Stormwater Site Plan

PREPARED FOR:

McGranahan Architects
Contact: Mr. Andy Hartung
2111 Pacific Avenue, Suite 100
Tacoma, WA 98402

PROJECT:

Pierce College Puyallup
Campus Parking Expansion – Lot A
Puyallup, WA
2200718.13

PREPARED BY:

Claire Hovde, PE
Project Engineer

REVIEWED BY:

William J. Fierst, PE
Principal

DATE:

September 2023
Revised January 2024
Revised March 2024

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03/14/2024

I hereby state that this Storm Drainage Report for the Pierce College - Puyallup Campus Parking Expansion project has been prepared by me or under my supervision and meets the standard of care and expertise that is usual and customary in this community for professional engineers. I understand that City of Puyallup does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

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1.0 Project Overview

This Stormwater Site Plan (SSP) describes proposed stormwater mitigation for the Campus Parking Expansion project at Pierce College Puyallup (PCP). PCP is bounded by 39th Avenue SE to the south, Wildwood Park Drive to the north and east, and Bradley Lake and commercial properties to the west in Puyallup, Washington. Refer to Appendix A-1 for the Vicinity Map. The total campus area is approximately 122.30 acres and is situated on eight separate parcels.

The project proposes a new parking lot, Parking Lot A. Improvements include asphalt paving, concrete paving, and stormwater management. Refer to Appendix A-3 for the Developed Conditions Map for more information. A detention pond is proposed for stormwater flow control for proposed impervious surfaces. A bioretention swale will be used upstream of the proposed flow control facility for stormwater quality treatment for pollution generating impervious surfaces (PGIS).

This SSP describes the stormwater facilities designed for this project. The drainage plans and report have been prepared to satisfy all requirements of the Department of Ecology (DOE) 2019 *Stormwater Management Manual for Western Washington (SWMMWW)*, as adopted by City of Puyallup. This report accompanies the final site plan submitted for the proposed Campus Parking Expansion project at PCP.

1.1 Existing Conditions

The 122.30-acre site is currently partially developed and located on the north side of 39th Avenue SE. The site consists of several buildings, parking lots, detention ponds, forested area, wetlands, and an access drive loop that is routed around the perimeter of the developed portion of the site.

PCP is bounded by 39th Avenue SE to the south, Wildwood Park Drive to the north and east, and Bradley Lake and commercial properties to the west in Puyallup, Washington. A main entrance driveway to the site is located on the south side of the property along 39th Avenue SE. An additional driveway connection to the site is located at the northwest of the site and connects to 7th Street SE. All adjacent properties are downgradient of the site and do not appear to discharge stormwater onto the proposed site.

The campus straddles two drainage basins, as outlined by the City of Puyallup Drainage Basin Map. The basin delineation line runs approximately north/south down the middle of the site. The west side of the site is in the State Highway Basin and the east side of the site is in the Pothole Basin. Refer to Appendix A-4, City of Puyallup Drainage Basin Map, for more information. The proposed improvements are located within the State Highway Basin. Refer to Appendix A-2 for the Existing Conditions Map for more information.

The proposed parking lot is located at the northwest corner of the campus approximately 65 feet north the existing Health Education Center (HEP). Refer to Appendix A-5, Campus Map, for the building location. The site is located within the State Highway Basin. The existing condition at Parking Lot A consists of a heavily wooded area adjacent to the northwest campus driveway. Topography generally slopes from southwest to northeast. The Parking Lot A site drains to an existing detention pond located northwest of the site along College Way. The existing detention pond was constructed with the West Access Driveway project. The existing detention pond outfalls to Wildwood Creek. Refer to Appendix A-6, Downstream Map, for the existing detention pond location. This ditch eventually discharges to a large wetland, referred to as the Wildwood Creek wetland, located north of Bradley Lake Park and east of 7th Street SE. Refer to Section 2.8 of this report for more information.

1.1.1 Critical Areas

The site contains five wetlands onsite, per the City of Puyallup GIS Critical Areas Map (see Appendix A-7 for more information). College maps indicate 11 wetlands are located onsite. A Critical Areas Report by Grette Associates dated January 2022 has been completed for the wetlands that are near the proposed site improvements. For more information, see Section 2.8 of this report, and Appendix C-2, Critical Areas Report by Grette Associates, dated January 2022.

According to FEMA, the site is mapped within Zone X, Area of Minimal Flood Hazard. Refer to Appendix A-8 for the FEMA Flood Map.

1.1.2 Site Soils

Soils at the site are mapped by the Natural Resources Conservation Service (NRCS) as predominantly gravelly sandy loam underlain by glacial till. Refer to Appendix A-9 for the NRCS Soils Map.

Based on the Geotechnical Engineering Services Report by GeoEngineers, dated January 31, 2022, the site is underlain by glacial till. The report notes long-term design infiltration rates ranging from 0.015 to 0.043 in/hr. The long-term design infiltration rate is less than 0.3 in/hr; therefore, infiltration is considered infeasible.

Additional groundwater monitoring was performed by GeoEngineers and is presented in an addendum to supplement the Geotechnical Engineering Services Report. Refer to Appendix C-3 for more information.

1.2 Proposed Conditions

The project proposes a new parking lot, Parking Lot A. Improvements include asphalt paving, concrete paving, and stormwater management. Refer to Appendix A-3 for the Developed Conditions Map for more information. A detention pond is proposed for stormwater flow control for proposed impervious surfaces. A bioretention swale will be used upstream of the proposed flow control facilities for stormwater quality treatment for pollution generating surfaces.

The proposed parking lot consists of a 106-stall asphalt parking lot and a concrete sidewalk for connection to the campus. Drainage for the proposed parking lot is provided via sheet flow. Water quality for the parking lot is provided via a bioretention facility along the southwest side of the parking lot. Flow control is provided by a detention pond located northwest of the lot. Refer to Section 4.2 for more information. Proposed site areas are tabulated below.

	Acres	**Percent of Project Area**
Impervious Area	0.88	55%
Landscape Area	0.73	45%
Total Disturbed Area	**1.61**	**100%**

2.0 Minimum Requirements

The Campus Parking Expansion project is considered redevelopment and is subject to Minimum Requirements (MRs) 1 through 9 because the project proposes more than 5,000 square feet of new and replaced hard surfaces. However, the project does not exceed 50 percent of the existing site improvement value. Therefore, all minimum requirements apply to new hard surfaces and the converted vegetation. Refer to Appendix A-10 for the Flowcharts for Determining Minimum Requirements. Below is a discussion of how the project meets each of the requirements.

2.1 MR 1: Preparation of Stormwater Site Plans

A complete stormwater site plan including civil plans and this report are provided with this site development permit package.

2.2 MR 2: Construction Stormwater Pollution Prevention

A Construction Stormwater Pollution Prevention Plan (CSWPPP) is included under separate cover with this site development permit package.

2.3 MR 3: Source Control of Pollution

The project is required to provide source control of pollution. *SWMMWW* Volume IV, Chapter 3 was used as a reference because this is a parking lot project. Maintenance, repair, and cleaning of vehicles will be conducted inside a building which is consistent with the structural source controls of this chapter. Some additional practices include:

- Assign one or more individuals to be responsible for stormwater pollution control related to inspections, operation, maintenance, and emergencies.
- Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173-304 WAC for the definition of inert waste).
- Maintenance and repair of equipment and vehicles that may result in discharge or spillage of pollutants to the ground or into surface water runoff must be conducted inside the detail shop.
- Spills and leaks of gasoline or other pollutants will be promptly contained and cleaned. Solid absorbents should be used for cleanup of liquid spills. Spill cleanup materials shall not be flushed to storm drains. Pollutants shall not be hosed down from any area to the ground or storm drains.
- All pollutants, including waste materials and demolition debris created onsite during construction, shall be handled and disposed of in a manner that does not cause contamination of surface water.

The CSWPPP, under separate cover, provides details on source control of pollution during construction.

2.4 MR 4: Preservation of Natural Drainage Systems and Outfalls

The site is currently developed, with several sub-basins located throughout. The Parking Lot A site drains to an existing detention pond located at the far northwest corner of the campus. The existing detention pond outfalls to Wildwood Creek. Wildwood Creek discharges to a wetland northwest of the campus off 7th Street SE. Refer to Appendix A-6, Downstream Map, for more information on the project site's natural drainage systems and outfalls.

Stormwater from proposed improvements will outfall to the same waterbodies in the existing and proposed conditions within their respective sub-basins. Therefore, all proposed improvements will maintain onsite natural drainage courses.

In the existing condition, an outfall pipe located east of the parking lot discharges overflow stormwater from a detention pond to the east of the site. According to the Technical Information Report (TIR) for the Arts and Allied Health (AAH) Building, dated March 2008, the design was for overflow water to discharge and pond at this location, before overflowing to an existing stub connecting to the conveyance system within College Way. Relevant information from the TIR for the AAH Building is included as Appendix A-12. As discussed in a meeting with the City on May 16, 2023, stormwater from this area does not need to be treated as bypass in the proposed detention volume. As discussed, proposed improvements will meet the existing condition by continuing to allow water to pond at this location with an overflow structure that connects to the existing storm system within College Way.

2.5 MR 5: Onsite Stormwater Management

As outlined in Appendix A-10*,* the project results in more than 5,000 square feet of new plus replaced hard surfaces. Therefore, the project is subject to MRs 1 through 9 and List 2, as outlined in *SWMMWW* Section I-3.4.5.

Per *SWMMWW* Figure I-3.3, the project is subject to List 2 for considering feasibility of onsite stormwater management Best Management Practices (BMPs). List 2 feasibility follows:

Lawn and Landscaped Areas:

- BMP T5.13: Post Construction Soil Quality and Depth – The project will meet this requirement.

Roofs:

- No roofs are proposed with the project.

Other Hard Surfaces:

- BMP T5.30: Full Dispersion – Full dispersion is infeasible because there is either not adequate native vegetation or the dispersion area would be within a critical area buffer.

- BMP T5.15: Permeable Pavement – Permeable pavement is infeasible because the project has underlying soils that are not suitable for infiltration.

- BMP T7.30: Bioretention – Bioretention facilities are infeasible because the project has underlying soils that are not suitable for infiltration. However, bioretention facilities are proposed for the purpose of stormwater quality.

- BMP T5.12: Sheet Flow Dispersion – Sheet flow dispersion is infeasible because there is either not adequate native vegetation or the dispersion area would be within a critical area buffer.

- BMP T5.11: Concentrated Flow Dispersion – Concentrated flow dispersion is infeasible because there is either not adequate native vegetation or the dispersion area would be within a critical area buffer.

2.6 MR 6: Runoff Treatment

The proposed improvements include PGIS and will provide runoff treatment via BMP T7.30: Bioretention. Refer to Section 4.1 for more information. Refer to Appendix A-3 for the location of the proposed bioretention facility. Refer to Appendix B-1 for water quality calculations. Refer to Appendix A-10 for the Treatment Facility Selection Flow Chart.

2.7 MR 7: Flow Control

A detention pond will be used to meet flow control requirements. The flow control system has been calculated using the Western Washington Hydrology Model (WWHM) and meets all requirements of the 2019 *SWMMWW*. Refer to Section 4.3 for more information. Refer to Appendix A-3 for the location of the proposed flow control facility. Refer to Appendix B-1 for flow control calculations.

2.8 MR 8: Wetlands Protection

The site contains five wetlands onsite, per the City of Puyallup GIS Critical Areas Map (see Appendix A-7 for more information). College maps indicate 11 wetlands are located onsite. A Critical Areas Report by Grette Associates dated January 2022 has been completed for the wetlands that are near the proposed site improvements. Refer to Appendix C-2, Critical Areas Report by Grette Associates dated January 2022, for more information.

Per the Critical Areas Report by Grette Associates dated January 2022, Parking Lot A is located adjacent to Wetlands A and C. Wetland A is considered a Category IV wetland with a habitat score of 5 points and a 50-foot buffer. It is located approximately 155 feet from improvements at Parking Lot A. Wetland C is considered a Category III wetland with a habitat score of 6 points and a 150-foot buffer. It is located approximately 90 feet from improvements at Parking Lot A. However, as discussed with the City of Puyallup planner, Chris Beale, the City generally applies a buffer interruption where significant development cuts across a buffer. The northwest campus driveway is located within the improvements and Wetland C. Therefore, the buffer associated with Wetland C does not extend beyond the edge of asphalt associated with the paved driveway.

The Parking Lot A site drains to an existing detention pond located northwest of the site along College Way. The existing detention pond was constructed with the West Access Driveway project. The existing detention pond outfalls to Wildwood Creek. Refer to Appendix A-6, Downstream Map, for the existing detention pond location. This ditch eventually discharges to a large wetland, referred to as the Wildwood Creek wetland, located north of Bradley Lake Park and east of 7th Street SE. No work is planned in or near the wetland; therefore, it is not included in the onsite critical areas report. A separate Wetland Assessment and Rating was performed by Grette Associates dated February 28, 2024, for the Wildwood Creek wetland, which is included as Appendix C-4. According to the assessment, the wetland is a Category III wetland with a habitat rating of 5. Refer to Appendix A-13 for the 2019 *SWMMWW* Flow Chart for Determining the Wetland Protection Levels Required.

The drainage basin tributary to the Wildwood Creek wetland is large and contains approximately 73.49 acres in total area. The basin is partially developed and includes approximately 43.46 acres of impervious surfaces. Refer to Appendix A-11, Wetland Basin Map, for more information. The entire basin has been modeled in WWHM to calculate the wetland hydroperiods in the existing and proposed conditions per the guidelines set forth in the *SWMMWW*, Appendix I-D. The proposed improvements are in compliance with the *SWMMWW* and will therefore not impact the wetland's hydrology. Refer to Appendix B-2, Wetland Hydroperiod Calculations, for more information.

The existing hydrology for all onsite wetlands will not be impacted by the proposed work and therefore the project is in compliance with MR 8.

2.9 MR 9: Operations and Maintenance

An Operations and Maintenance Manual is provided with this submittal. Refer to Appendix D for more information.

3.0 Offsite Analysis

Runoff from Parking Lot A discharges from the proposed detention pond at the northwest end of the project site along College Way. Stormwater is then collected and conveyed via catch basins and 12-inch storm pipes. Stormwater is routed northwest for approximately 2,300 feet to an existing detention pond located at the far northwest corner of the campus. The existing detention pond outfalls to Wildwood Creek. Wildwood Creek discharges to a wetland northwest of the campus off 7th Street SE. Impacts to offsite drainage courses and conveyance systems are not anticipated.

4.0 Permanent Stormwater Control Plan

4.1 Existing Site Hydrology

The campus straddles two drainage basins, as outlined by the City of Puyallup Drainage Basin Map. The basin delineation line runs approximately north/south down the middle of the site. The west side of the site is in the State Highway Basin and the east side of the site is in the Pothole Basin. Refer to Appendix A-4, City of Puyallup Drainage Basin Map, for more information. The proposed improvements are located within the State Highway Basin. All adjacent properties are downgradient of the site and do not appear to discharge stormwater onto the proposed site.

Parking Lot A is located at the northwest corner of the campus approximately 65 feet north of the existing HEP. Refer to Appendix A-5, Campus Map, for the building location. Refer to Appendix A-6, Downstream Map, for the parking lot location. The site is located within the State Highway Basin. The existing conditions at Parking Lot A consist of a heavily wooded area adjacent to the northwest campus driveway. Topography generally slopes from southwest to northeast. Refer to Appendix A-2, Existing Conditions Map, for more information on the Parking Lot A existing basin.

4.2 Developed Site Hydrology

All proposed improvements will maintain onsite natural drainage courses, as outlined in Section 4.1. Stormwater from proposed improvements will outfall to the same locations within their respective sub-basins. Stormwater flows from proposed developed areas will meet all requirements set forth in the *SWMMWW*. Proposed developed hydrology will not further impact downstream drainage courses.

4.3 Flow Control System

A detention pond will be used to meet flow control requirements. Refer to Appendix A-3 for the location of the proposed flow control facility. Refer to Appendix B-1 for flow control calculations. Refer to Appendix B-5 for the Emergency Overflow Spillway Sizing Calculations.

The flow control system has been calculated using WWHM and meets all requirements of the 2019 *SWMMWW*. The project will use BMP T5.13: Post Construction Soil Quality and Depth for all pervious areas impacted by the project. Per *SWMMWW* Volume V, Chapter 11, project areas meeting the requirements set forth by BMP T5.13 may model pervious area as pasture rather than lawn. The project intends to use these criteria.

4.4 Water Quality System

The proposed improvements include PGIS. All proposed improvements that include PGIS will provide runoff treatment via BMP T7.30: Bioretention. Refer to Appendix A-3 for the location of the proposed bioretention facility. The bioretention facility will use perforated pipe underdrains. Stormwater will be treated by the bioretention facility before being conveyed to the downstream flow control facility.

The water quality system has been calculated using WWHM and meets all requirements of the 2019 *SWMMWW.* Refer to Appendix B-1 for water quality calculations.

The surface pool drawdown time was determined to be 1.18 hours, which is under the maximum allowable drawdown time of 24 hours. Calculations for the drawdown time can be found in Appendix B-4.

4.5 Conveyance System Analysis and Design

The onsite conveyance system consists of catch basins and 12-inch storm pipes with a minimum slope of 0.005 ft/ft. Using Manning's equation, the capacity of a 12-inch CPEP pipe at 0.005 ft/ft is 2.985 cubic feet per second, which is larger than the 0.8020 cubic feet per second peak flow from the site. The storm drainage system is adequately sized and will not surcharge. Refer to Appendix B-3 for the conveyance capacity calculations.

5.0 Construction Stormwater Pollution Prevention Plan

A CSWPPP will be included under a separate cover for this site development permit package.

6.0 Special Reports and Studies

This project includes a Geotechnical Engineering Services Report by GeoEngineers, dated January 31, 2022; a Critical Areas Report by Grette Associates, dated January 2022; and a Supplemental Groundwater Information Addendum #1 by GeoEngineers, dated October 31, 2022. Refer to Appendix C for these special reports.

7.0 Conclusion

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

AHBL, Inc.

