/4 of its gage.	All gabion mesh capable of containing rock and retaining designed form.

Energy Dissipaters			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
	Collapsed or Deformed Baskets	Gabion basket shape deformed due to any cause.	All gabion baskets intact, structure stands as designed.
	Missing Rock	Any rock missing that could cause gabion to lose structural integrity.	No rock missing.
Internal:			
Manhole/ Chamber	Worn or Damaged Post, Baffles, Side of Chamber	Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot which would make structure unsound.	Structure replaced to design standards.

Fencing/Gates/Bollards/Water Quality Sign

Stormwater facilities such as detention ponds or treatment wetlands often have fences to protect them from damage and keep children away from ponds or hazardous areas. Some facilities are required to have informational signs telling the public that the site is a stormwater facility.

Fencing/Gates/Bollards/Water Quality Sign			
Drainage System Feature	**Potential Defect**	**Conditions When Maintenance Is Needed**	**Minimum Performance Standard**
Fencing (Site)	Site erosion or holes under fence	Erosion or holes more than 4 inches high and 12-18 inches wide permitting access through an opening under a fence.	No access under the fence.
Fencing (Wood Posts, Boards, and Cross Members)	Missing or damaged parts	Missing or broken boards, post out of plumb by more than 6 inches or cross members broken	No gaps on fence due to missing or broken boards, post plumb to within 1½ inches, cross members sound.
	Weakened by rotting or insects	Any part showing structural deterioration due to rotting or insect damage	All parts of fence are structurally sound.
	Damaged or failed post foundation	Concrete or metal attachments deteriorated or unable to support posts.	Post foundation capable of supporting posts even in strong wind.
Fencing (Metal Posts, Rails, and Fabric)	Damaged parts	Post out of plumb more than 6 inches.	Post plumb to within 1½ inches.
		Top rails bent more than 6 inches.	Top rail free of bends greater than 1 inch.
		Any part of fence (including post, top rails, and fabric) more than 1 foot out of design alignment.	Fence is aligned and meets design standards.
		Missing or loose tension wire.	Tension wire in place and holding fabric.
	Deteriorated paint or protective coating	Part or parts that have a rusting or scaling condition that has affected structural adequacy.	Structurally adequate posts or parts with a uniform protective coating.
	Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	Fabric mesh openings within 50% of grid size.
Chain Link Fencing Gate	Damaged or missing members	Missing gate.	Gates in place.
		Broken or missing hinges such that gate cannot be easily opened and closed by a maintenance person.	Hinges intact and lubed. Gate is working freely.
		Gate is out of plumb more than 6 inches and more than 1 foot out of design alignment.	Gate is aligned and vertical.
		Missing stretcher bar, stretcher bands, and ties.	Stretcher bar, bands, and ties in place.
	Locking mechanism does not lock gate	Locking device missing, non-functioning or does not link to all parts.	Locking mechanism prevents opening of gate.
	Openings in fabric	Openings in fabric are such that an 8-inch diameter ball could fit through.	Fabric mesh openings within 50% of grid size.

Fencing/Gates/Bollards/Water Quality Sign			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
Bollards	Damaged or missing	Bollard broken, missing, does not fit into support hole or hinge broken or missing.	No access for motorized vehicles to get into facility.
	Does not lock	Locking assembly or lock missing or cannot be attached to lock bollard in place.	No access for motorized vehicles to get into facility.
Water Quality Sign	Sign is Damaged or Missing	Water quality sign is leaning more than 8 inches off vertical.	Sign reset to plumb.
		Water quality sign is missing or 20% of the surface is unreadable.	Sign replaced.