Claire F. Hovde, PE
Project Engineer

CFH/jms/lsk

September 2023
Revised January 2024
Revised March 2024

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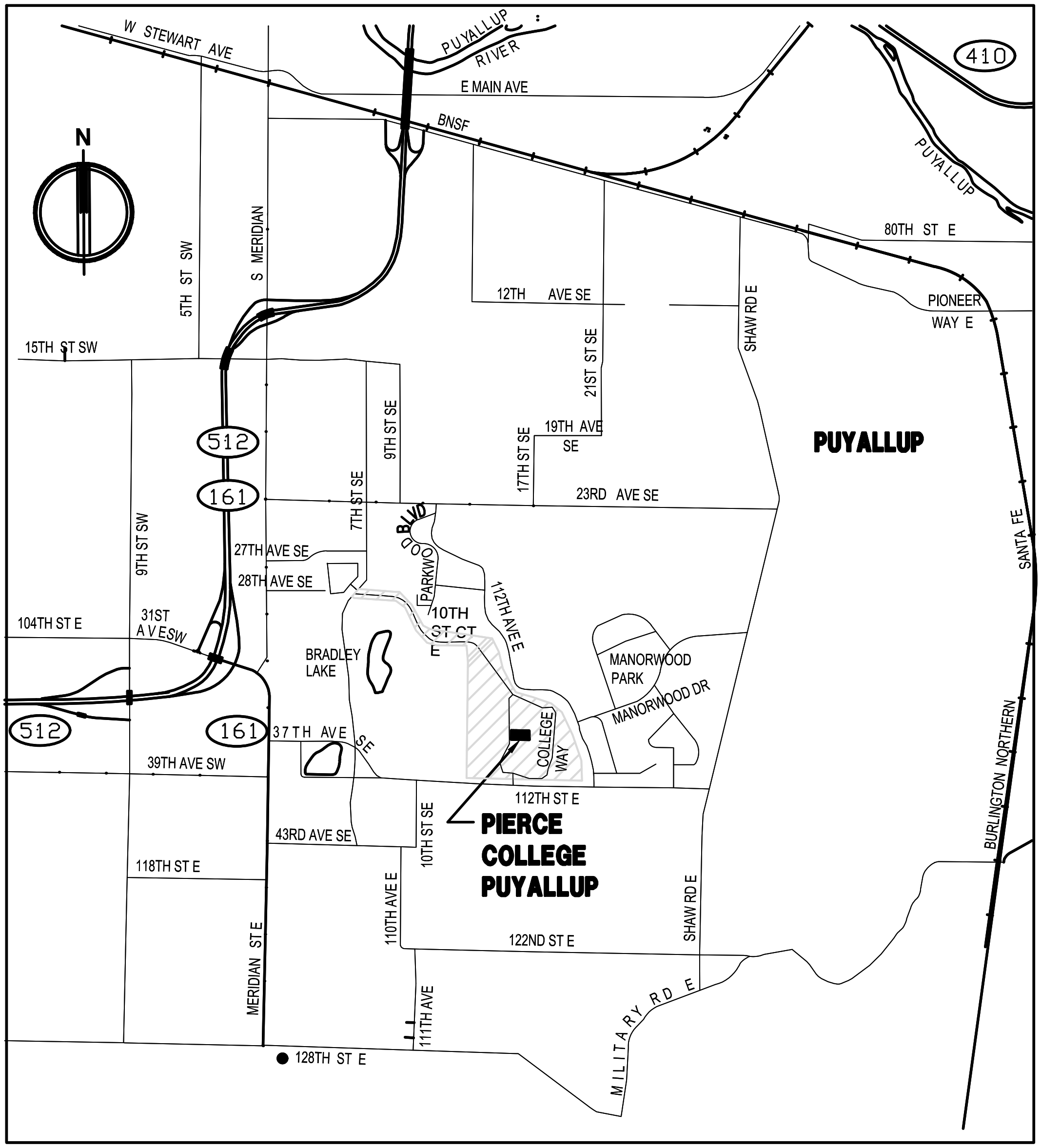
Appendix A

Exhibits



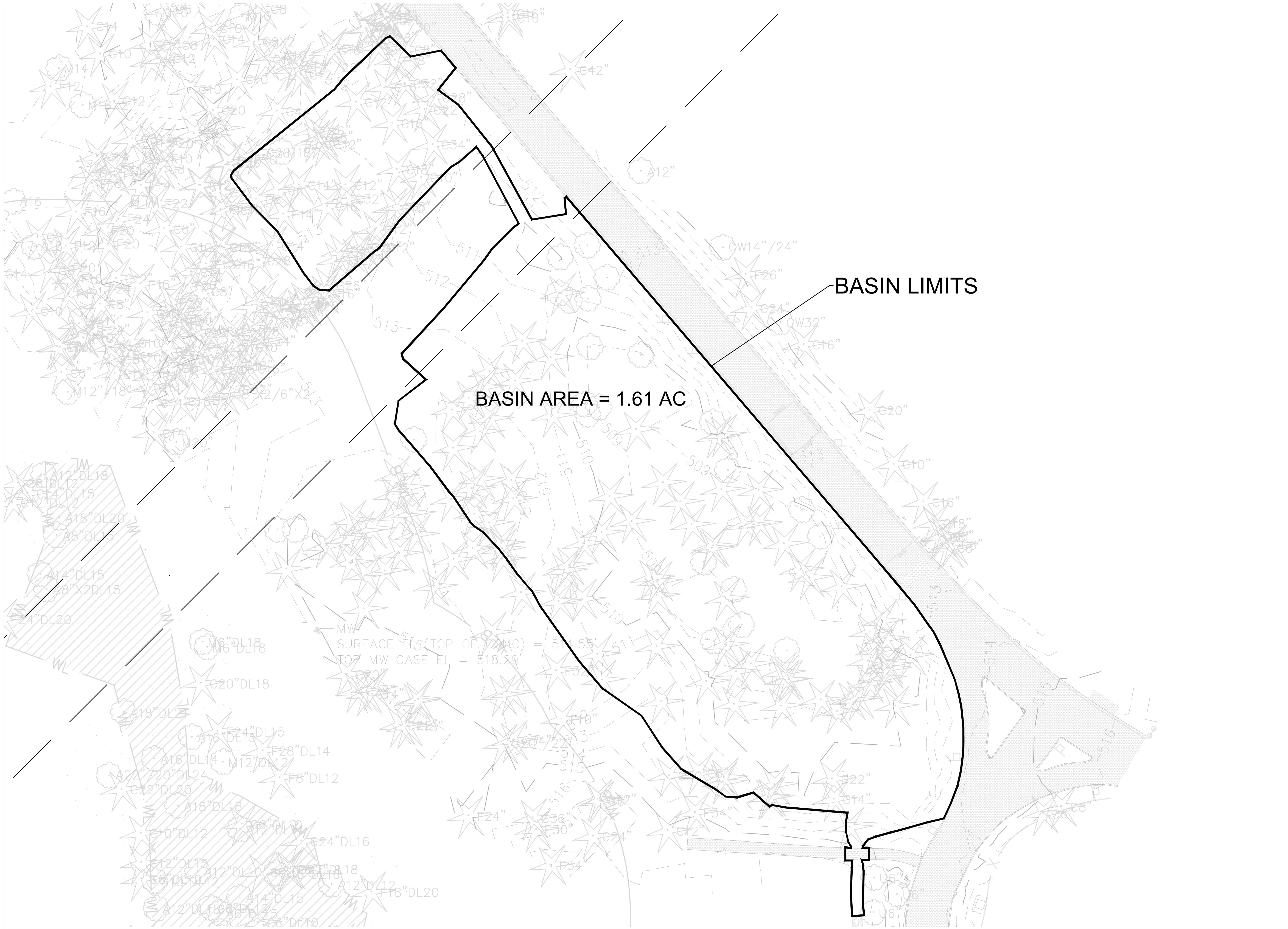
AHBL
2215 North 30th Street, Suite 300
Tacoma, WA 98403
253.383.2422 TEL 253.383.2572 FAX

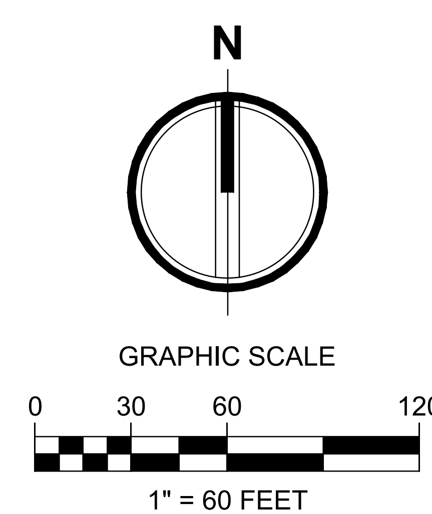
Pierce College Puyallup

Vicinity Map

DRAWN BY: ACP | DATE: 6/29/2021 | JOB NO.: 2190297.10

EX A-1





AHBL

Civil Engineers
Structural Engineers
Landscape Architects
Community Planners
Land Surveyors
Neighbors

TACOMA · SEATTLE

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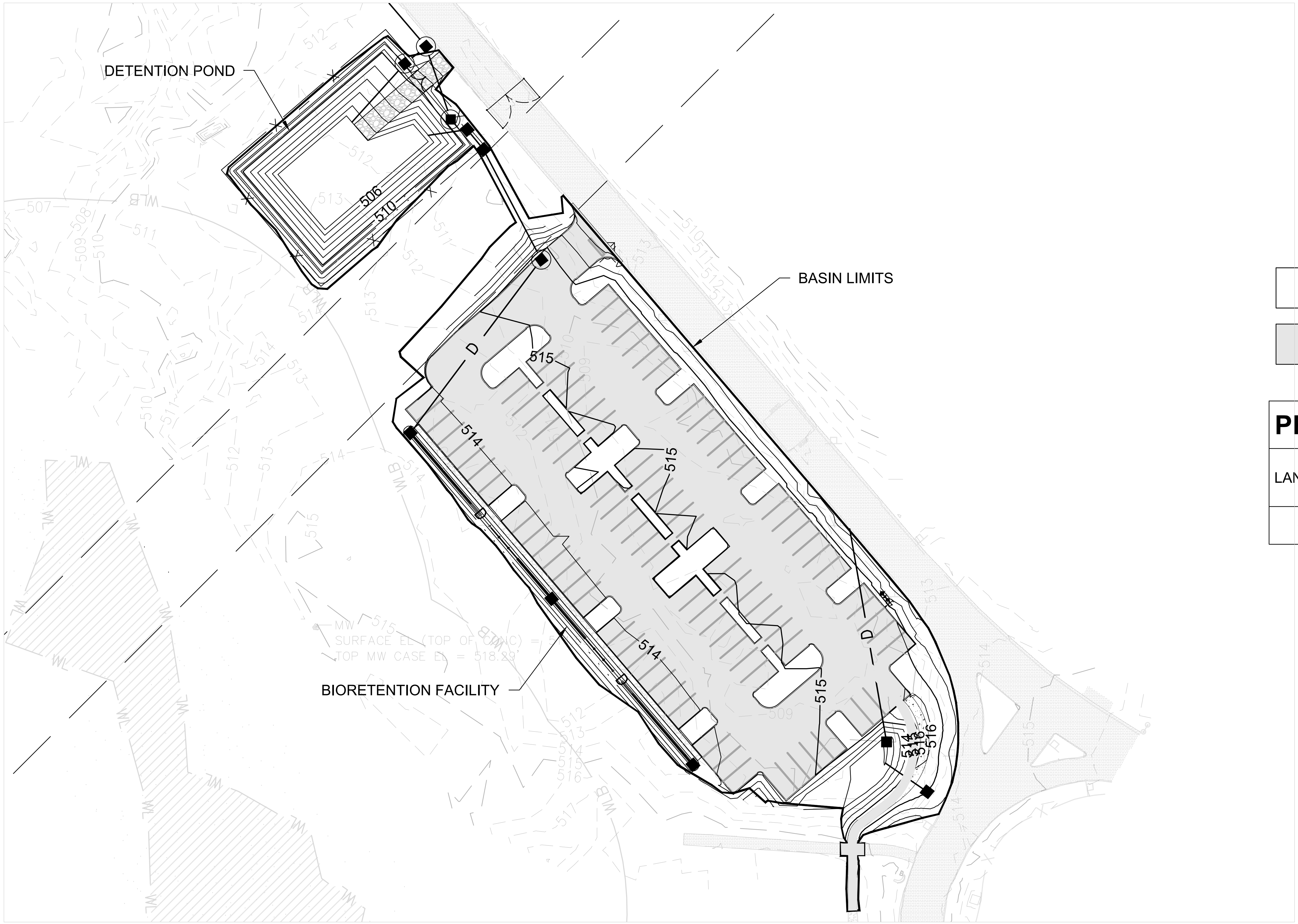
316 Occidental Avenue South, Suite 320, Seattle, WA 98104 206.267.2425 TEL

PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

EXISTING CONDITIONS MAP
PARKING LOT A

EX-A2



	LAWN AND LANDSCAPING
	IMPERVIOUS SURFACE

PROPOSED BASIN AREAS

LANDSCAPE	IMPERVIOUS	TOTAL
0.73 AC	0.88 AC	1.61 AC

N

GRAPHIC SCALE

0 30 60 120

1" = 60 FEET

AHBL
Civil Engineers
Structural Engineers
Landscape Architects
Community Planners
Land Surveyors
Neighbors
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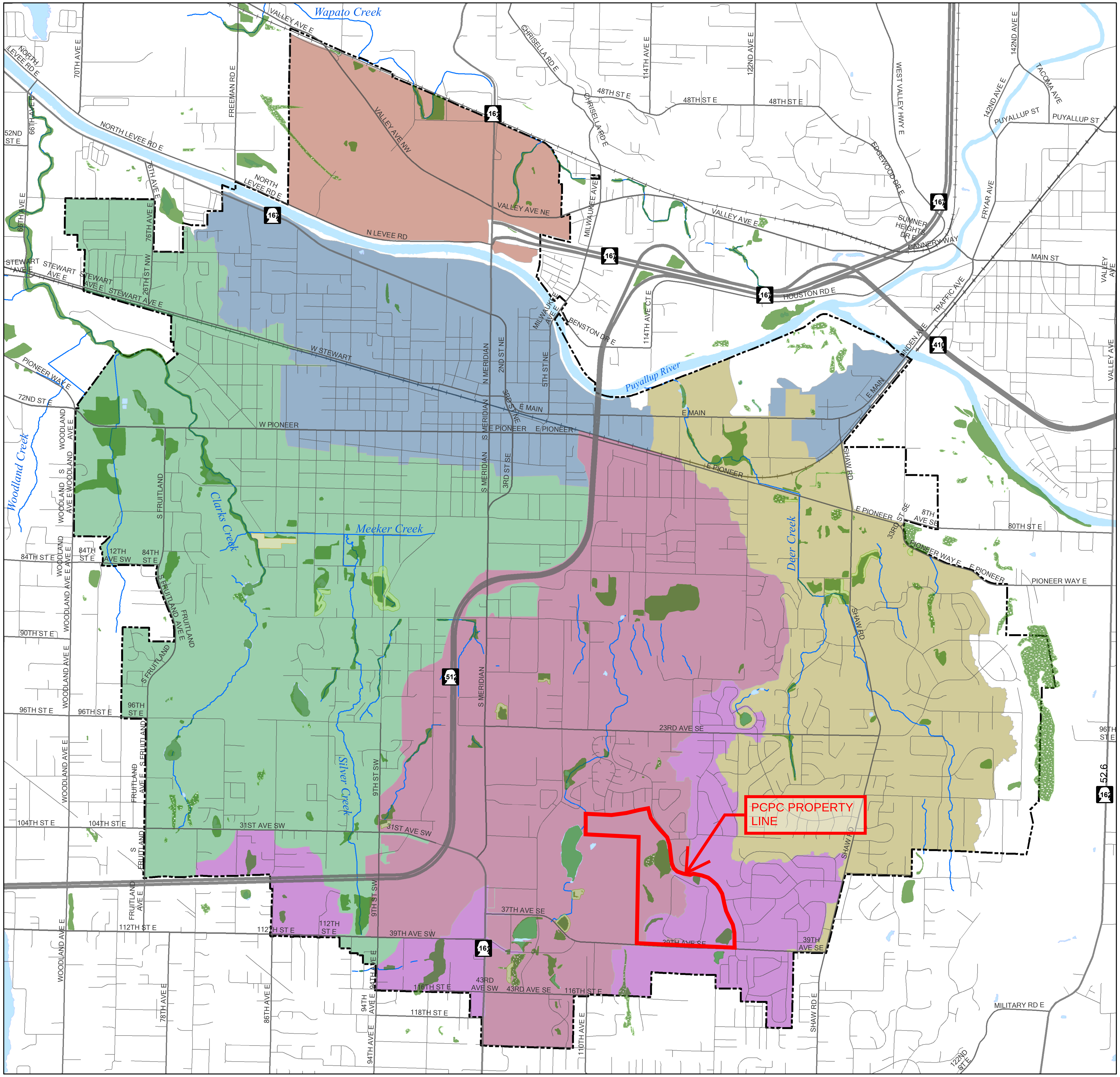
316 Occidental Avenue South, Suite 320, Seattle, WA 98104 206.267.2425 TEL

PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

DEVELOPED CONDITIONS MAP
PARKING LOT A

A-3

Appendix A-4



City of Puyallup Drainage Basins

Legend

Drainage Basins

- Clarks Creek
- Pothole
- Puyallup River North
- Puyallup River South
- Shaw Road
- State Highway

Wetlands

- Field-verified
- Unverified
- Buffer
- Mitigation Site

- City Limits
- Waterbodies
- Streams

City of Puyallup drainage data provided as part of the November 2011 Comprehensive Stormwater Plan developed by Brown and Caldwell.
Edited by City of Puyallup Collections Division.

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. Orthophotos and other data may not align. The County and the City of Puyallup assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'AS IS' AND 'WITH ALL FAULTS'. The County and City of Puyallup makes no warranty of fitness for a particular purpose.

0 1,500 3,000 6,000
Feet

Date: 1/2/2020

File Name: jgrbich/COP Website/Drainage Basins.mxd (PDF)

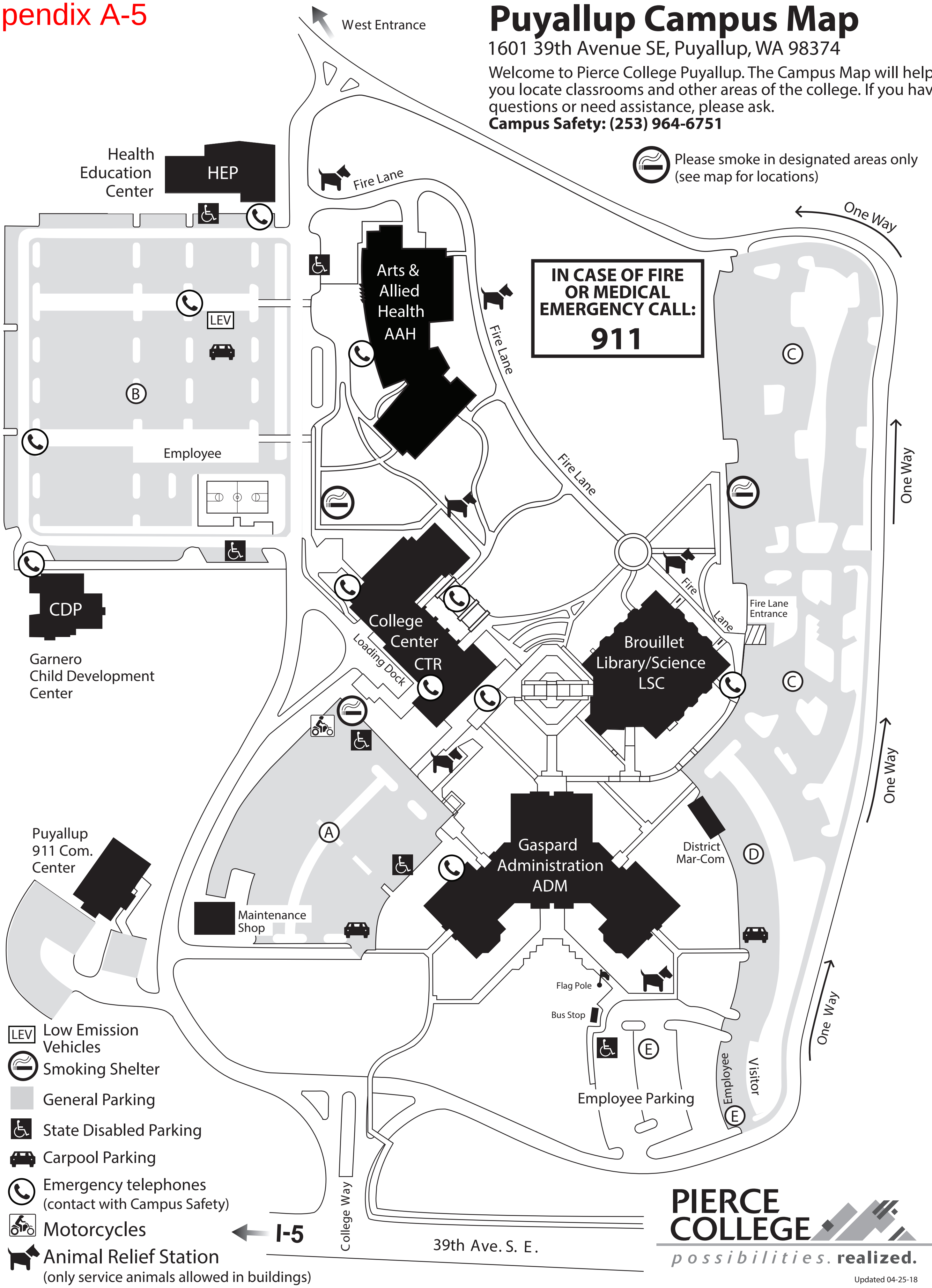
Appendix A-5

Puyallup Campus Map

1601 39th Avenue SE, Puyallup, WA 98374

Welcome to Pierce College Puyallup. The Campus Map will help you locate classrooms and other areas of the college. If you have questions or need assistance, please ask.

Campus Safety: (253) 964-6751



PIERCE COLLEGE
possibilities. realized.

Updated 04-25-18

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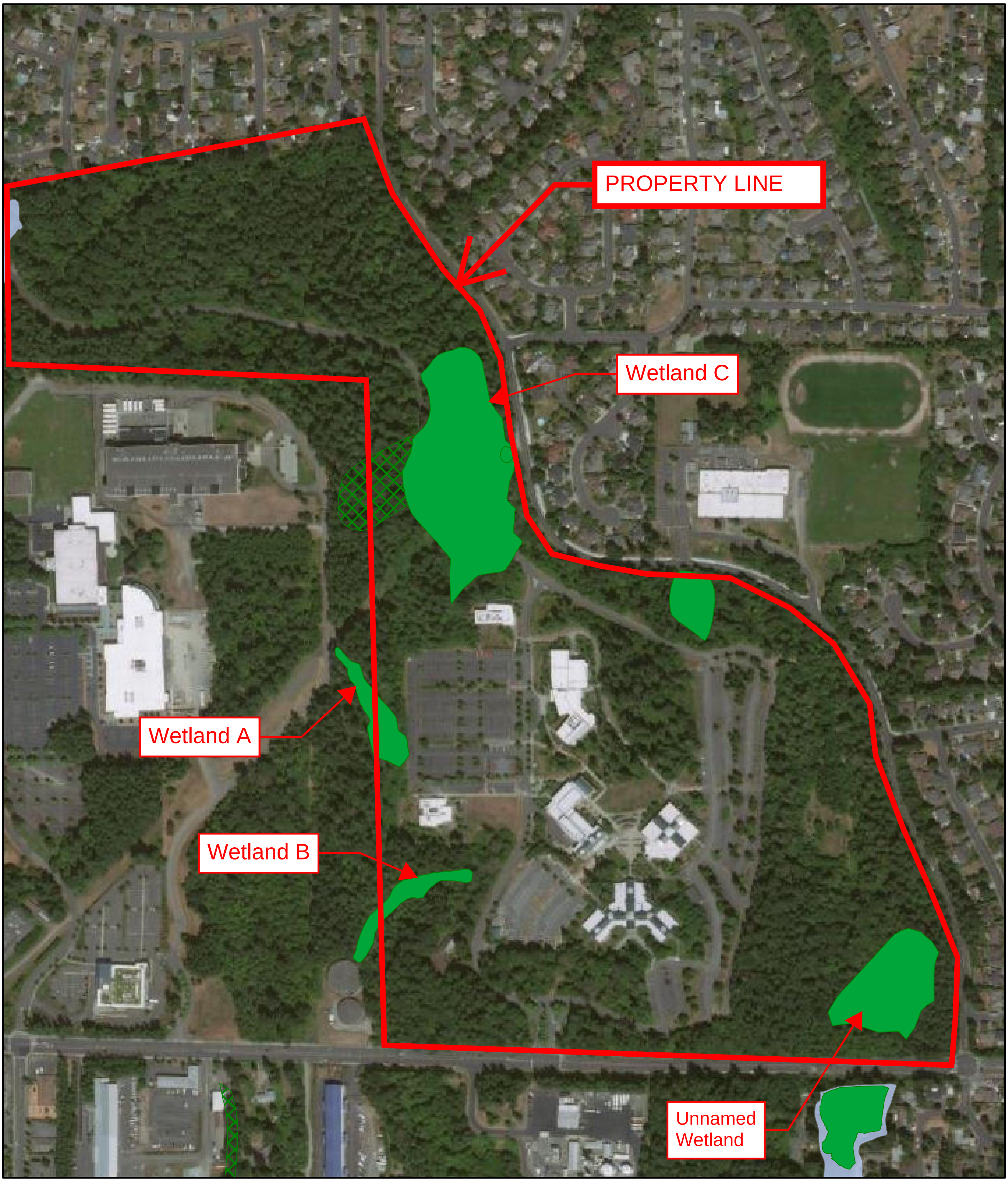
Pierce College Puyallup - Parking Lot A

Appendix A-6 Downstream Map

A-6

Appendix A-7

ArcGIS Web Map



6/29/2021, 11:26:01 AM

City Limits

Wetlands

Field-verified

Unverified

Unverified

Regulated Floodplain 2017

Zone X (SHADED)

1:9,028

0 0.05 0.1 0.2 mi

0 0.07 0.15 0.3 km

Maxar

Web AppBuilder for ArcGIS

Maxar | Jennifer Recco, GIS Coordinator, City of Puyallup;

Appendix A-8

National Flood Hazard Layer FIRMette

FEMA

122°16'39"W 47°9'35"N

122°16'2"W 47°9'10"N

Feet 0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

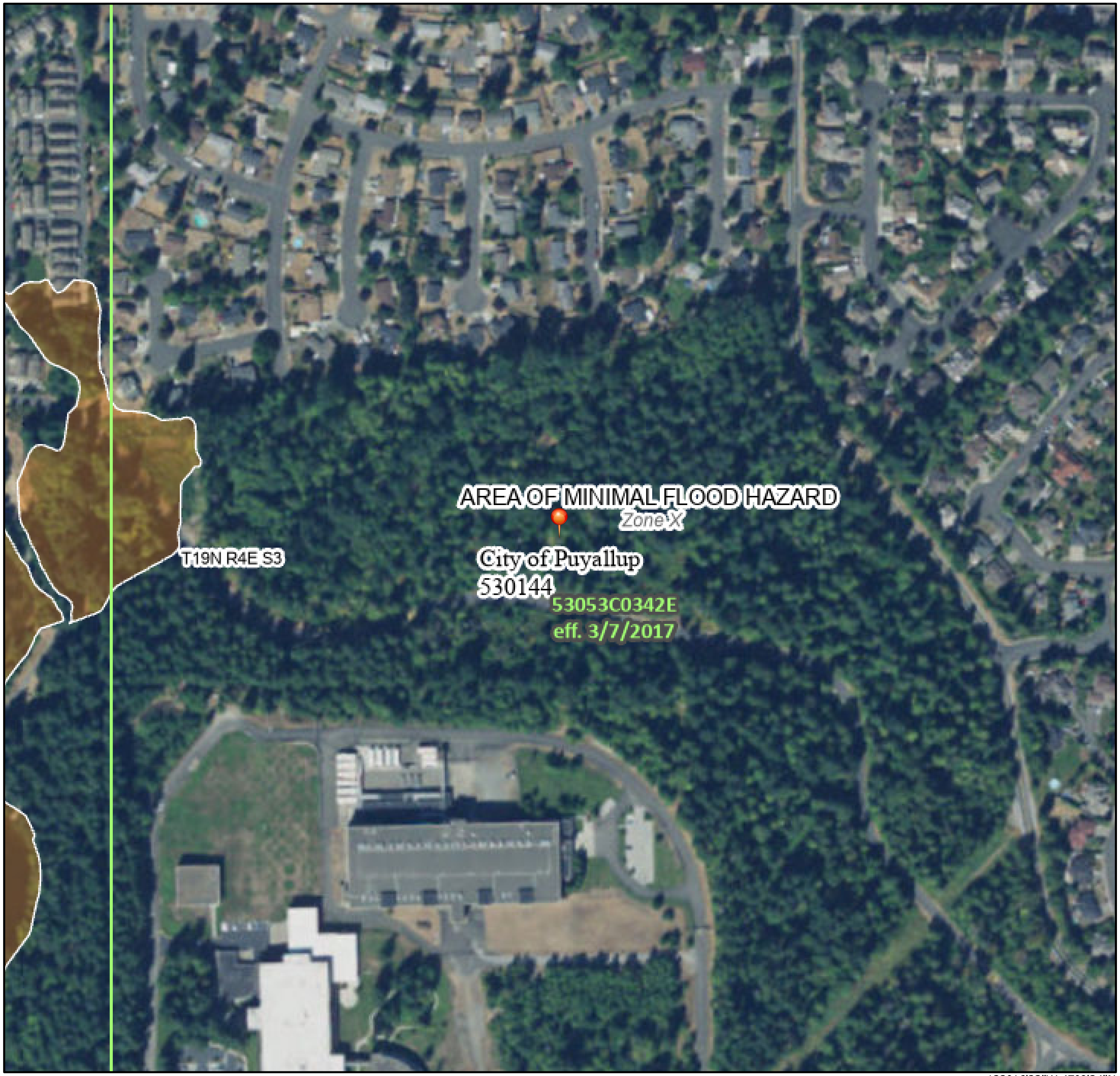
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/29/2021 at 4:45 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

National Flood Hazard Layer FIRMette

FEMA

122°17'1"W 47°9'59"N



122°16'23"W 47°9'34"N

Feet 0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS

- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/29/2021 at 4:51 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Appendix A-9

Soil Map—Pierce County Area, Washington

Map Scale: 1:7,010 if printed on B landscape (17" x 11") sheet.

N

Meters: 0, 100, 200, 400, 600

Feet: 0, 300, 600, 1200, 1800

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 16, Jun 4, 2020

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

Date(s) aerial images were photographed: Jul 29, 2018—Jul 22, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
4A	Bellingham silty clay loam	1.4	0.3%
13B	Everett very gravelly sandy loam, 0 to 8 percent slopes	157.9	34.8%
18B	Indianola loamy sand, 0 to 5 percent slopes	20.3	4.5%
18C	Indianola loamy sand, 5 to 15 percent slopes	41.7	9.2%
19B	Kapowsin gravelly ashy loam, 0 to 6 percent slopes	42.1	9.3%
19C	Kapowsin gravelly ashy loam, 6 to 15 percent slopes	141.4	31.2%
19E	Kapowsin gravelly ashy loam, 30 to 65 percent slopes	32.9	7.3%
20B	Kitsap silt loam, 2 to 8 percent slopes	2.8	0.6%
24D	Neilton gravelly loamy sand, 8 to 25 percent slopes	4.4	1.0%
W	Water	8.8	1.9%
Totals for Area of Interest		**453.7**	**100.0%**

Pierce County Area, Washington

13B—Everett very gravelly sandy loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t629
Elevation: 30 to 900 feet
Mean annual precipitation: 35 to 91 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 180 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Everett and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Everett

Setting

Landform: Eskers, moraines, kames
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Crest, interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Sandy and gravelly glacial outwash

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 3 inches: very gravelly sandy loam
Bw - 3 to 24 inches: very gravelly sandy loam
C1 - 24 to 35 inches: very gravelly loamy sand
C2 - 35 to 60 inches: extremely cobbly coarse sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A

Forage suitability group: Droughty Soils (G002XS401WA), Droughty Soils (G002XN402WA), Droughty Soils (G002XF403WA)
Other vegetative classification: Droughty Soils (G002XS401WA), Droughty Soils (G002XN402WA), Droughty Soils (G002XF403WA)
Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 10 percent
Landform: Ridges, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Indianola

Percent of map unit: 10 percent
Landform: Terraces, eskers, kames
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 16, Jun 4, 2020

Hydrologic Soil Group: B
Forage suitability group: Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
Other vegetative classification: Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 5 percent
Landform: Ridges, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Mckenna

Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Dupont

Percent of map unit: 2 percent
Landform: Depressions, troughs
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Norma

Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Harstine

Percent of map unit: 2 percent
Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Neilton

Percent of map unit: 2 percent
Landform: Outwash terraces

Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 16, Jun 4, 2020

Pierce County Area, Washington

19C—Kapowsin gravelly ashy loam, 6 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2t61x
Elevation: 50 to 900 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 150 to 220 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Kapowsin and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kapowsin

Setting

Landform: Moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Volcanic ash mixed with glacial drift over dense glaciomarine deposits

Typical profile

Ap - 0 to 7 inches: gravelly ashy loam
Bhs - 7 to 11 inches: gravelly ashy loam
Bs1 - 11 to 15 inches: gravelly ashy loam
2Bs2 - 15 to 25 inches: loam
3Bstm - 25 to 29 inches: loam
3Cd - 29 to 59 inches: gravelly loam

Properties and qualities

Slope: 6 to 15 percent
Depth to restrictive feature: More than 80 inches; More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: About 11 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B
Forage suitability group: Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
Other vegetative classification: Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XN302WA)
Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 5 percent
Landform: Ridges, hills
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope, talf
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Neilton

Percent of map unit: 2 percent
Landform: Outwash terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Norma

Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Mckenna

Percent of map unit: 2 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Dupont

Percent of map unit: 2 percent
Landform: Depressions, troughs
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Harstine

Percent of map unit: 2 percent
Landform: Ridges
Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Nose slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 16, Jun 4, 2020

Pierce County Area, Washington

19E—Kapowsin gravelly ashy loam, 30 to 65 percent slopes

Map Unit Setting

National map unit symbol: 2t620
Elevation: 50 to 900 feet
Mean annual precipitation: 30 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 150 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Kapowsin and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kapowsin

Setting

Landform: Moraines
Landform position (two-dimensional): Footslope, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Volcanic ash mixed with glacial drift over dense glaciomarine deposits

Typical profile

Ap - 0 to 7 inches: gravelly ashy loam
Bhs - 7 to 11 inches: gravelly ashy loam
Bs1 - 11 to 15 inches: gravelly ashy loam
2Bs2 - 15 to 25 inches: loam
3Bstm - 25 to 29 inches: loam
3Cd - 29 to 59 inches: gravelly loam

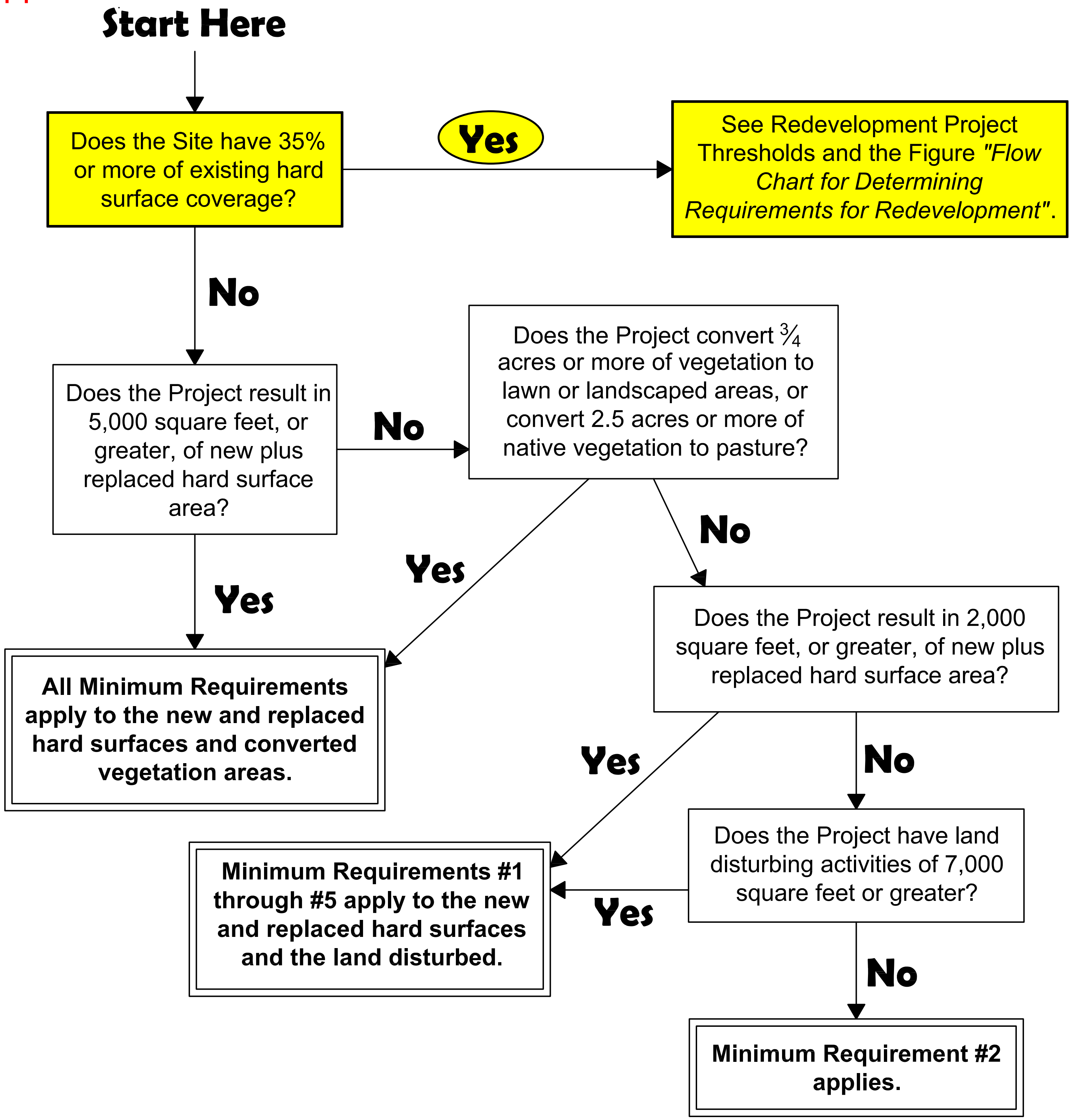
Properties and qualities

Slope: 30 to 65 percent
Depth to restrictive feature: More than 80 inches; More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: About 11 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e