Grounds

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

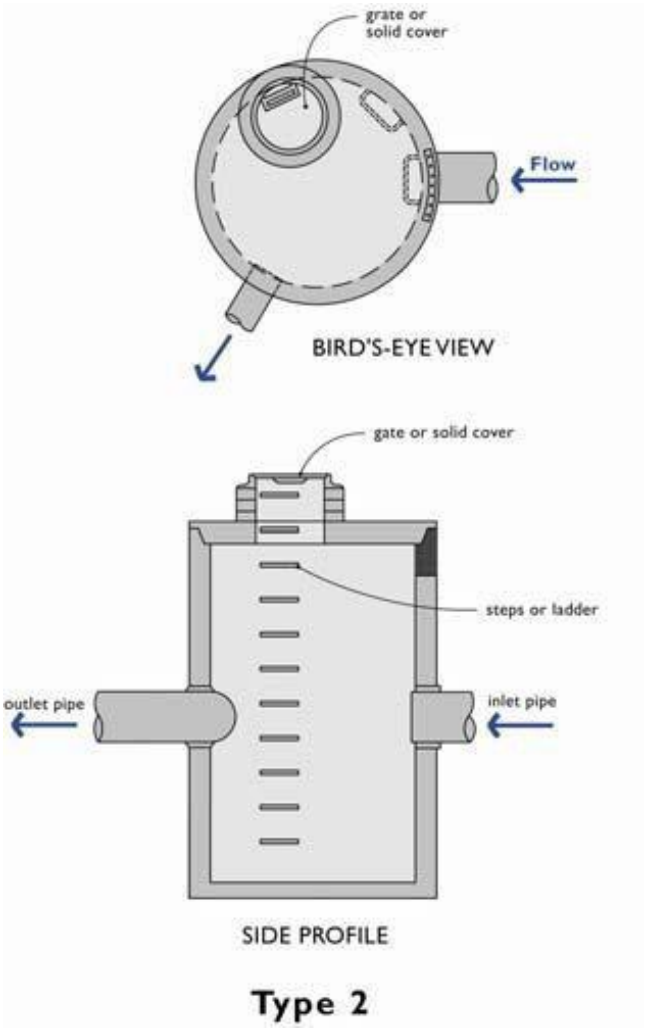
Manhole

A manhole is an underground concrete structure typically fitted with a slotted grate to collect stormwater runoff and route it through underground pipes. Manholes can also be used as a junction in a pipe system and may have a solid lid. A manhole is also known as a Type 2 catch basin.

Manholes are round concrete structures ranging in diameter from 4 feet to 8 feet. They are used when the connecting conveyance pipe is 18 inches or greater or the depth from grate to pipe bottom exceeds 5 feet. Manholes typically have steps mounted on the side of the structure to allow access.

Manholes typically provide a storage volume (sump) below the outlet pipe to allow sediments and debris to settle out of the stormwater runoff. Some manholes are also fitted with a spill control device (inverted elbow on outlet pipe) intended to contain large quantities of grease or oils.

Manholes are often associated with other stormwater facilities.



Key Operations and Maintenance Considerations

- The most common tool for cleaning manholes is a truck with a tank and vacuum hose (Vactor® truck) to remove sediment and debris from the sump.
- A manhole may be an enclosed space where harmful chemicals and vapors can accumulate. Therefore, if the inspection and maintenance requires entering a manhole, it should be conducted by an individual trained and certified to work in hazardous confined spaces.

Manhole			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Trash and Debris	Trash or debris which is located immediately in front of the opening or is blocking inletting capacity of the basin by more than 10%.	No trash or debris located immediately in front of manhole or on grate opening.
		Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the basin.
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into manhole.)	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering manhole through cracks.	Pipe is regrouted and secure at basin wall.

	Settlement/ Misalignment	Manhole has settled more than 1 inch or has rotated more than 2 inches out of alignment.	Manhole replaced or repaired to design standards.
	Vegetation Inhibiting System	Vegetation growing across and blocking more than 10% of the opening.	No vegetation blocking opening to manhole.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source.	No contaminants or pollutants present.
Manhole Cover	Cover Not in Place	Cover is missing or only partially in place. Any open manhole is a safety hazard and requires immediate maintenance.	Manhole cover is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread. One or more bolts are missing.	Mechanism opens with proper tools. All bolts are seated and no bolts are missing. Cover is secure.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure (Intent is to keep cover from sealing off access to maintenance).	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to manhole wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate Opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Media Cartridge Filters

Media cartridge filters are passive, flow-through, stormwater treatment systems. They are comprised of one or more vaults that house rechargeable, media-filled filter cartridges. Stormwater passes through a filtering medium, which traps particulates and/or adsorb pollutants such as dissolved metals and hydrocarbons. Once filtered through the media, the treated stormwater is directed to a collection pipe or discharged into an open channel drainage way.