Appendix A-10

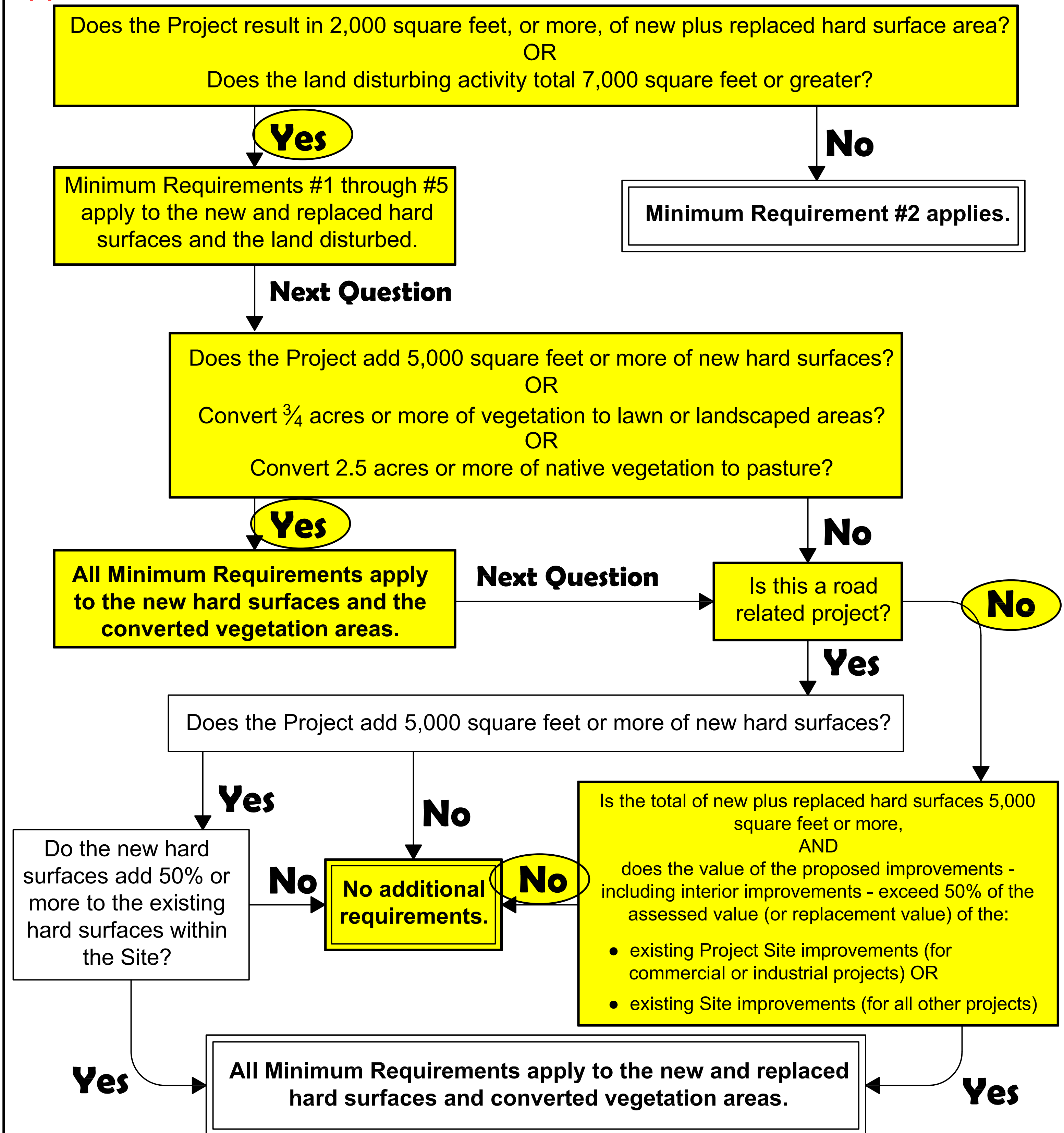


DEPARTMENT OF ECOLOGY
State of Washington

Flow Chart for Determining Requirements for New Development

Revised March 2019

Appendix A-10

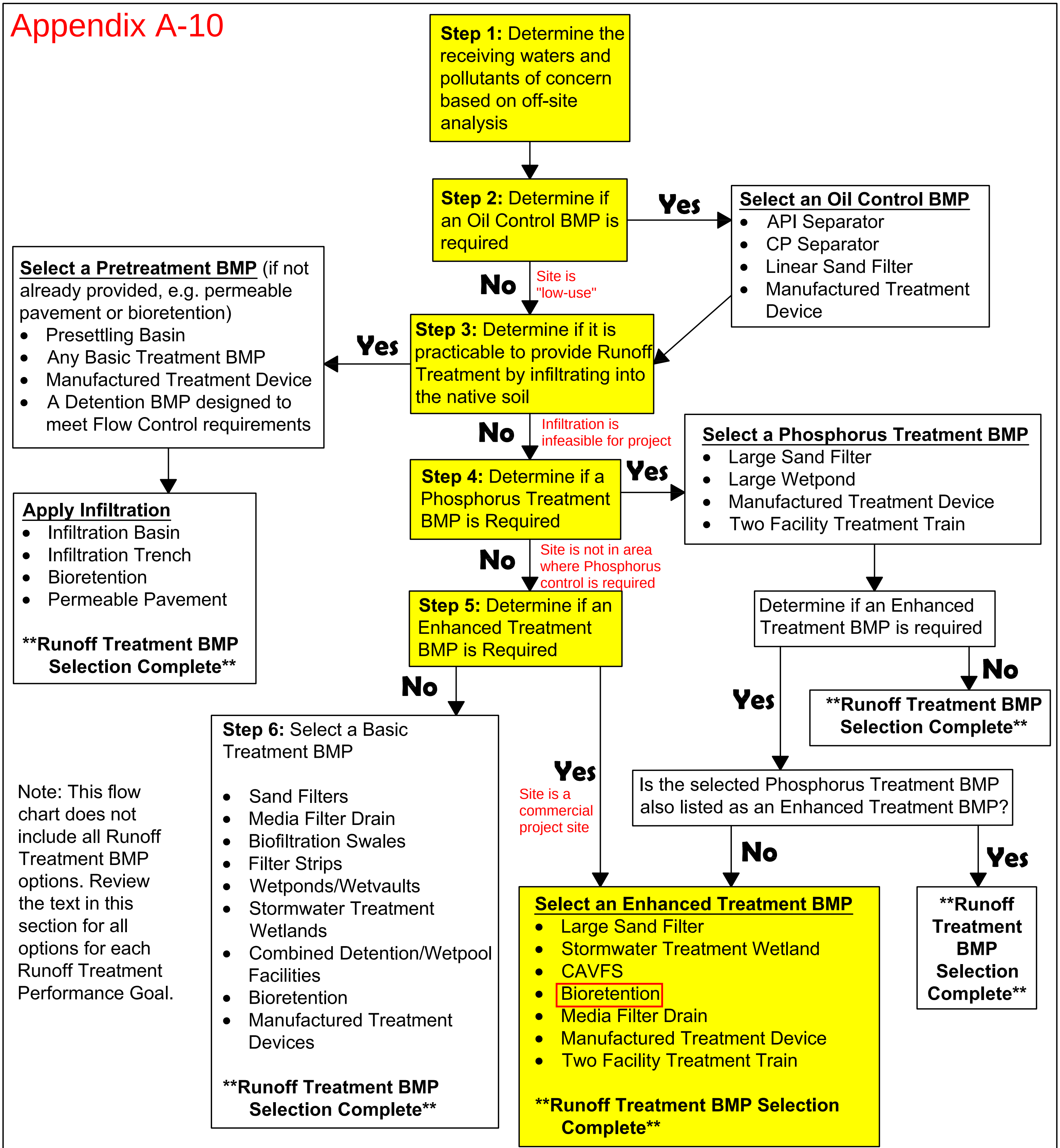


DEPARTMENT OF ECOLOGY
State of Washington

Flow Chart for Determining Requirements for Redevelopment

Revised March 2019

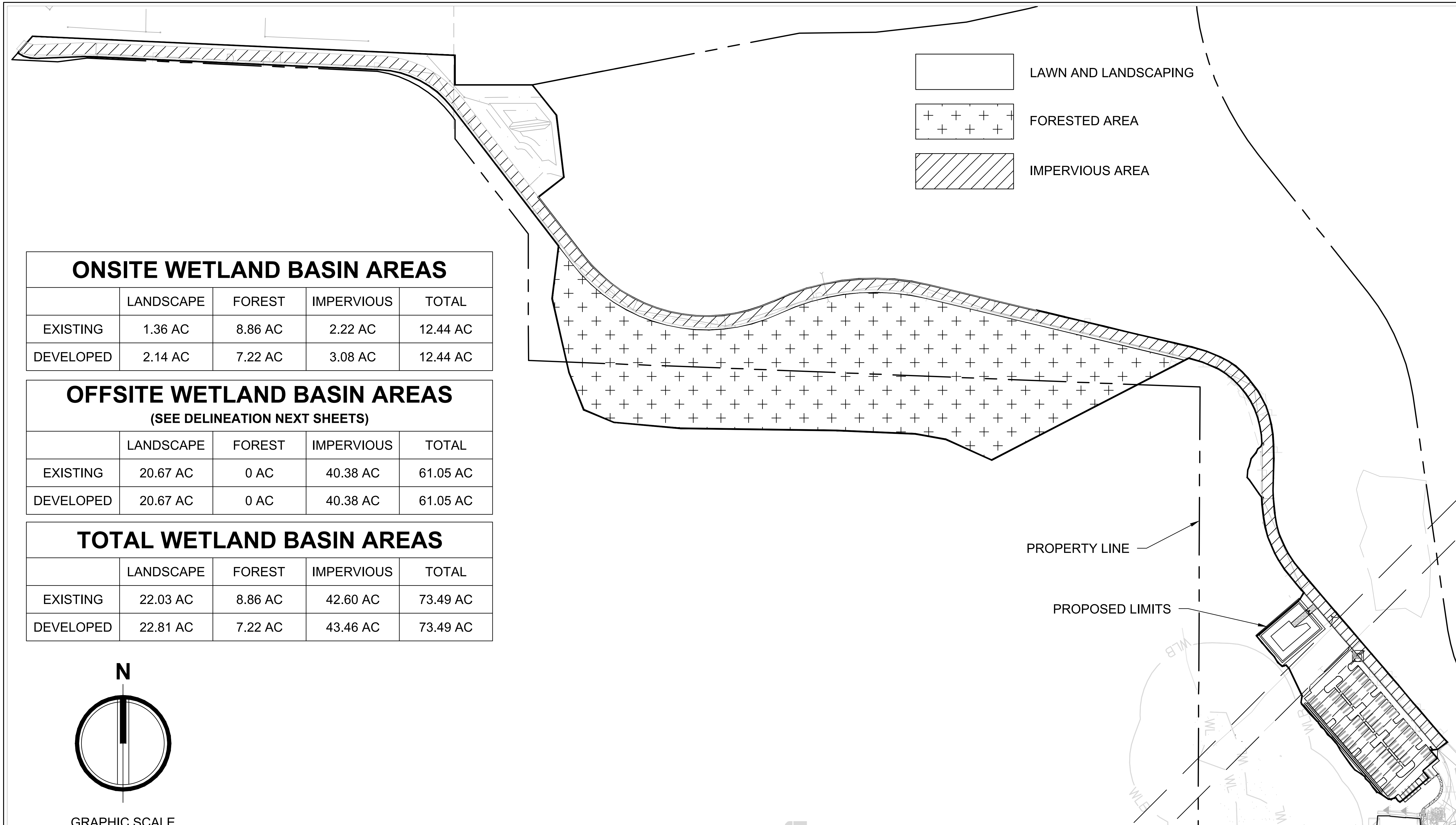
Appendix A-10



DEPARTMENT OF
ECOLOGY
State of Washington

Runoff Treatment BMP Selection Flow Chart

Revised January 2019



ONSITE WETLAND BASIN AREAS

	LANDSCAPE	FOREST	IMPERVIOUS	TOTAL
EXISTING	1.36 AC	8.86 AC	2.22 AC	12.44 AC
DEVELOPED	2.14 AC	7.22 AC	3.08 AC	12.44 AC

OFFSITE WETLAND BASIN AREAS

(SEE DELINEATION NEXT SHEETS)

	LANDSCAPE	FOREST	IMPERVIOUS	TOTAL
EXISTING	20.67 AC	0 AC	40.38 AC	61.05 AC
DEVELOPED	20.67 AC	0 AC	40.38 AC	61.05 AC

TOTAL WETLAND BASIN AREAS

	LANDSCAPE	FOREST	IMPERVIOUS	TOTAL
EXISTING	22.03 AC	8.86 AC	42.60 AC	73.49 AC
DEVELOPED	22.81 AC	7.22 AC	43.46 AC	73.49 AC

N

GRAPHIC SCALE

0 100 200 400

1" = 200 FEET

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316 Occidental Avenue South, Suite 320, Seattle, WA 98104 206.267.2425 TEL

PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

WETLAND BASIN MAP
ONSITE AREAS

A–11

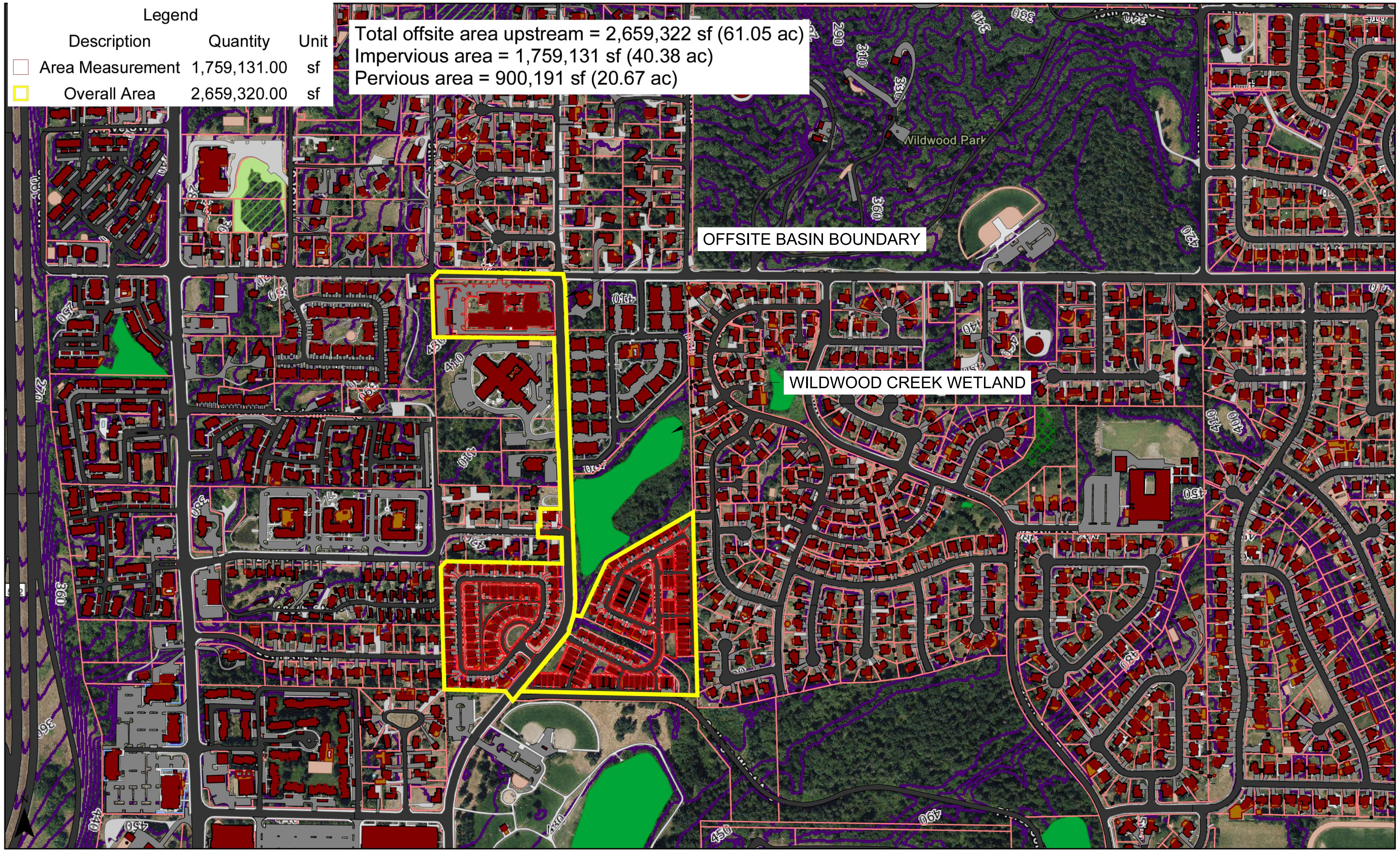
City of Puyallup Engineering Division

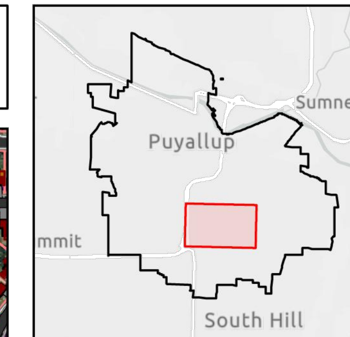
Pierce College Planimetrics 4

PUYALLUP WASHINGTON

Legend

Description	Quantity	Unit
Area Measurement	1,759,131.00	sf
Overall Area	2,659,320.00	sf





Planimetrics 2020

- Building
- Deck/Patio
- Paved Road
- Paved Driveway or Parking Lot
- Unpaved Driveway or Parking Lot
- Sidewalk
- Other Impermeable Surface

Tax Parcels

- Condominium
- Base Parcel
- Condominium

Wetlands

- Field-verified Delineated
- Field-verified
- Unverified
- Buffer

- 10ft Contour

- City Limits

0 0.17 0.35 0.7 mi

Scale: 1:9,028

Map produced using City of Puyallup GIS web apps.

Date: 8/21/2023

The printed information was derived from digital databases within the City of Puyallup GIS Portal. The City of Puyallup cannot accept responsibility for any errors, omissions, or positional accuracy, and therefore, there are no warranties which accompany this product. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

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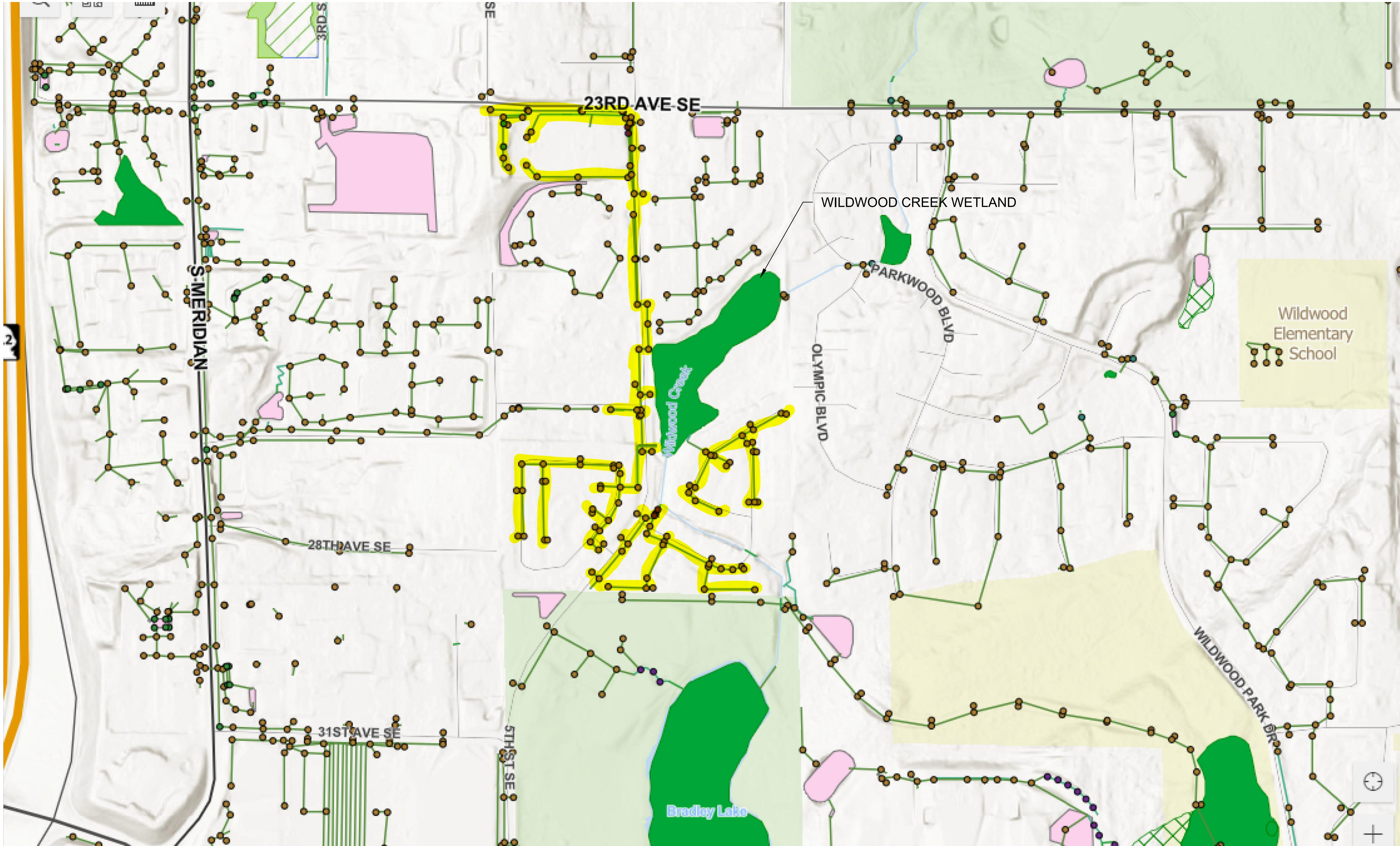
PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

WETLAND BASIN MAP
OFFSITE AREAS

A-11



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PIERCE COLLEGE PUYALLUP
CAMPUS PARKING EXPANSION

WETLAND BASIN MAP
OFFSITE STORM DRAINING TO WETLAND

A-11

Appendix A-12

Technical Information Report

PREPARED FOR:

MSGS Architects
510 Capital Way South
Olympia, WA 98501-1204

PROJECT:

Pierce College Puyallup
Arts and Allied Health Building
Phase 2
City of Puyallup, WA
204122.10

PREPARED BY:

Michael R. Norton, EIT
Project Engineer

REVIEWED BY:

James R. Carlsen, PE
Associate/Senior Project Manager

June 2007
Revised August 2007
Revised March 2008

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3-14-08

DOREEN S. GAVIN
STATE OF WASHINGTON
23467
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES: 8-27-09

I hereby state that this Technical Information Report for the Pierce College Puyallup Arts and Allied Health Building, Phase 2, has been prepared by me or under my supervision, and meets the standard of care and expertise that is usual and customary in this community for professional engineers. I understand that City of Puyallup does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

Technical Information Report

PREPARED FOR:

MSGS Architects
510 Capital Way South
Olympia, WA 98501-1204

PROJECT:

Pierce College Puyallup
Arts and Allied Health Building
Phase 2
City of Puyallup, WA
204122.10

PREPARED BY:

Michael R. Norton, EIT
Project Engineer

REVIEWED BY:

James R. Carlsen, PE
Associate/Senior Project Manager

June 2007
Revised August 2007
Revised March 2008

TABLE OF CONTENTS

APPENDICES

3.2 Downstream Analysis

In the developed condition, site runoff that enters the main conveyance system is directed into a detention facility located in the northwest corner of the project site. The remaining portion of the site is either piped or sheet flows to a small pond directly across the proposed fire lane from the main detention pond. Existing piping installed during Phase 1 activities allows the small pond to discharge to the main detention facility.

Flow control from the detention pond meets the criteria established by the City Standards. During the 2-year/24-hour design storm, the peak rate of runoff from the project site shall be no greater than 50 percent of the existing conditions 2-year/24-hour peak rate of runoff. During the 10-year/24-hour and 100-year/24-hour design storms, the peak rates of runoff from the new development shall be no greater than the existing condition 10-year and 100-year/24-hour peak rate of runoff. See Appendix B, Exhibit B-5 – Detention Pond Calculations.

Discharge from the detention pond is conveyed underneath the access road to the west and daylights at approximately 507.50, the existing point of discharge from the project site. Details for the existing outfall are provided in Appendix E – Existing Outfall Details.

Upon discharge from the detention pond, runoff generally parallels the Pierce College Puyallup Western Access Driveway on the southern side for approximately 375 feet, where it becomes blocked by a berm covering existing 26- and 30-inch natural gas lines. Runoff will soak into the underlying soils at approximately ¼-inch per hour for groundwater aquifer recharge. The infiltration rate of ¼-inch inch per hour is typical of gravelly loam with an applied safety factor of four (*KCSWDM* Table 4.5.2 – Maximum Infiltration Rates for Soil provided in Appendix B, Exhibit B-5 – Detention Pond Calculations). To provide an overflow path in case of inundation, an existing stub out on the southern side of the Pierce College Puyallup Western Access Driveway will be uncapped, allowing for overflow to enter into the driveway conveyance system, which was designed to accommodate stormwater runoff from the Health Education Center. The Health Education Center has not been connected to the driveway conveyance system, so the uncapped stub provides an effective means to convey any excess runoff if necessary.

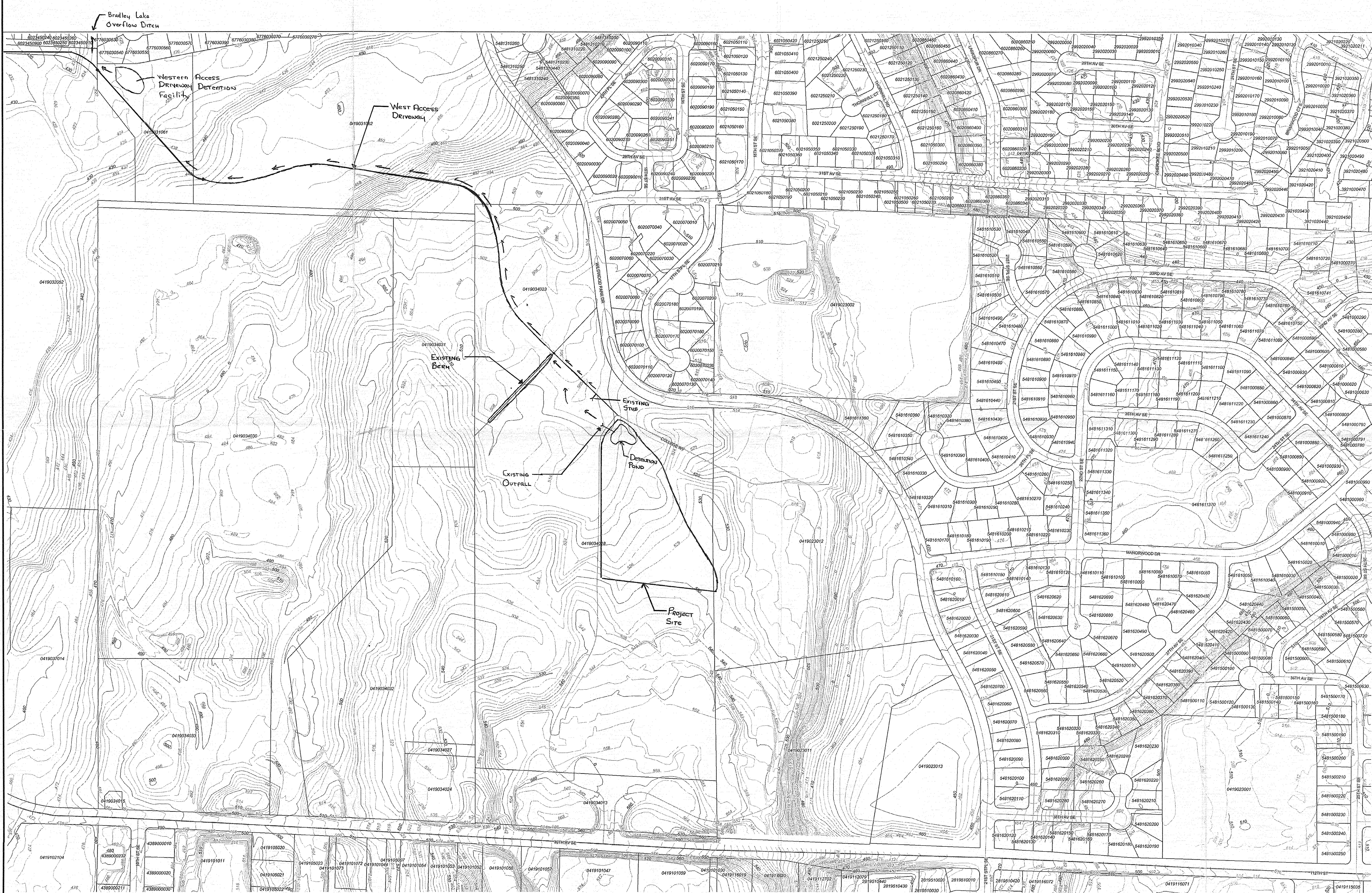
Once entering the Western Access Driveway conveyance system, it travels approximately ½ mile before entering the stormwater detention facility for the Western Access Driveway. The outlet from this facility is to the overflow ditch from Lake Bradley. See Appendix B, Exhibit B-6 – Topographic Map/Downstream Analysis.

A field reconnaissance was performed from the point of discharge from the Arts and Allied Health detention pond to the constricting berm covering the natural gas lines. Vegetation generally consists of forested areas with dense brush and grass. No evidence of erosion, scouring or previous flooding was present at the time of the visit.

Given that this project will be discharging at the existing location for the site at a rate no more than existing conditions during the 100-year/24-hour event, and that no evidence of problems due to runoff downstream were observed during field reconnaissance, it is anticipated that stormwater runoff from this project will have no downstream impact.

The project lies within the State Highway Basin according to the City of Puyallup Drainage Basins and Streams Map, included as Exhibit B-7 within Appendix B. More specifically, the site lies within the Fruitland Mutual Water Well No. 5 aquifer recharge area, designated as

Project Title: Pierce College Puyallup



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1200 6th Avenue, Suite 1620, Seattle, WA 98101
206-267-2425 Tel 206-267-2429 Fax

Map Legend

- Tax Parcels
- Contours - County
  - Intermediate Contour
  - Index Contour
- Contours - Cities
  - Intermediate Contour
  - Index Contour
- Roads
  - Interstate
  - Limited Access State Routes
  - Other State Routes
  - Ramps
  - Major Arterial
  - Collector
  - Local Access

B-6

Topographic Map / Downstream Analysis

Scale 1:2,400

0 200 400 ft.

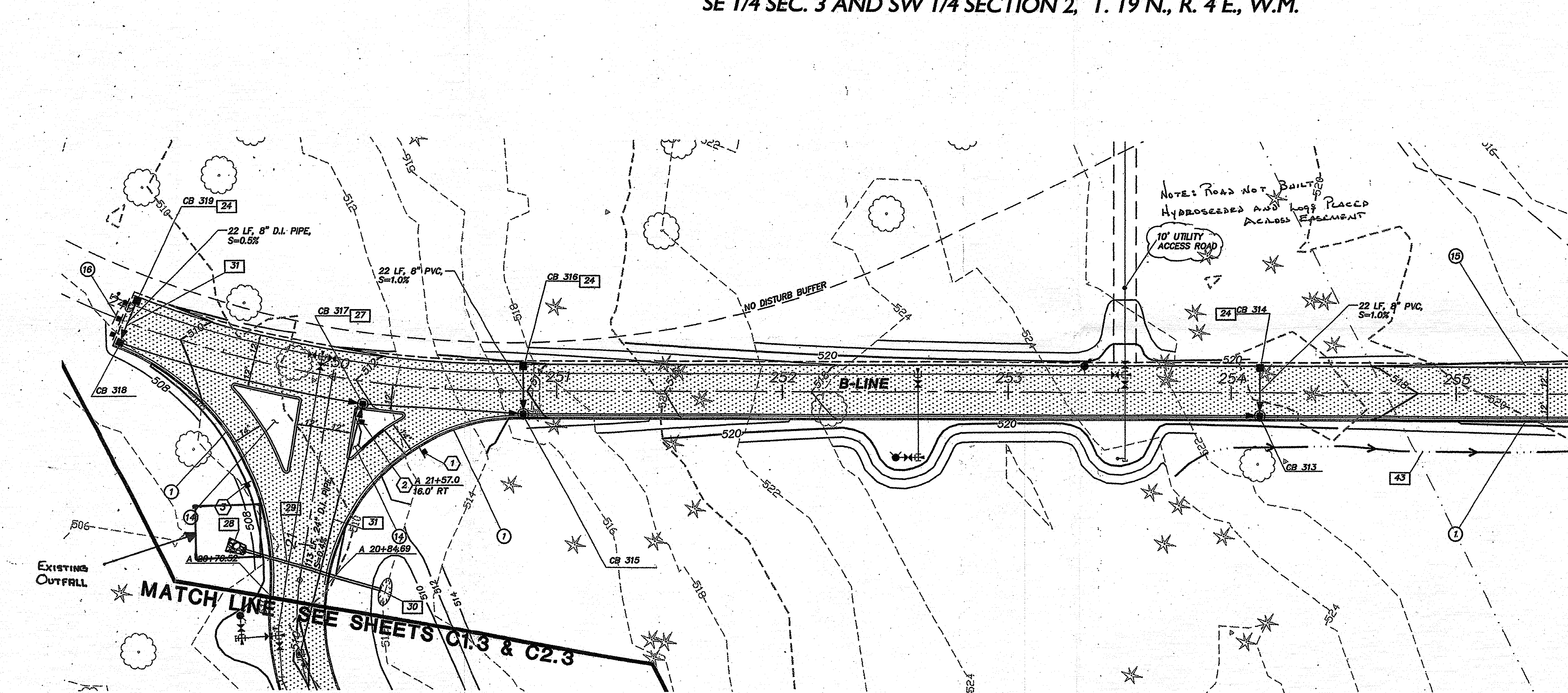
Printed: 2/26/08 1:43 PM

Map Notes: Contours

APPENDIX E

Existing Outfall Details

SE 1/4 SEC. 3 AND SW 1/4 SECTION 2, T. 19 N., R. 4 E., W.M.



SCALE IN FEET

HORIZ. 30 15 0 30 60

VERT. 5 0 5 10

4" HEAVY DUTY PAVEMENT SECTION

GENERAL NOTES:

1. SEE SHEET C0.2 FOR HORIZONTAL AND VERTICAL CONTROL DATA.
2. SEE SHEET C5.3 FOR TYPICAL ROADWAY SECTION.
3. SEE SHEET C5.12 FOR CITY OF PUYALLUP STANDARD NOTES.
4. SEE SHEET C5.13 FOR OTHER GENERAL NOTES.
5. ALL SIGNAGE SHALL BE IN ACCORDANCE WITH THE CITY OF PUYALLUP STANDARDS AND THE MOST RECENT VERSION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).

CONSTRUCTION NOTES:

1 CONSTRUCT CEMENT CONCRETE CURB AND GUTTER PER CITY STANDARD NO. 105.1, SEE SHEET C5.1 FOR DETAIL.

14 CONSTRUCT CEMENT CONCRETE RAISED ISLAND, SEE SHEET C5.5 FOR DETAIL.

15 CONSTRUCT ASPHALT CONCRETE RAISED EDGE, SEE DETAIL ON SHEET C5.3.

16 CONSTRUCT TYPE III BARRICADE PER CITY STANDARD NO. 112, SEE SHEET C5.2 FOR DETAIL.

SIGNING NOTES:

1 A 21+48.5 (44.6' RT) INSTALL 36" x36" x 36" R1-2 "YIELD SIGN" PER CITY STANDARD NO. 111.1, SEE SHEET C5.2 FOR DETAIL

2 A 21+57.0 (16.0' RT) INSTALL 30" x 30" R1-1 "STOP " SIGN PER CITY STANDARD NO. 111.1, SEE SHEET C5.2 FOR DETAIL.

3 A 21+21.5 (30.0' LT) INSTALL 36" x 36" x 36" R1-2 "YIELD" SIGN PER CITY STANDARD NO. 111.1, SEE SHEET C5.2 FOR DETAILS.

DRAINAGE CONSTRUCTION NOTES:

24 INSTALL VANED CATCH BASIN GRATE PER CITY STANDARD NO. 204 SEE SHEET C5.6 FOR DETAIL.

27 ROTATE TYPE 2-48 CATCH BASIN 180 DEGREES SUCH THAT ACCESS LADDER IS ON THE STREET SIDE OF THE GRATE.

28 CONSTRUCT ROCK DISPERSION PAD. SEE SHEET C6.2 FOR DETAIL.

29 INSTALL 65 LF 12" DUCTILE IRON PIPE TO INVERTS SHOWN. DUCTILE IRON PIPE SHALL BE CLASS 50, CONFORMING TO AWWA C151.

30 INSTALL TRASH RACKS ON EXPOSED PIPE ENDS PER CITY STANDARD NO. 209. SEE SHEET C5.11 FOR DETAIL.

31 DUCTILE IRON PIPE SHALL BE CLASS 50, CONFORMING TO AWWA C151.

43 CONSTRUCT RUNOFF CAPTURE DITCH PER TYPICAL ROADWAY SECTION. SEE SHEET C5.3. LINE DITCH WITH GRASS SEED.

SW QUADRANT

CURB RETURN ELEVATIONS (ELEVATIONS ARE TOP OF CURB)	
PC A 20+76.52 (12.0' LT)	510.78
1/4	510.94
1/2	510.77
3/4	510.30
PT B 249+03.72 (12.0' RT)	509.56

Δ=73°09'24"
R=110.00'
T=81.63'
L=140.45'

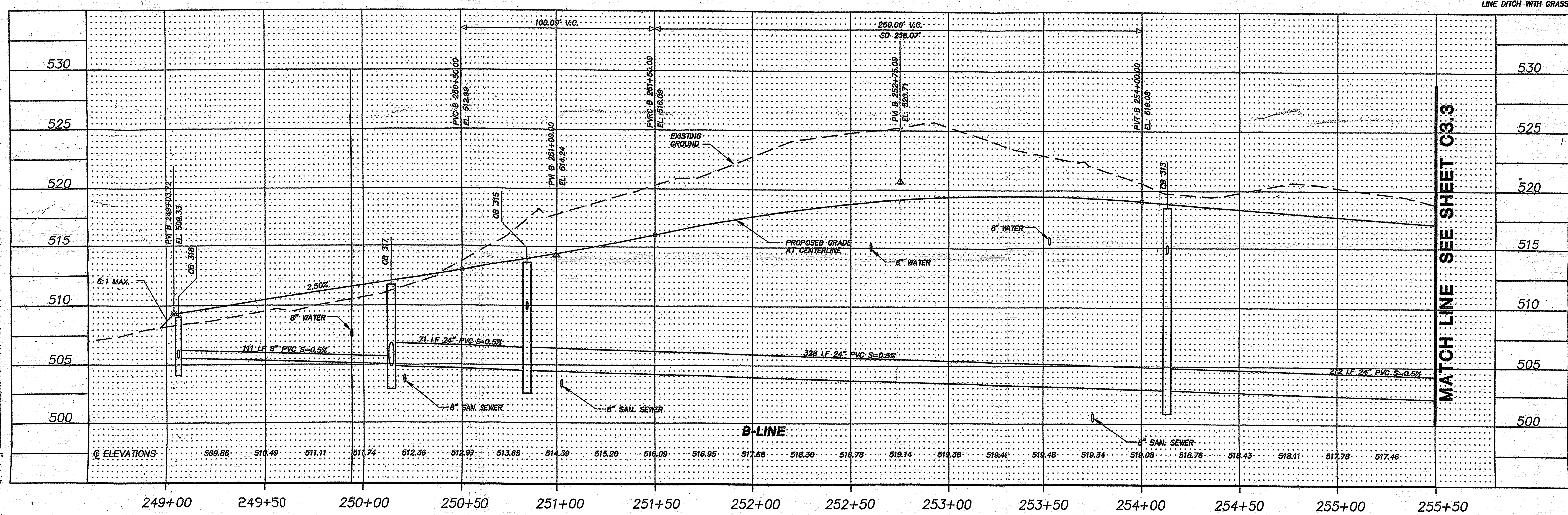
SE QUADRANT

CURB RETURN ELEVATIONS (ELEVATIONS ARE TOP OF CURB)	
PC A 20+84.69 (12.0' RT)	510.86
1/4	511.39
1/2	512.24
3/4	513.22
PT B 250+83.97 (12.0' RT)	514.14

Δ=80°30'29"
R=88.00'
T=74.51'
L=123.65'

CATCH BASIN TABLE

STRUCT.	STATION	OFFSET	TYPE	RIM	I.E. IN	I.E. OUT
313	B 254+13	10.34 RT	2-48	518.57	514.59 (8" NE) 502.87 (24" NW)	502.87 (24" SE)
314	B 254+13	12.0 LT	1	518.68		514.81 (8" SW)
315	B 250+85	10.34 RT	2-48	513.59	509.65 (8" NE) 504.51 (24" NW)	504.51 (24" SE)
316	B 250+85	12.0 LT	1	513.70		509.87 (8" SW)
317	B 250+14	12.0 RT	2-48	511.74	505.03 (8" NW) 504.87 (24" SW)	504.87 (24" SE)
318	B 249+06	10.34 RT	1	509.05	505.59 (8" NE)	505.59 (8" SE)
319	B 249+06	12.0 LT	1	509.15		505.70 (8" SW)



APPROVED

BY [signature] CITY OF PUYALLUP ENGINEERING DEPARTMENT

DATE 6/02/03

NOTE:
This approval is void after 1 year from approval date.

The City will not be responsible for errors and/or omissions of these plans.

Field conditions may dictate changes to these plans as determined by the city engineer.

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STATE OF WASHINGTON
26874
REGISTERED PROFESSIONAL ENGINEER
5/30/03
EXPIRES: 11/21/03

Pierce College Puyallup

College Center Building
Pierce College
Puyallup, Washington

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UTILITY RD NOT CONSTRUCTED

REVISIONS:

REVISION NUMBER	IN PROGRESS	NO CHANGES THIS SHEET	REVISION EDITION CLOSING DATE

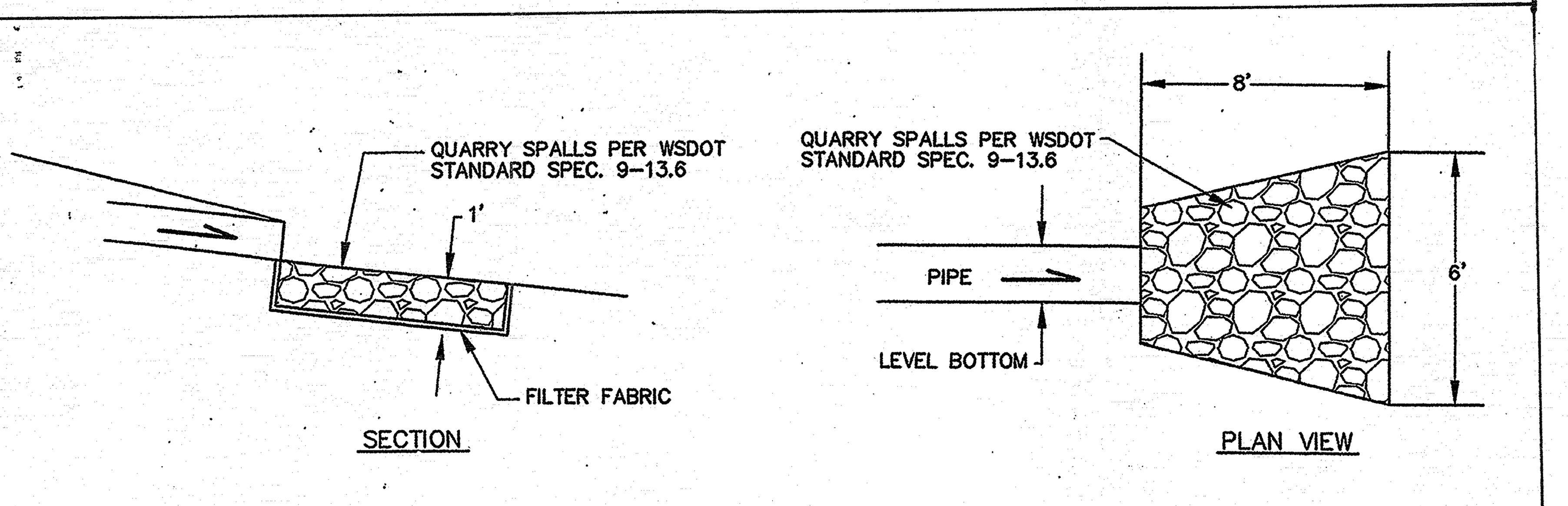
date May 2003
designed by MJJ
drawn by LER/JMB
checked by TPA
approved by TPA

Sheet Title
B-LINE PLAN & PROFILE

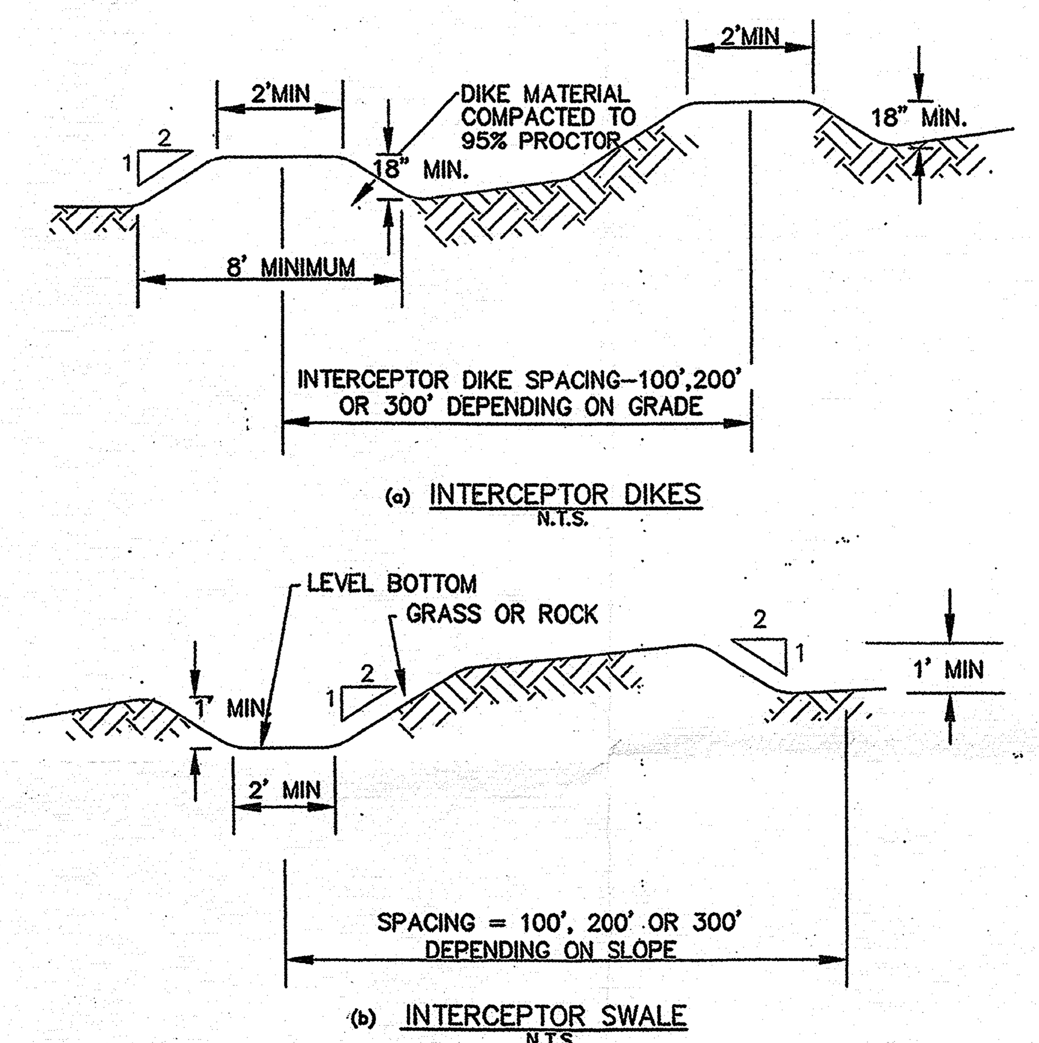
Sheet No.
C3.2

17 of 41
Job No.