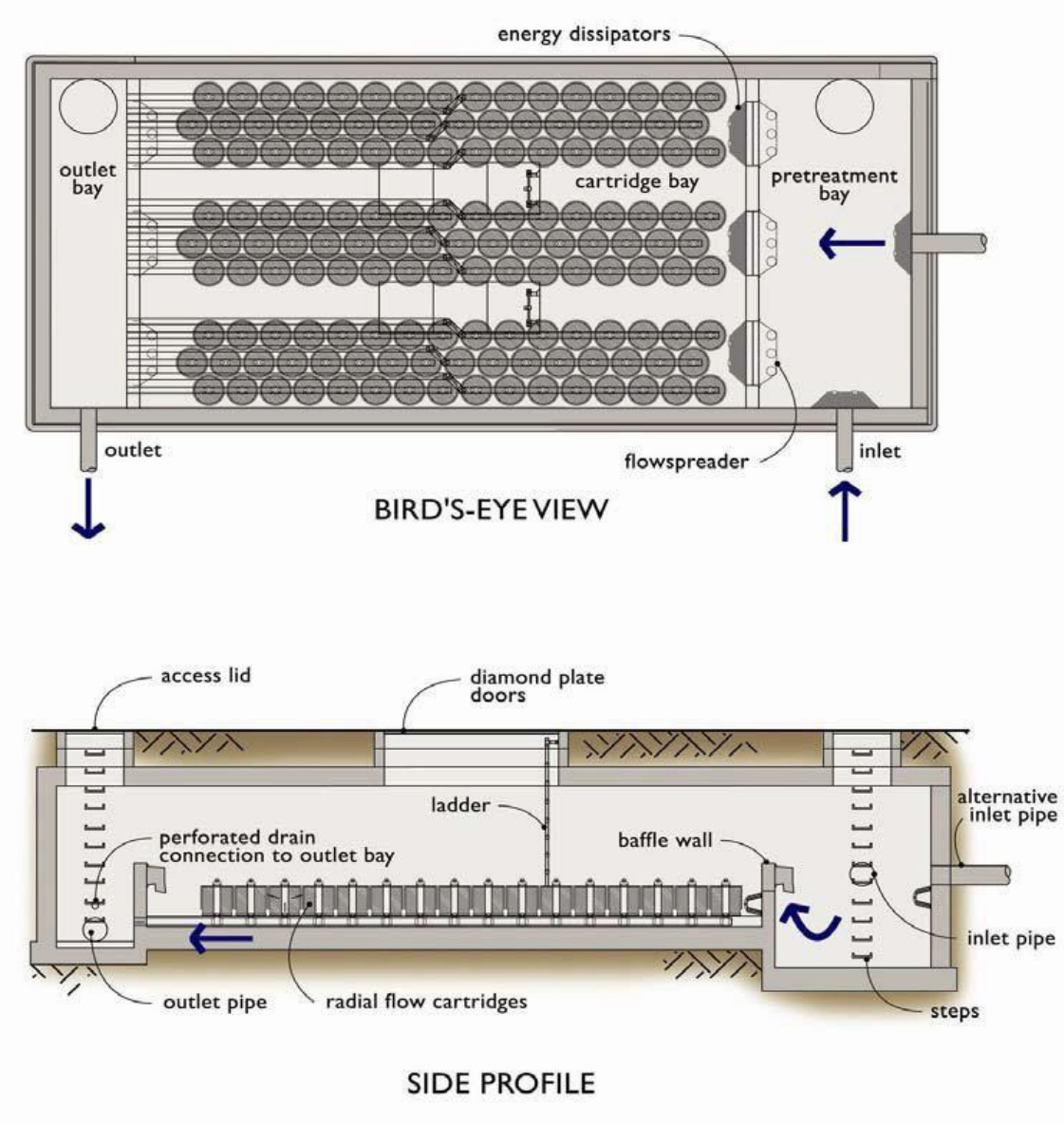
The filter media can be housed in cartridge filters enclosed in concrete vaults or catch basins. Structures will have vault doors or manhole lids (older designs) for maintenance access. Various types of filter media are available from system manufacturers.

StormFilter® units are an example of a proprietary manufactured media cartridge filter system. See manufacturer's publications for additional maintenance information.

Facility objects that are typically associated with a manufactured media filter system include:

- access road or easement
- control structure/flow restrictor
- conveyance stormwater pipe

Media Cartridge Filter Vault with Accumulated Sediment



Key Operations and Maintenance Considerations

- The most common tool for cleaning media cartridge filters is a truck with a tank and vacuum hose (e.g.Vactor® truck) to remove sediment and debris from the vault.
- Media cartridge filters are enclosed spaces where harmful chemicals and vapors can accumulate. Therefore, the inspection and maintenance of these facilities should be conducted by an individual trained and certified to work in hazardous confined spaces.
- Cartridges require replacement when the individual cartridges no longer meet the specifications for pollutant removal.

Media Cartridge Filters			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into vault.)	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached.	Frame is sitting flush on the riser rings or top slab and firmly attached.
Forebay	Sediment Accumulation	Sediment accumulation exceeds 6 inches or 1/3 of available sump.	All sediment removed from storage area.
Media Filter Vault	Sediment Accumulation on Top Media Filters (Cartridges)	Sediment depth exceeds 0.25-inches (on top of filter cartridges).	No sediment deposits which would impede permeability of the compost media. No sediment deposits on top of cartridges. (Sediment on cartridges likely indicates that cartridges are plugged and require maintenance.)
	Sediment Accumulation in Vault	Sediment depth exceeds 4 inches in chamber. Look for other indicators of clogged cartridges or overflow.	No sediment deposits in vault bottom of first chamber. Cartridges have been checked and replaced or serviced as needed.
	Trash and Debris Accumulation	Trash and debris accumulated in vault.	No trash or debris in vault.
	Sediment in Drain Pipes/Clean-Outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris has been removed.
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced to design specifications.
	Cover/lid not in place	Cover/lid is missing or only partially in place. Any open manhole requires immediate maintenance.	Manhole access covered.
	Locking mechanism not working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts cannot be seated. Self-locking cover/lid does not work.	Mechanism opens with proper tools.
	Cover/lid difficult to remove	One maintenance person cannot remove cover/lid after applying 80 lbs. of lift.	Cover/lid can be removed and reinstalled by one maintenance person.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.

	Frame and/or Top Slab	Cracks wider than 1/2 inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4 inch at the joint of the inlet/outlet pipe.
	Baffles Damaged	Baffles corroding, cracking, warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to design specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets design specifications, and is safe to use as determined by inspection personnel.
Below Ground Cartridge Type	Compost Media Clogging	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges have been replaced and drawdown time and overflow frequency are per design standards.
	Short Circuiting	Flows do not properly enter filter cartridges.	Flows are properly entering filter cartridges. Cartridges have been replaced if necessary.
	Filter Cartridges Submerged	Filter vault does not drain within 24 hours following storm. Look for evidence of submergence due to backwater or excessive hydrocarbon loading.	Filter media have been checked and replaced if needed and vault drains down within 24 of a storm event. (If cartridges are plugged with oil, additional treatment or source control BMP may be needed.)

Tab 10.0

CITY OF PUYALLUP
ENGINEERING SERVICES
ESTIMATE OF COST

ON-SITE

DATE: 2/3/26	**ESTIMATOR: Cara Visintainer, PE**
PERMIT NUMBER:	**EMAIL: cvisintainer@core-states.com**