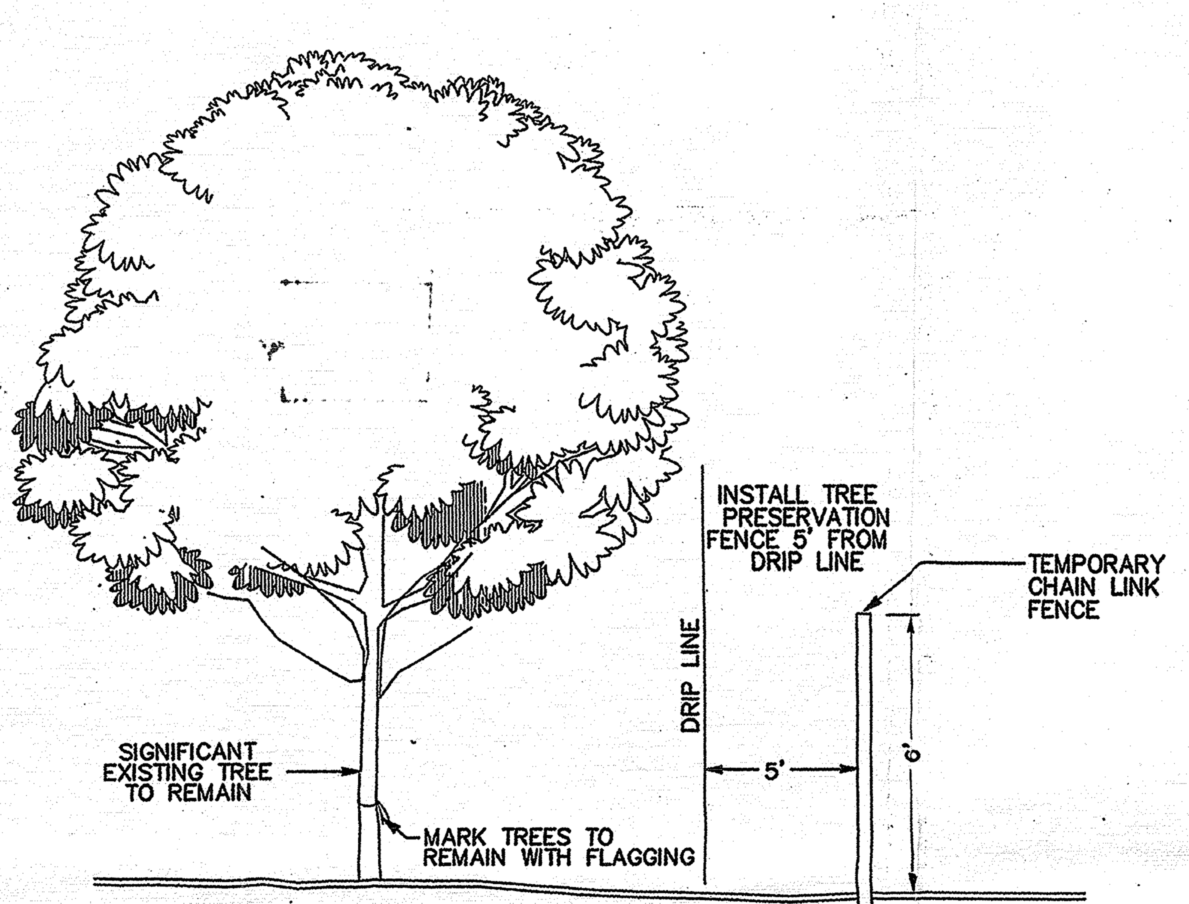
State Project No.
2000-050 G (1-1)



ROCK DISPERSION PAD
N.T.S.



TEMPORARY INTERCEPTOR DIKES AND SWALES
N.T.S.



TYPICAL EXISTING TREE PROTECTION
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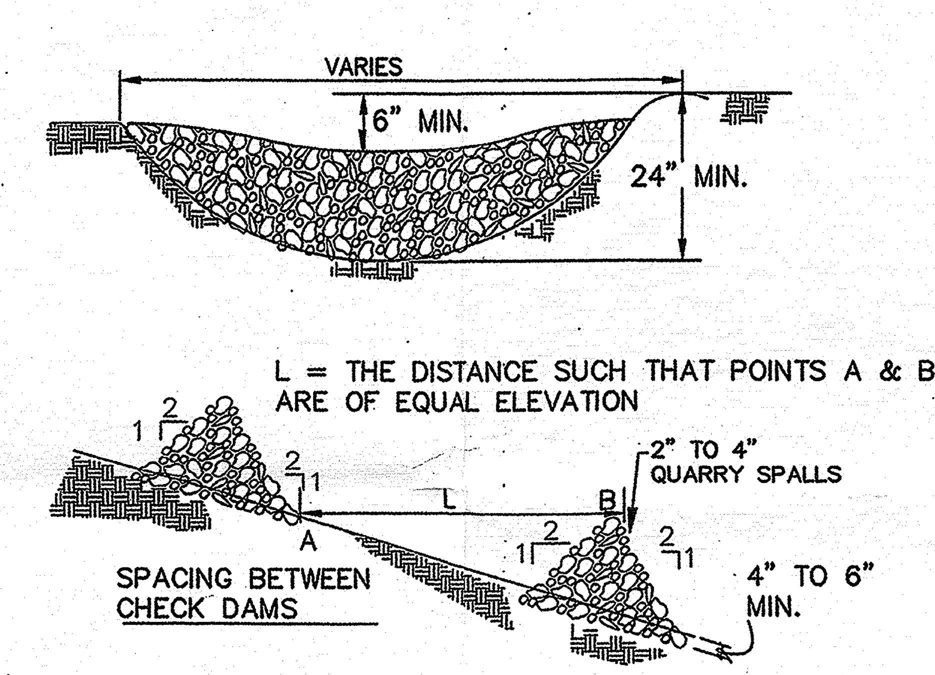


ROCK CHECK DAMS
N.T.S.

GENERAL NOTES:

1. EROSION CONTROL MEASURES ARE NOT LIMITED TO THE ITEMS ON THESE PLANS. THE CONTRACTOR IS RESPONSIBLE FOR THE INSTALLATION AND MAINTENANCE OF ALL EROSION CONTROL MEASURES. NO SILTATION OF EXISTING OR PROPOSED DRAINAGE FACILITIES SHALL BE ALLOWED. CONTRACTOR IS RESPONSIBLE FOR ANY MIGRATION OF SEDIMENTS TO OFF-SITE PROPERTIES.
2. EROSION AND SEDIMENTATION CONTROL FACILITIES SHALL BE INSPECTED AFTER EACH STORM EVENT AND DAILY DURING PROLONGED RAINFALL. REPAIRS TO OR REPLACEMENT OF EROSION AND SEDIMENTATION CONTROL FACILITIES SHALL BE ACCOMPLISHED PROMPTLY.
3. GRADING SHOWN IS CONCEPTUAL FOR PURPOSES OF TEMPORARY EROSION AND SEDIMENT CONTROL. CONTRACTOR SHALL ESTABLISH PRELIMINARY GRADING BASED ON FINAL GRADING PLANS, SECTIONS AND DETAILS OF THE PLANS.
4. SOILS SHALL BE STOCKPILED WITHIN THE FOOTPRINT OF THE PROPOSED PARKING LOT ON HIGHER POSITIONS TO MINIMIZE CONTACT WITH SURFACE WATER. SOIL SHALL BE PILED AND COVERED WITH PLASTIC. PLASTIC SHALL BE ANCHORED WITH SANDBAGS AND STAKES.
5. TURBID WATER FROM DEWATERING OF EXCAVATIONS SHALL BE DIRECTED TO THE SEDIMENT TRAP OR POND.
6. ALL DISTURBED AREAS SUCH AS DETENTION FACILITIES, ROADWAY BACK SLOPES, ETC. SHALL BE SEEDED WITH A PERENNIAL GROUND COVER GRASS TO MINIMIZE EROSION. GRASS SEEDING SHALL BE DONE USING AN APPROVED HYDROSEEDER OR AS OTHERWISE APPROVED BY THE CITY OF PUYALLUP.
7. SEEDING: SEED MIXTURE SHALL BE 40% RED CREEPING FESCUE, 40% PERENNIAL RYEGRASS, 10% HIGHLAND BENGRASS AND 10% WHITE CLOVER AND SHALL BE APPLIED AT THE RATE OF 40-80 POUNDS PER ACRE DEPENDING ON THE SLOPE. SOIL MUST BE LOOSE ENOUGH FOR THE ROOTS TO ESTABLISH.
8. FERTILIZER: SHALL BE APPLIED AT 400# PER ACRE OF 10-20-20 (10 POUNDS PER 1100 SQUARE FEET) OR EQUIVALENT.
9. SEDIMENT DEPOSITS REMAINING IN PLACE AFTER THE EROSION AND SEDIMENTATION CONTROL FACILITIES ARE NO LONGER NEEDED SHALL BE EITHER DRESSED TO CONFORM TO THE EXISTING GRADE, PREPARED AND SEEDED, OR DISPOSED OF OFFSITE AT AN APPROVED LOCATION, AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
10. SEE SHEET C5.12 FOR CITY OF PUYALLUP EROSION AND SEDIMENTION CONTROL NOTES.

TESC CONSTRUCTION NOTES:

1 PRIOR TO ANY CLEARING AND GRADING, STAKE AND FLAG CLEARING LIMITS. AREAS WITHIN CLEARING LIMITS BUT NOT INDICATED AS TREE PROTECTION AREAS ARE TO BE CLEARED. CONTRACTOR WILL REMOVE AND PROPERLY DISPOSE OF ALL PLANTS, TREES, AND VEGETATION EXCEPT AS NOTED.

2 ERECT 6' CHAIN LINK FENCE AROUND ALL TREE PROTECTION ZONES AS INDICATED, SEE DETAIL THIS SHEET. NOTIFY LANDSCAPE ARCHITECT FOR REVIEW OF FENCE LOCATION AND TO VERIFY THAT TREE PROTECTION MEASURES ARE IN PLACE PRIOR TO ANY CLEARING WORK. TREE PROTECTION MEASURES ARE TO REMAIN IN PLACE THROUGH THE DURATION OF CONSTRUCTION. NO HEAVY EQUIPMENT, NO STOCKPILING OF MATERIALS OR STORAGE ALLOWED WITHIN TREE PROTECTION AREAS. THE ONLY EXCEPTION TO THIS WOULD BE DURING REMOVAL OF HAZARDOUS TREES FOR SHORT INTERVALS ONLY.

3 ERECT ORANGE MESH WETLAND BUFFER FENCE AROUND BUFFER PROTECTION ZONE AS INDICATED. NOTIFY LANDSCAPE ARCHITECT FOR REVIEW OF FENCE LOCATION AND TO VERIFY THAT WETLAND PROTECTION MEASURES ARE IN PLACE PRIOR TO ANY CLEARING WORK. WETLAND PROTECTION MEASURES ARE TO REMAIN IN PLACE THROUGH THE DURATION OF CONSTRUCTION.

4 CONSTRUCT FILTER FABRIC FENCE PER CITY STANDARD NO. 210. SEE SHEET C6.3 FOR DETAIL.

5 TEMPORARY BOULDER STOCKPILE AREA. TO BE USED FOR EXCAVATED BOULDERS THAT WILL ULTIMATELY BE INCORPORATED INTO LANDSCAPING. THIS AREA SHALL BE GRADED TO PROVIDE DRAINAGE TOWARD TEMPORARY INTERCEPTOR DITCHES AND THE SEDIMENT TRAP. BOULDERS SHALL BE COVERED WITH PLASTIC. ANCHOR PLASTIC WITH SANDBAGS AND STAKES. UPON COMPLETION OF BOULDER INSTALLATION, THIS AREA SHALL BE GRADED TO FINAL GRADE AND HYDROSEEDED UNLESS OTHERWISE SPECIFIED ON LANDSCAPING PLAN.

6 TEMPORARY BOULDER STOCKPILE AREA. TO BE USED FOR EXCAVATED STONES THAT ARE LARGER THAN 3-MAN STONES. THIS AREA SHALL BE GRADED TO PROVIDE DRAINAGE TOWARD TEMPORARY INTERCEPTOR DITCHES AND/OR THE SEDIMENT POND. BOULDERS SHALL BE COVERED WITH PLASTIC. ANCHOR PLASTIC WITH SANDBAGS AND STAKES.

7 CONSTRUCT TEMPORARY SEDIMENT POND PER DETAILS ON THIS SHEET. RISER PIPE SHALL BE MARKED ONE FOOT ABOVE THE BOTTOM OF THE POND. SEDIMENT SHALL BE REMOVED FROM THE POND AFTER EACH STORM EVENT OR WHEN THE DEPTH OF SEDIMENT REACHES ONE FOOT. SEDIMENT WILL BE PROPERLY DISPOSED OF OFFSITE OR SHALL BE VEGETATED OR OTHERWISE STABILIZED ONSITE. SEDIMENT SHALL NOT BE CONSIDERED SUITABLE FOR STRUCTURAL BACKFILL.

8 CONSTRUCT TEMPORARY SEDIMENT TRAP PER DETAILS ON THIS SHEET. A STAFF GAGE SHALL BE INSTALLED WITH A PROMINENT MARK ONE FOOT ABOVE THE BOTTOM OF THE TRAP. SEDIMENT WILL BE REMOVED AFTER EACH STORM EVENT OR WHEN THE DEPTH OF SEDIMENT REACHES ONE FOOT. SEDIMENT SHALL BE PROPERLY DISPOSED OF OFF-SITE OR SHALL BE VEGETATED OR OTHERWISE STABILIZED ON-SITE. SEDIMENT SHALL NOT BE CONSIDERED SUITABLE FOR STRUCTURAL BACKFILL.

9 CONSTRUCT INTERCEPTOR SWALE PER DETAIL ON THIS SHEET, WITH 200' MAXIMUM SPACING. LOCATIONS SHOWN ARE APPROXIMATE; CONTRACTOR TO DETERMINE FINAL LOCATION. GRADE FOR POSITIVE DRAINAGE, WITH MAXIMUM SLOPE = 3.0%. SWALES SHALL BE SEEDED OR OTHERWISE STABILIZED PRIOR TO ANY CLEARING OR GRADING ACTIVITIES.

10 CONSTRUCT INTERCEPTOR DIKE PER DETAIL ON THIS SHEET. GRADE UPSLOPE SIDE TO ACHIEVE POSITIVE DRAINAGE TOWARD PIPE SLOPE DRAIN OR ROCK DISPERSION PAD.

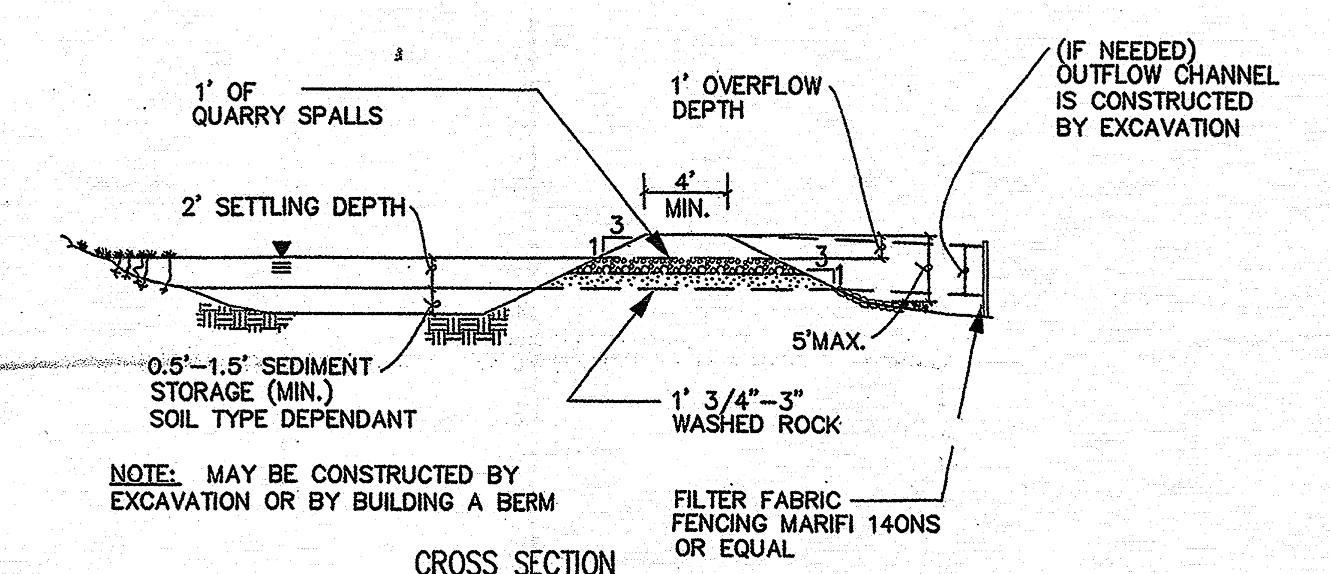
11 CONSTRUCT CHECK DAM PER DETAIL ON THIS SHEET. LOCATIONS SHOWN ARE APPROXIMATE; CONTRACTOR TO DETERMINE FINAL NUMBER AND LOCATIONS. CHECK DAMS SHALL BE INSPECTED AFTER EACH STORM EVENT AND REPAIRED AS NECESSARY. SEDIMENT SHALL BE REMOVED WHEN DEPTH OF SEDIMENTS EQUALS ONE-HALF THE CHECK DAM HEIGHT OR ONE FOOT, WHICHEVER IS LOWER.

12 INSTALL TEMPORARY 12" CMP, 65 LF.

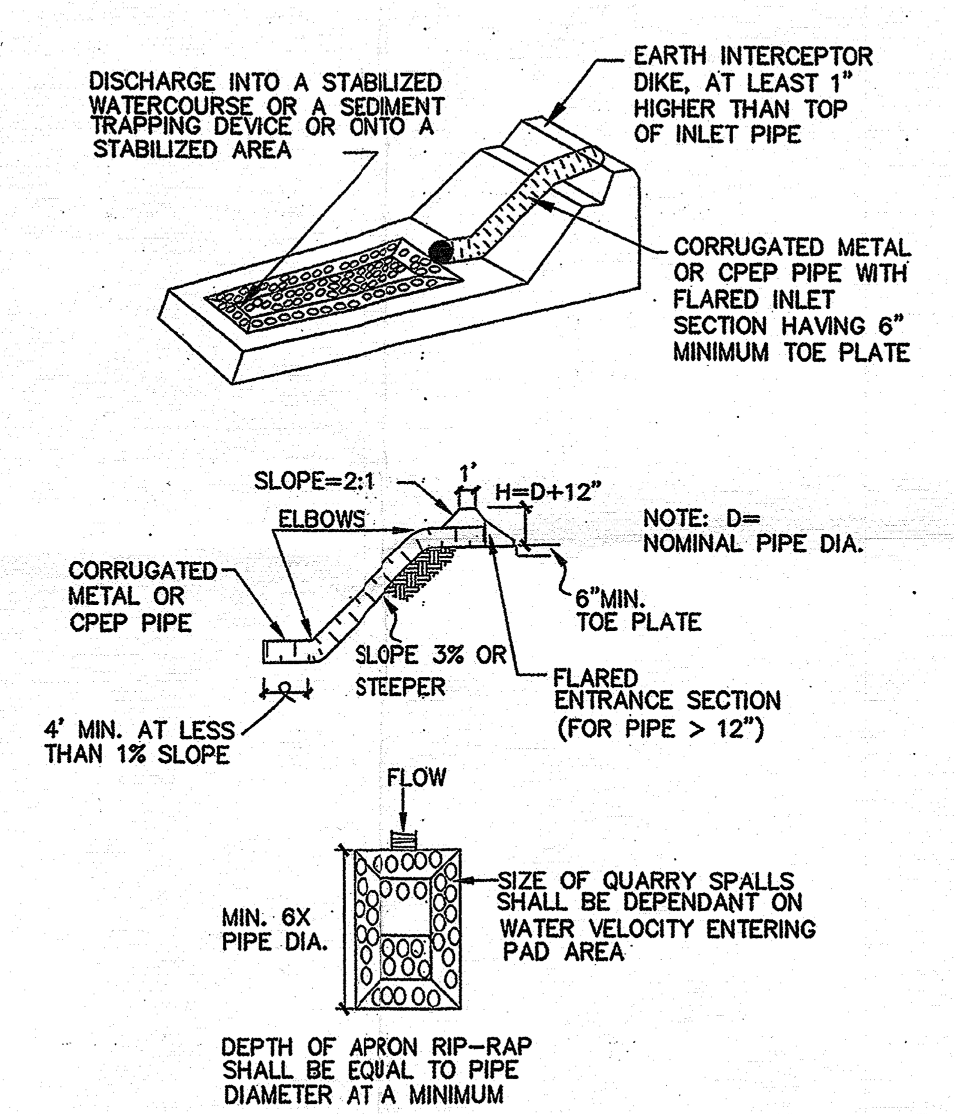
13 CONSTRUCT ROCK DISPERSION PAD PER DETAIL ON THIS SHEET.

14 CONSTRUCT PIPE SLOPE DRAIN PER DETAIL ON THIS SHEET.

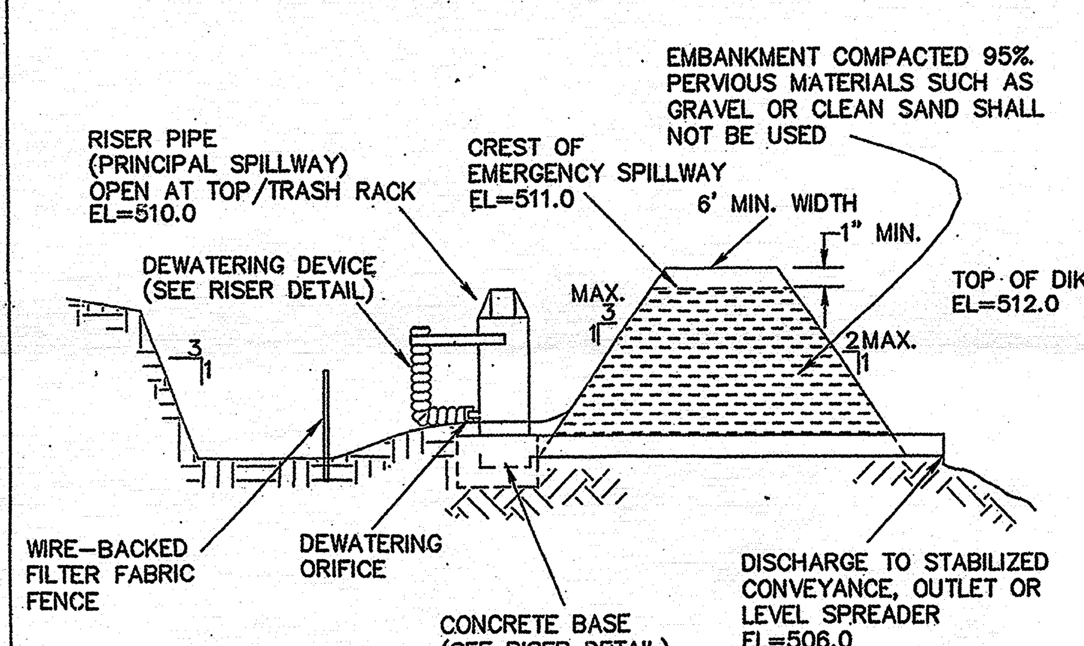
15 CONSTRUCT CONSTRUCTION ENTRANCE PER CITY STANDARD NO. 116.1. SEE SHEET C6.3 FOR DETAIL. CONTRACTOR SHALL PROVIDE CONSTRUCTION ENTRANCE AT ALL POINTS OF ENTRY FROM EXISTING PAVED AREAS.



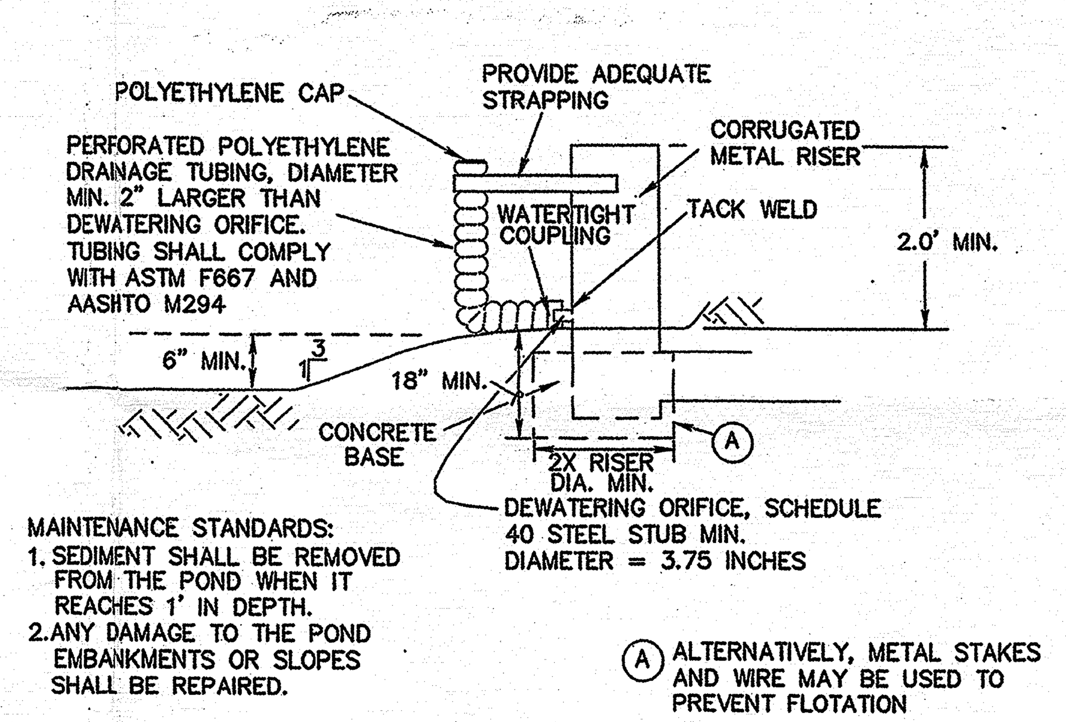
SEDIMENT TRAP
N.T.S.



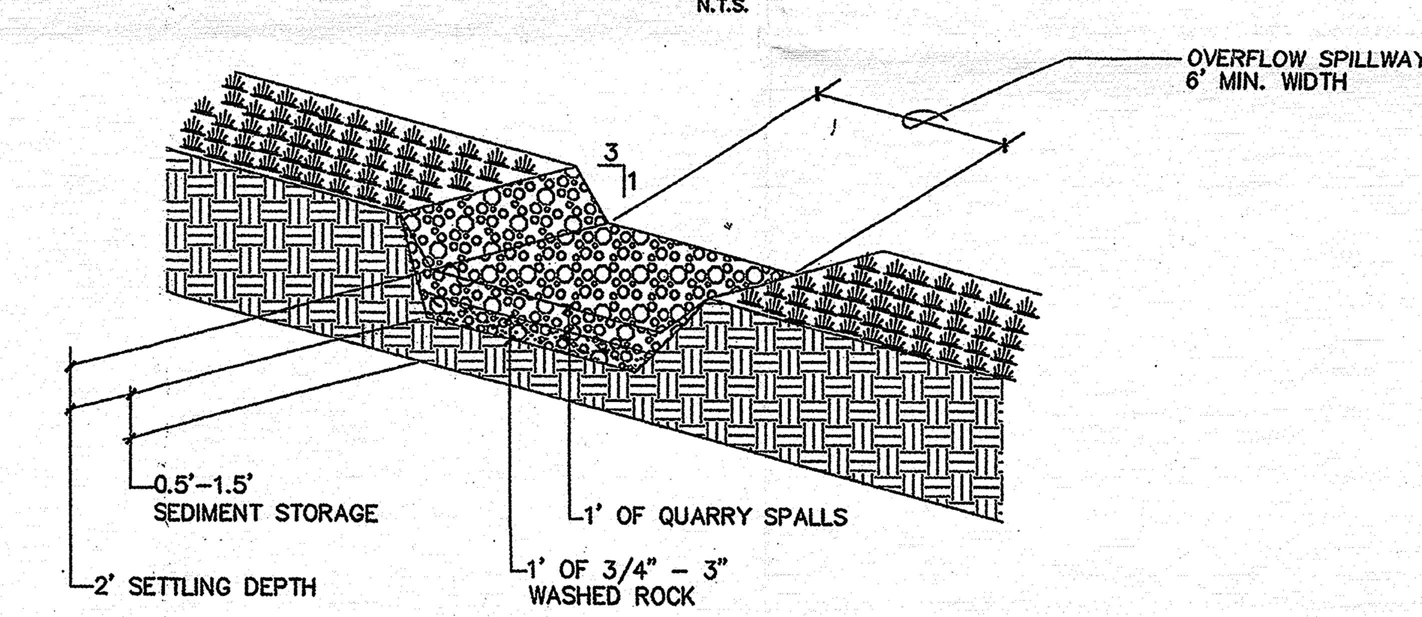
PIPE SLOPE DRAINS
N.T.S.



SEDIMENT POND CROSS-SECTION
N.T.S.



SEDIMENT POND RISER DETAIL
N.T.S.



SEDIMENT TRAP OUTLET
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5/30/03
EXPIRES: 11/21/03

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REVISIONS:

REVISION NUMBER	IN PROGRESS	NO CHANGES THIS SHEET	REVISION EDITION CLOSING DATE

date May 2003
designed by MJJ
drawn by LER/JMB
checked by TPA
approved by TPA

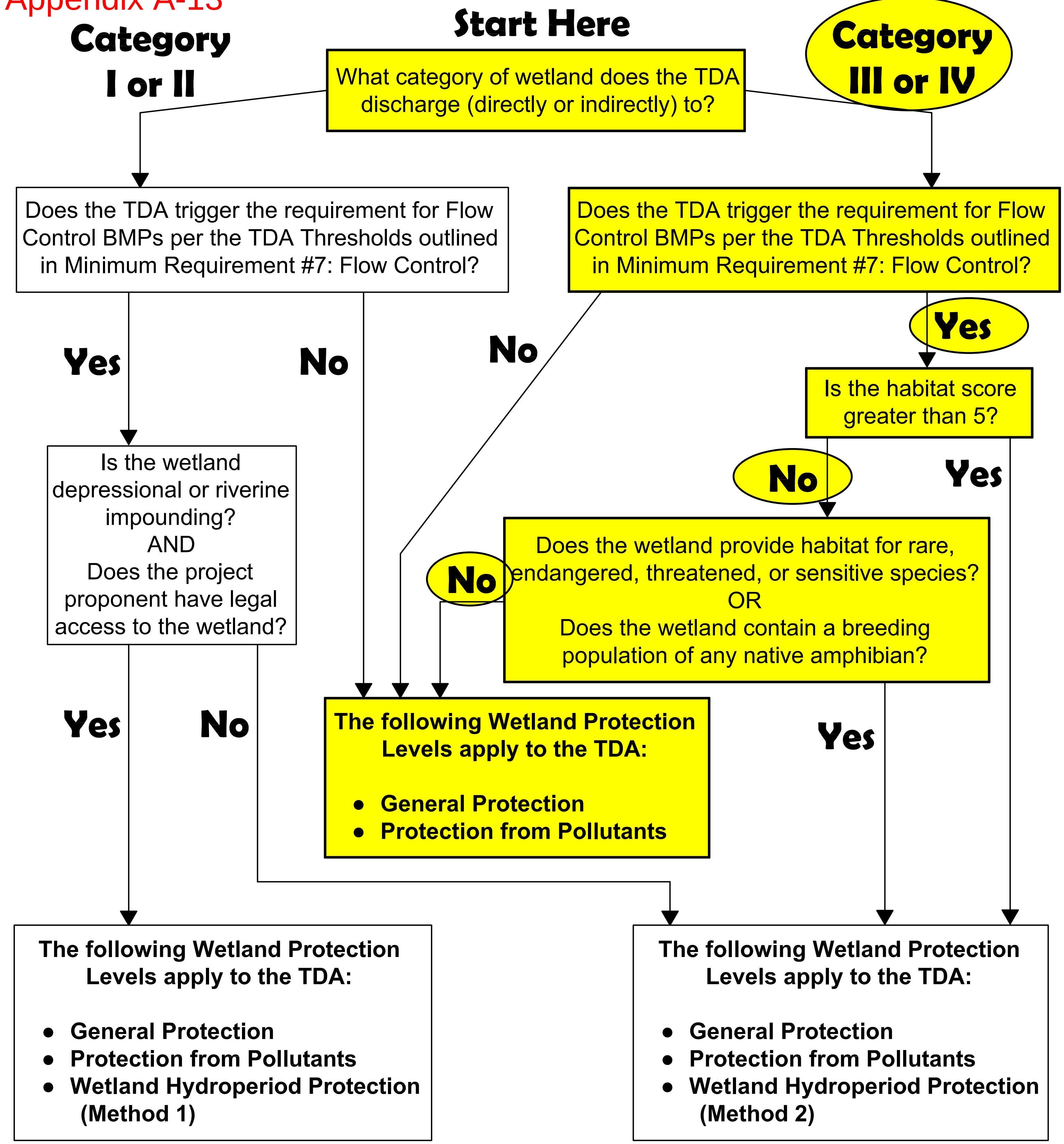
Sheet Title
EROSION CONTROL DETAILS AND NOTES

Sheet No.
C6.2

Job No.

State Project No.
2000-050 G (1-1)

Appendix A-13



DEPARTMENT OF ECOLOGY
State of Washington

Flow Chart for Determining the Wetland Protection Levels Required

Revised May 2019

Appendix B

Flow Control, Water Quality, Wetland Hydroperiod, and Conveyance Calculations

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 20240102 Lot A Detention Pond

Site Name:	Pierce College Puyallup
Site Address:	1601 39th AVE SE
City:	Puyallup, WA 98374
Report Date:	1/2/2024
Gage:	40 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/03/31
Version:	4.2.19

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	1.61
Pervious Total	1.61
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.61

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	0.73
Pervious Total	0.73
Impervious Land Use	acre
SIDEWALKS FLAT	0.02
PARKING FLAT	0.86
Impervious Total	0.88
Basin Total	1.61

Routing Elements
Predeveloped Routing

Mitigated Routing

Trapezoidal Pond 1

Bottom Length:	82.00 ft.
Bottom Width:	32.00 ft.
Depth:	6 ft.
Volume at riser head:	0.5319 acre-feet.
Side slope 1:	3 To 1
Side slope 2:	3 To 1
Side slope 3:	3 To 1
Side slope 4:	3 To 1
Discharge Structure	
Riser Height:	5 ft.
Riser Diameter:	36 in.
Orifice 1 Diameter:	0.550 in. Elevation:0.5 ft.
Orifice 2 Diameter:	0.500 in. Elevation:3.8 ft.
Orifice 3 Diameter:	1.400 in. Elevation:4.3 ft.
Element Flows To:	

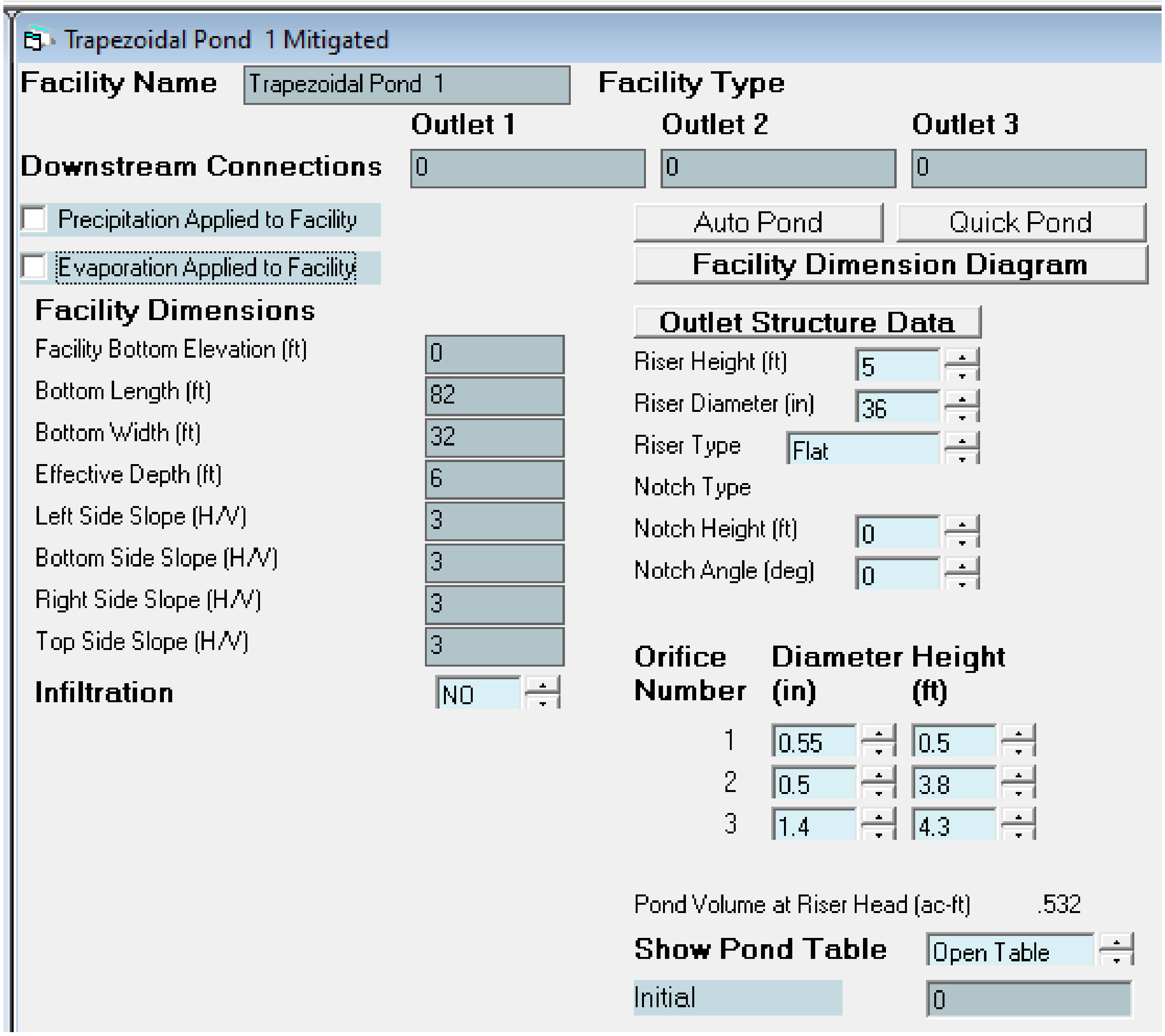
Outlet 1 Outlet 2

Pond Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.060	0.000	0.000	0.000
0.0667	0.061	0.004	0.000	0.000
0.1333	0.062	0.008	0.000	0.000
0.2000	0.063	0.012	0.000	0.000
0.2667	0.064	0.016	0.000	0.000
0.3333	0.065	0.021	0.000	0.000
0.4000	0.066	0.025	0.000	0.000
0.4667	0.067	0.029	0.000	0.000
0.5333	0.068	0.034	0.001	0.000
0.6000	0.070	0.039	0.002	0.000
0.6667	0.071	0.043	0.003	0.000
0.7333	0.072	0.048	0.004	0.000
0.8000	0.073	0.053	0.004	0.000
0.8667	0.074	0.058	0.005	0.000
0.9333	0.075	0.063	0.005	0.000
1.0000	0.076	0.068	0.005	0.000
1.0667	0.077	0.073	0.006	0.000
1.1333	0.079	0.078	0.006	0.000
1.2000	0.080	0.084	0.006	0.000
1.2667	0.081	0.089	0.007	0.000
1.3333	0.082	0.094	0.007	0.000
1.4000	0.083	0.100	0.007	0.000
1.4667	0.085	0.106	0.008	0.000
1.5333	0.086	0.111	0.008	0.000
1.6000	0.087	0.117	0.008	0.000
1.6667	0.088	0.123	0.008	0.000
1.7333	0.089	0.129	0.009	0.000
1.8000	0.091	0.135	0.009	0.000
1.8667	0.092	0.141	0.009	0.000
1.9333	0.093	0.147	0.009	0.000
2.0000	0.094	0.154	0.010	0.000
2.0667	0.096	0.160	0.010	0.000
2.1333	0.097	0.166	0.010	0.000