STREET	UNIT	UNIT COST	PLAN QUANTITY	TOTAL
6" CURB & 18" GUTTER	LF	$19.00	1884	35,796.00
DRIVE APPROACH	SY	$55.00	159	8,745.00
SIDEWALK	SY	$35.00	873	30,555.00
WHEEL CHAIR RAMP	LS	$2,800.00		0.00
MONUMENT	EA	$650.00	6	3,900.00
STREET SIGN	EA	$280.00	12	3,360.00
WARNING SIGN	EA	$230.00		0.00
PERMANENT BARRICADE	EA	$850.00		0.00
STREET LIGHT	EA	$5,500.00	6	33,000.00
METER BASE AND PANEL FOR ST LT	EA	$13,200.00		0.00
ROADWAY EXCAVATION / HAUL	CY	$35.00		0.00
GRAVEL BASE	TON	$25.00	2056	51,400.00
TOP COURSE	TON	$30.00	411	12,330.00
CLASS B ASPHALT CONCRETE	TON	$95.00	910	86,450.00
RAISE M.H. / VALVE BOX TO GRAD	EA	$425.00	32	13,600.00
PERMEABLE BALLAST/RESERVOIR	TON	$40.00		0.00
PERMEABLE SIDEWALK	SY	$45.00		0.00
PERMEABLE ASPHALT	TON	$200.00		0.00
CHANNELIZATION	LS	$12,000.00	1	12,000.00
TRAFFIC SIGNAL	LS			0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00

STORM DRAINAGE

ROUGH GRADING	CY	$3.00	64459	193,377.00
EROSION CONTROL	SF	$0.50	20000	10,000.00
48" STORM SEWER MANHOLE	EA	$3,605.00		0.00
54" STORM SEWER MANHOLE	EA	$4,265.00		0.00
60" STORM SEWER MANHOLE	EA	$5,075.00		0.00
72" STORM SEWER MANHOLE	EA	$7,615.00		0.00
84" STORM SEWER MANHOLE	EA	$10,150.00		0.00
96" STORM SEWER MANHOLE	EA	$14,720.00		0.00
FLOW CONTROL MANHOLE	EA	$4,900.00	1	4,900.00
CATCH BASIN TYPE I	EA	$1,800.00	14	25,200.00
CATCH BASIN TYPE II	EA	$3,550.00	5	17,750.00
6" D.I.P.	LF	$75.00	745	55,875.00
8" D.I.P.	LF	$85.00		0.00
12" D.I.P.	LF	$90.00	138	12,420.00
8" PVC	LF	$50.00	741	37,050.00
12" PVC	LF	$65.00	752	48,880.00
18" PVC	LF	$85.00	48	4,080.00
21" PVC	LF	$100.00		0.00
24" PVC	LF	$125.00		0.00
30" PVC	LF	$150.00		0.00
36" RCP	LF	$275.00		0.00
42" RCP	LF	$350.00		0.00

48" RCP	LF	$440.00		0.00
4" OR 6" PERFORATED UNDERDRAIN	LF	$35.00		0.00
CLEANOUTS	EA	$425.00	32	13,600.00
DISPERSION TRENCH	LF	$110.00	50	5,500.00
BIOSWALE / DETENTION POND	CF	$2.00		0.00
COMPOST / COALESCE FILTER	LF	$7.70		0.00
CATCH BASIN FILTER	EA	$9,500.00		0.00
MODULAR WETLAND	EA	$15,000.00		0.00
DENTENTION VAULT	LS	$600,000.00	1	600,000.00
CONTECH STORMFILTER	LS	$20,000.00	1	20,000.00

WATER	UNIT	UNIT COST	PLAN QUANTITY	TOTAL
3/4" WATER SERVICE / METER	EA	$850.00	25	21,250.00
1" WATER SERVICE / METER	EA	$1,000.00		0.00
1 1/2" WATER SERVICE / METER	EA	$1,430.00		0.00
2" WATER SERVICE / METER	EA	$2,000.00		0.00
FIRE HYDRANT ASSEMBLY	EA	$3,400.00	2	6,800.00
2' BLOW OFF ASSEMBLY	EA	$2,080.00		0.00
6" GATE VALVE	EA	$750.00	2	1,500.00
8" GATE VALVE	EA	$820.00	4	3,280.00
10" BUTTERFLY VALVE	EA	$1,300.00		0.00
12" BUTTERFLY VALVE	EA	$1,500.00		0.00
AIR RELIEF VALVE	EA	$2,400.00		0.00
6" D.I.P.	LF	$75.00		0.00
8" D.I.P.	LF	$85.00	882	74,970.00
10" D.I.P.	LF	$100.00		0.00
12" D.I.P.	LF	$115.00		0.00
16" D.I.P.	LF	$145.00		0.00
2" DOUBLE CHECK ASSEMBLY	EA	$1,950.00		0.00
2" REDUCED PRESSURE ASSEMBLY	EA	$1,625.00		0.00
2" DOUBLE DETECTOR CHECK	EA	$1,625.00		0.00
6" DOUBLE DETECTOR CHECK	EA	$7,500.00		0.00
ADJUST WM TO GRADE	EA	$500.00		0.00
4" D.I.P.	LF	$65.00	245	15,925.00
4" Gate Valve	EA	$600.00	1	600.00
MISC. ITEMS				0.00

SANITARY

SANITARY SEWER MANHOLE	EA	$4,000.00	13	52,000.00
DROP MANHOLE	EA	$5,000.00		0.00
TERMINAL CLEAN OUT	EA	$425.00		0.00
SIDE SEWER	LF	$60.00	938	56,280.00
8" SANITARY PVC	LF	$70.00	1432	100,240.00
10" SANITARY PVC	LF	$75.00		0.00
12" SANITARY PVC	LF	$90.00		0.00
18" SANITARY PVC	LF	$100.00		0.00
GREASE INTERCEPTOR	GALLON	$6.90		0.00
OIL/WATER SEPARATOR	GALLON	$6.90		0.00
TYPE 1 CATCH BASIN	EA	$1,800.00		0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00

RETAINING WALLS

ROCK RETAINING WALL	S.Y./ FACE	$250.00		0.00
POURED IN PLACE RETAINING WALL	S.Y./ FACE	$250.00		0.00
KEYSTONE WALL	S.F./FACE	$35.00	9050	316,750.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00

MISCELLANEOUS

RELOCATE POWER POLE/TRANSFORMER				0.00
PRIVATE UTILITY TRENCHING	LF	$3.00	1450	4,350.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00

TOTAL	1,993,713.00
20% CONTINGENCY	398,742.60
GRAND TOTAL	2,392,455.60

CITY OF PUYALLUP
ENGINEERING SERVICES
ESTIMATE OF COST

OFF-SITE

DATE:	**ESTIMATOR:**
PERMIT NUMBER:	**EMAIL:**

STREET	UNIT	UNIT COST	PLAN QUANTITY	TOTAL
6" CURB & 18" GUTTER	LF	$19.00		0.00
DRIVE APPROACH	SY	$55.00		0.00
SIDEWALK	SY	$35.00		0.00
WHEEL CHAIR RAMP	EA	$2,800.00		0.00
MONUMENT	EA	$650.00		0.00
STREET SIGN	EA	$280.00		0.00
WARNING SIGN	EA	$230.00		0.00
PERMANENT BARRICADE	EA	$850.00		0.00
STREET LIGHT	EA	$5,500.00		0.00
METER BASE AND PANEL FOR ST LT	EA	$13,200.00		0.00
ROADWAY EXCAVATION / HAUL	CY	$35.00		0.00
GRAVEL BASE	TON	$25.00		0.00
TOP COURSE	TON	$30.00		0.00
CLASS B ASPHALT CONCRETE	TON	$95.00		0.00
RAISE M.H. / VALVE BOX TO GRAD	EA	$425.00		0.00
PERMEABLE BALLAST/RESERVOIR	TON	$40.00		0.00
PERMEABLE SIDEWALK	SY	$45.00		0.00
PERMEABLE ASPHALT	TON	$200.00		0.00
CHANNELIZATION	LS			0.00
TRAFFIC SIGNAL	LS			0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00

STORM DRAINAGE

ROUGH GRADING	CY	$3.00		0.00
EROSION CONTROL	SF	$0.50		0.00
48" STORM SEWER MANHOLE	EA	$3,605.00		0.00
54" STORM SEWER MANHOLE	EA	$4,265.00		0.00
60" STORM SEWER MANHOLE	EA	$5,075.00		0.00
72" STORM SEWER MANHOLE	EA	$7,615.00		0.00
84" STORM SEWER MANHOLE	EA	$10,150.00		0.00
96" STORM SEWER MANHOLE	EA	$14,720.00		0.00
FLOW CONTROL MANHOLE	EA	$4,900.00		0.00
CATCH BASIN TYPE I	EA	$1,800.00		0.00
CATCH BASIN TYPE II	EA	$3,550.00		0.00
6" D.I.P.	LF	$75.00		0.00
8" D.I.P.	LF	$85.00		0.00
12" D.I.P.	LF	$90.00		0.00
8" PVC	LF	$50.00		0.00
12" PVC	LF	$65.00		0.00
18" PVC	LF	$85.00		0.00
21" PVC	LF	$100.00		0.00
24" PVC	LF	$125.00		0.00
30" PVC	LF	$150.00		0.00
36" RCP	LF	$275.00		0.00
42" RCP	LF	$350.00		0.00

48" RCP	LF	$440.00		0.00
4" OR 6" PERFORATED UNDERDRAIN	LF	$35.00		0.00
CLEANOUTS	EA	$425.00		0.00
DISPERSION TRENCH	LF	$110.00		0.00
BIOSWALE / DETENTION POND	CF	$2.00		0.00
COMPOST / COALESCE FILTER	LF	$7.70		0.00
CATCH BASIN FILTER	EA	$9,500.00		0.00
MODULAR WETLAND	EA	$15,000.00		0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00

WATER	UNIT	UNIT COST	PLAN QUANTITY	TOTAL
3/4" WATER SERVICE / METER	EA	$850.00		0.00
1" WATER SERVICE / METER	EA	$1,000.00		0.00
1 1/2" WATER SERVICE / METER	EA	$1,430.00		0.00
2" WATER SERVICE / METER	EA	$2,000.00		0.00
FIRE HYDRANT ASSEMBLY	EA	$3,400.00		0.00
2' BLOW OFF ASSEMBLY	EA	$2,080.00		0.00
6" GATE VALVE	EA	$750.00		0.00
8" GATE VALVE	EA	$820.00		0.00
10" BUTTERFLY VALVE	EA	$1,300.00		0.00
12" BUTTERFLY VALVE	EA	$1,500.00		0.00
AIR RELIEF VALVE	EA	$2,400.00		0.00
6" D.I.P.	LF	$75.00		0.00
8" D.I.P.	LF	$85.00		0.00
10" D.I.P.	LF	$100.00		0.00
12" D.I.P.	LF	$115.00		0.00
16" D.I.P.	LF	$145.00		0.00
2" DOUBLE CHECK ASSEMBLY	EA	$1,950.00		0.00
2" REDUCED PRESSURE ASSEMBLY	EA	$1,625.00		0.00
2" DOUBLE DETECTOR CHECK	EA	$1,625.00		0.00
6" DOUBLE DETECTOR CHECK	EA	$7,500.00		0.00
ADJUST WM TO GRADE	EA	$500.00		0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00

SANITARY				
SANITARY SEWER MANHOLE	EA	$4,000.00		0.00
DROP MANHOLE	EA	$5,000.00		0.00
TERMINAL CLEAN OUT	EA	$425.00		0.00
SIDE SEWER	LF	$60.00		0.00
8" SANITARY PVC	LF	$70.00		0.00
10" SANITARY PVC	LF	$75.00		0.00
12" SANITARY PVC	LF	$90.00		0.00
18" SANITARY PVC	LF	$100.00		0.00
GREASE INTERCEPTOR	GALLON	$6.90		0.00
OIL/WATER SEPARATOR	GALLON	$6.90		0.00
TYPE 1 CATCH BASIN	EA	$1,800.00		0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00

RETAINING WALLS				
ROCK RETAINING WALL	S.Y./ FACE	$250.00		0.00
POURED IN PLACE RETAINING WALL	S.Y./ FACE	$250.00		0.00
KEYSTONE WALL	S.F./FACE	$35.00		0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00

MISCELLANEOUS				
RELOCATE POWER POLE/TRANSFORMER				0.00
PRIVATE UTILITY TRENCHING	LF	$3.00		0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00
MISC. ITEMS				0.00

TOTAL	0.00
20% CONTINGENCY	0.00
GRAND TOTAL	0.00

Total Valuation	2,392,455.60
Engineer Inspection Fee (3%)	71,773.67
Required Performance Bond Amt (150%)	0.00
TOTAL	2,464,229.27