2.2000	0.098	0.173	0.010	0.000
2.2667	0.100	0.180	0.010	0.000
2.3333	0.101	0.186	0.011	0.000
2.4000	0.102	0.193	0.011	0.000
2.4667	0.104	0.200	0.011	0.000
2.5333	0.105	0.207	0.011	0.000
2.6000	0.106	0.214	0.011	0.000
2.6667	0.108	0.221	0.012	0.000
2.7333	0.109	0.228	0.012	0.000
2.8000	0.110	0.236	0.012	0.000
2.8667	0.112	0.243	0.012	0.000
2.9333	0.113	0.251	0.012	0.000
3.0000	0.114	0.258	0.013	0.000
3.0667	0.116	0.266	0.013	0.000
3.1333	0.117	0.274	0.013	0.000
3.2000	0.118	0.282	0.013	0.000
3.2667	0.120	0.290	0.013	0.000
3.3333	0.121	0.298	0.013	0.000
3.4000	0.123	0.306	0.014	0.000
3.4667	0.124	0.314	0.014	0.000
3.5333	0.126	0.323	0.014	0.000
3.6000	0.127	0.331	0.014	0.000
3.6667	0.128	0.340	0.014	0.000
3.7333	0.130	0.348	0.014	0.000
3.8000	0.131	0.357	0.014	0.000
3.8667	0.133	0.366	0.016	0.000
3.9333	0.134	0.375	0.017	0.000
4.0000	0.136	0.384	0.018	0.000
4.0667	0.137	0.393	0.019	0.000
4.1333	0.139	0.402	0.019	0.000
4.2000	0.140	0.411	0.020	0.000
4.2667	0.142	0.421	0.020	0.000
4.3333	0.143	0.430	0.030	0.000
4.4000	0.145	0.440	0.038	0.000
4.4667	0.146	0.450	0.043	0.000
4.5333	0.148	0.460	0.048	0.000
4.6000	0.150	0.470	0.051	0.000
4.6667	0.151	0.480	0.055	0.000
4.7333	0.153	0.490	0.058	0.000
4.8000	0.154	0.500	0.061	0.000
4.8667	0.156	0.510	0.064	0.000
4.9333	0.157	0.521	0.066	0.000
5.0000	0.159	0.531	0.069	0.000
5.0667	0.161	0.542	0.619	0.000
5.1333	0.162	0.553	1.622	0.000
5.2000	0.164	0.564	2.917	0.000
5.2667	0.165	0.575	4.442	0.000
5.3333	0.167	0.586	6.157	0.000
5.4000	0.169	0.597	8.027	0.000
5.4667	0.170	0.608	10.01	0.000
5.5333	0.172	0.620	12.10	0.000
5.6000	0.174	0.631	14.23	0.000
5.6667	0.175	0.643	16.39	0.000
5.7333	0.177	0.655	18.54	0.000
5.8000	0.179	0.667	20.64	0.000
5.8667	0.180	0.679	22.66	0.000
5.9333	0.182	0.691	24.56	0.000
6.0000	0.184	0.703	26.34	0.000

6.0667	0.185	0.715	27.95	0.000



Bioretention 1

Bottom Length:	250.00 ft.
Bottom Width:	1.10 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	1.5
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	6
Offset (in.):	6
Flow Through Underdrain (ac-ft.):	441.524
Total Outflow (ac-ft.):	484.838
Percent Through Underdrain:	91.07

Discharge Structure

Riser Height: 0.5 ft.
Riser Diameter: 36 in.

Element Flows To:

Outlet 1	Outlet 2
Trapezoidal Pond 1	

Bioretention Hydraulic Table

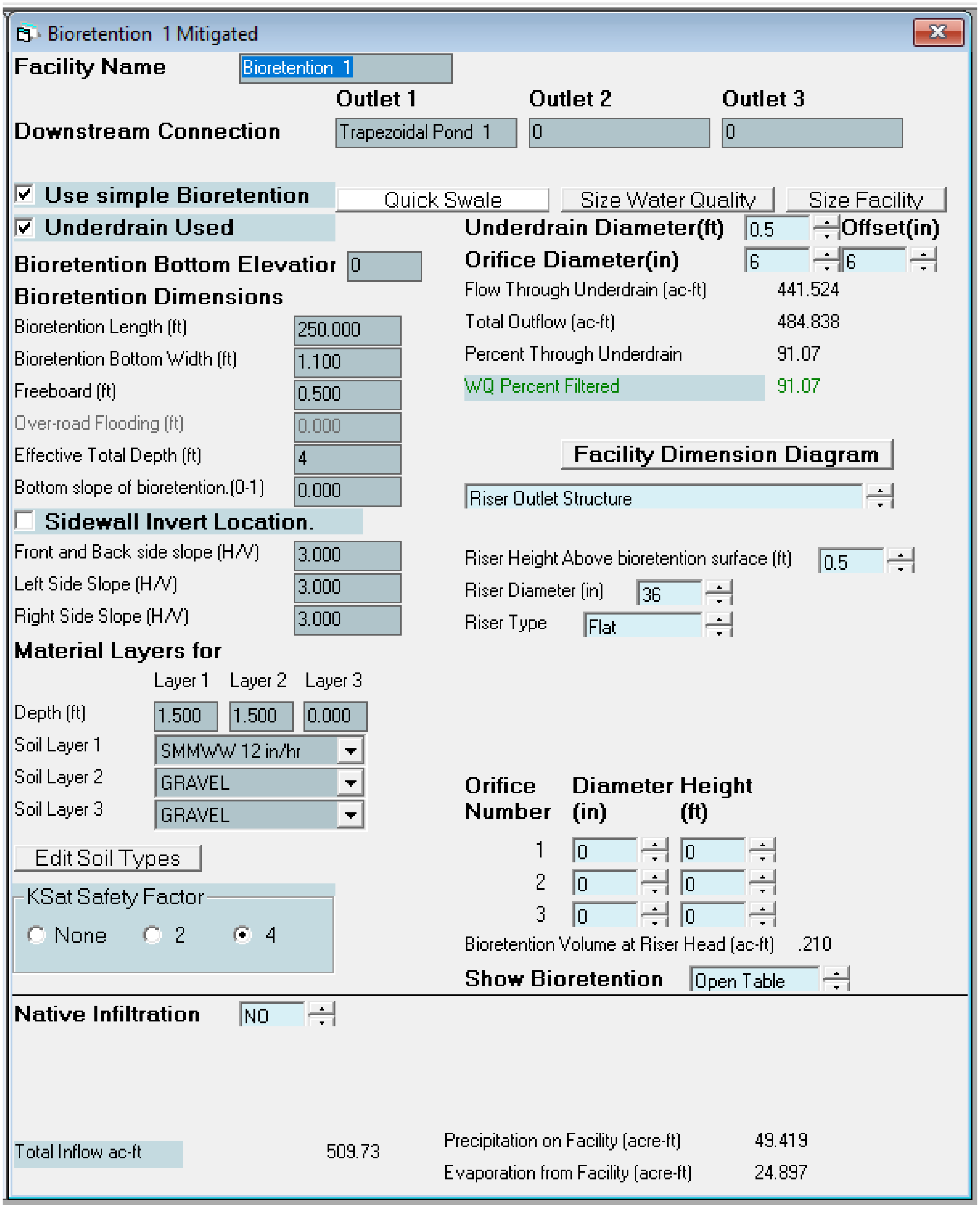
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.1175	0.0000	0.0000	0.0000
0.0440	0.1171	0.0001	0.0000	0.0000
0.0879	0.1153	0.0003	0.0000	0.0000
0.1319	0.1136	0.0005	0.0000	0.0000
0.1758	0.1119	0.0008	0.0000	0.0000
0.2198	0.1102	0.0010	0.0000	0.0000
0.2637	0.1084	0.0013	0.0000	0.0000
0.3077	0.1067	0.0016	0.0000	0.0000
0.3516	0.1050	0.0020	0.0000	0.0000
0.3956	0.1033	0.0024	0.0000	0.0000
0.4396	0.1016	0.0028	0.0000	0.0000
0.4835	0.0999	0.0033	0.0000	0.0000
0.5275	0.0982	0.0037	0.0000	0.0000
0.5714	0.0965	0.0043	0.0000	0.0000
0.6154	0.0948	0.0048	0.0000	0.0000
0.6593	0.0931	0.0054	0.0000	0.0000
0.7033	0.0914	0.0060	0.0000	0.0000
0.7473	0.0897	0.0066	0.0000	0.0000
0.7912	0.0880	0.0073	0.0000	0.0000
0.8352	0.0863	0.0080	0.0000	0.0000
0.8791	0.0846	0.0087	0.0000	0.0000
0.9231	0.0830	0.0095	0.0000	0.0000
0.9670	0.0813	0.0103	0.0000	0.0000
1.0110	0.0796	0.0111	0.0000	0.0000
1.0549	0.0780	0.0120	0.0000	0.0000
1.0989	0.0763	0.0129	0.0000	0.0000
1.1429	0.0746	0.0138	0.0022	0.0000
1.1868	0.0730	0.0148	0.0024	0.0000
1.2308	0.0713	0.0158	0.0028	0.0000
1.2747	0.0697	0.0168	0.0033	0.0000
1.3187	0.0680	0.0178	0.0038	0.0000

1.3626	0.0664	0.0189	0.0043	0.0000
1.4066	0.0648	0.0201	0.0049	0.0000
1.4505	0.0631	0.0212	0.0056	0.0000
1.4945	0.0615	0.0224	0.0062	0.0000
1.5385	0.0598	0.0235	0.0070	0.0000
1.5824	0.0582	0.0246	0.0077	0.0000
1.6264	0.0566	0.0258	0.0086	0.0000
1.6703	0.0550	0.0270	0.0094	0.0000
1.7143	0.0534	0.0282	0.0104	0.0000
1.7582	0.0517	0.0295	0.0114	0.0000
1.8022	0.0501	0.0308	0.0124	0.0000
1.8462	0.0485	0.0321	0.0135	0.0000
1.8901	0.0469	0.0334	0.0146	0.0000
1.9341	0.0453	0.0348	0.0158	0.0000
1.9780	0.0437	0.0362	0.0171	0.0000
2.0220	0.0421	0.0377	0.0183	0.0000
2.0659	0.0405	0.0391	0.0255	0.0000
2.1099	0.0389	0.0406	0.0255	0.0000
2.1538	0.0374	0.0422	0.0255	0.0000
2.1978	0.0358	0.0437	0.0255	0.0000
2.2418	0.0342	0.0453	0.0255	0.0000
2.2857	0.0326	0.0469	0.0255	0.0000
2.3297	0.0310	0.0486	0.0255	0.0000
2.3736	0.0295	0.0503	0.0255	0.0000
2.4176	0.0279	0.0520	0.0255	0.0000
2.4615	0.0263	0.0537	0.0255	0.0000
2.5055	0.0248	0.0555	0.0255	0.0000
2.5495	0.0232	0.0573	0.0255	0.0000
2.5934	0.0217	0.0591	0.0255	0.0000
2.6374	0.0201	0.0610	0.0255	0.0000
2.6813	0.0186	0.0629	0.0255	0.0000
2.7253	0.0170	0.0648	0.0255	0.0000
2.7692	0.0155	0.0668	0.0255	0.0000
2.8132	0.0140	0.0688	0.0255	0.0000
2.8571	0.0124	0.0708	0.0255	0.0000
2.9011	0.0109	0.0729	0.0255	0.0000
2.9451	0.0094	0.0750	0.0255	0.0000
2.9890	0.0078	0.0771	0.0255	0.0000
3.0000	0.0063	0.0776	0.0255	0.0000

Bioretention Surface Hydraulic Table

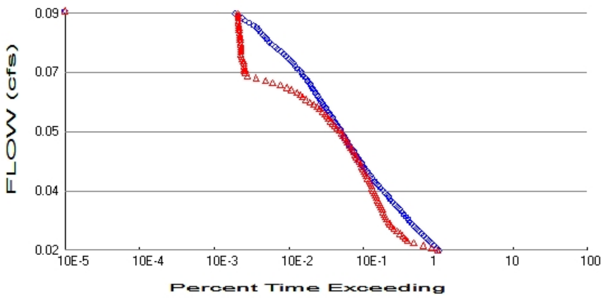
Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**To Amended(cfs)**	**Infilt(cfs)**
3.0000	0.1175	0.0776	0.0000	0.0191	0.0000
3.0440	0.1193	0.0828	0.0000	0.0191	0.0000
3.0879	0.1210	0.0881	0.0000	0.0202	0.0000
3.1319	0.1227	0.0935	0.0000	0.0208	0.0000
3.1758	0.1245	0.0989	0.0000	0.0213	0.0000
3.2198	0.1262	0.1044	0.0000	0.0219	0.0000
3.2637	0.1280	0.1100	0.0000	0.0225	0.0000
3.3077	0.1298	0.1156	0.0000	0.0230	0.0000
3.3516	0.1315	0.1214	0.0000	0.0236	0.0000
3.3956	0.1333	0.1272	0.0000	0.0241	0.0000
3.4396	0.1351	0.1331	0.0000	0.0247	0.0000
3.4835	0.1368	0.1391	0.0000	0.0253	0.0000
3.5275	0.1386	0.1451	0.1450	0.0255	0.0000
3.5714	0.1404	0.1513	0.6076	0.0255	0.0000
3.6154	0.1422	0.1575	1.2467	0.0255	0.0000
3.6593	0.1439	0.1638	2.0218	0.0255	0.0000

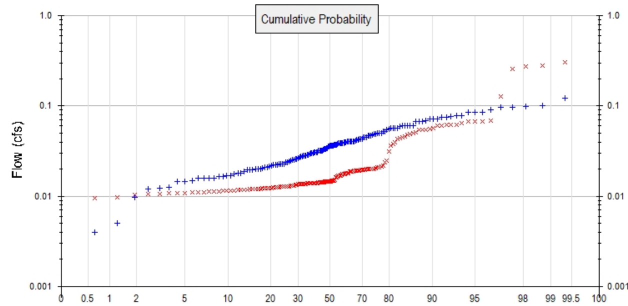
3.7033	0.1457	0.1701	2.9110	0.0255	0.0000
3.7473	0.1475	0.1766	3.8993	0.0255	0.0000
3.7912	0.1493	0.1831	4.9745	0.0255	0.0000
3.8352	0.1511	0.1897	6.1264	0.0255	0.0000
3.8791	0.1529	0.1964	7.3452	0.0255	0.0000
3.9231	0.1547	0.2031	8.6215	0.0255	0.0000
3.9670	0.1565	0.2100	9.9461	0.0255	0.0000
4.0000	0.1579	0.2152	11.309	0.0255	0.0000



Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.61
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.73
Total Impervious Area: 0.88

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.036377
5 year	0.05597
10 year	0.067295
25 year	0.079562
50 year	0.087453
100 year	0.094299

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.017389
5 year	0.03311
10 year	0.050121
25 year	0.083016
50 year	0.119152
100 year	0.168973

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.029	0.015
1903	0.022	0.012
1904	0.038	0.014
1905	0.019	0.017
1906	0.010	0.010
1907	0.056	0.015
1908	0.041	0.013
1909	0.040	0.014
1910	0.056	0.014
1911	0.036	0.015

1912	0.122	0.020
1913	0.057	0.049
1914	0.015	0.010
1915	0.024	0.019
1916	0.036	0.014
1917	0.012	0.012
1918	0.039	0.054
1919	0.030	0.014
1920	0.037	0.014
1921	0.040	0.020
1922	0.041	0.014
1923	0.032	0.020
1924	0.016	0.013
1925	0.020	0.013
1926	0.035	0.013
1927	0.026	0.013
1928	0.028	0.018
1929	0.056	0.020
1930	0.036	0.014
1931	0.034	0.015
1932	0.026	0.020
1933	0.029	0.015
1934	0.074	0.068
1935	0.034	0.051
1936	0.031	0.017
1937	0.049	0.014
1938	0.030	0.014
1939	0.003	0.010
1940	0.033	0.020
1941	0.020	0.011
1942	0.050	0.068
1943	0.025	0.015
1944	0.052	0.021
1945	0.040	0.015
1946	0.024	0.011
1947	0.017	0.012
1948	0.077	0.018
1949	0.067	0.043
1950	0.020	0.012
1951	0.025	0.012
1952	0.100	0.054
1953	0.091	0.061
1954	0.032	0.020
1955	0.028	0.011
1956	0.015	0.012
1957	0.048	0.022
1958	0.097	0.255
1959	0.061	0.127
1960	0.018	0.011
1961	0.061	0.062
1962	0.033	0.019
1963	0.016	0.011
1964	0.017	0.012
1965	0.068	0.062
1966	0.020	0.013
1967	0.030	0.013
1968	0.032	0.017
1969	0.030	0.014

1970	0.047	0.018
1971	0.072	0.062
1972	0.047	0.018
1973	0.061	0.031
1974	0.034	0.014
1975	0.076	0.275
1976	0.041	0.017
1977	0.018	0.011
1978	0.067	0.057
1979	0.020	0.014
1980	0.039	0.014
1981	0.036	0.018
1982	0.017	0.011
1983	0.061	0.024
1984	0.028	0.014
1985	0.043	0.014
1986	0.036	0.019
1987	0.069	0.054
1988	0.043	0.039
1989	0.040	0.013
1990	0.045	0.015
1991	0.037	0.019
1992	0.047	0.050
1993	0.049	0.014
1994	0.072	0.019
1995	0.016	0.014
1996	0.078	0.067
1997	0.032	0.012
1998	0.039	0.015
1999	0.004	0.012
2000	0.029	0.019
2001	0.016	0.011
2002	0.052	0.014
2003	0.045	0.016
2004	0.039	0.014
2005	0.072	0.020
2006	0.023	0.013
2007	0.024	0.014
2008	0.039	0.015
2009	0.026	0.014
2010	0.022	0.019
2011	0.020	0.012
2012	0.030	0.014
2013	0.023	0.012
2014	0.016	0.012
2015	0.031	0.012
2016	0.013	0.012
2017	0.055	0.021
2018	0.099	0.307
2019	0.098	0.067
2020	0.031	0.013
2021	0.050	0.044
2022	0.021	0.013
2023	0.042	0.019
2024	0.085	0.014
2025	0.038	0.017
2026	0.060	0.025
2027	0.023	0.014

2028	0.020	0.011
2029	0.041	0.036
2030	0.075	0.046
2031	0.025	0.011
2032	0.015	0.012
2033	0.022	0.012
2034	0.022	0.013
2035	0.085	0.277
2036	0.045	0.018
2037	0.012	0.011
2038	0.037	0.019
2039	0.005	0.008
2040	0.021	0.014
2041	0.028	0.012
2042	0.086	0.065
2043	0.041	0.021
2044	0.055	0.045
2045	0.037	0.038
2046	0.043	0.056
2047	0.032	0.019
2048	0.042	0.013
2049	0.038	0.015
2050	0.027	0.013
2051	0.038	0.016
2052	0.023	0.014
2053	0.040	0.061
2054	0.050	0.048
2055	0.021	0.011
2056	0.018	0.012
2057	0.028	0.017
2058	0.034	0.020
2059	0.059	0.020

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	**Predeveloped**	**Mitigated**
1	0.1223	0.3073
2	0.1002	0.2774
3	0.0987	0.2752
4	0.0976	0.2547
5	0.0968	0.1269
6	0.0910	0.0684
7	0.0858	0.0681
8	0.0849	0.0670
9	0.0845	0.0667
10	0.0785	0.0651
11	0.0774	0.0625
12	0.0761	0.0620
13	0.0746	0.0617
14	0.0742	0.0612
15	0.0720	0.0605
16	0.0718	0.0572
17	0.0717	0.0562
18	0.0693	0.0542
19	0.0680	0.0539
20	0.0673	0.0539
21	0.0668	0.0508
22	0.0610	0.0498

23	0.0606	0.0487
24	0.0606	0.0481
25	0.0605	0.0461
26	0.0600	0.0448
27	0.0592	0.0438
28	0.0570	0.0429
29	0.0564	0.0393
30	0.0563	0.0382
31	0.0563	0.0363
32	0.0552	0.0311
33	0.0547	0.0246
34	0.0523	0.0235
35	0.0518	0.0219
36	0.0503	0.0215
37	0.0501	0.0209
38	0.0501	0.0207
39	0.0492	0.0204
40	0.0489	0.0201
41	0.0482	0.0201
42	0.0474	0.0201
43	0.0471	0.0200
44	0.0468	0.0200
45	0.0454	0.0199
46	0.0452	0.0196
47	0.0446	0.0196
48	0.0434	0.0195
49	0.0433	0.0195
50	0.0429	0.0193
51	0.0422	0.0192
52	0.0421	0.0192
53	0.0411	0.0190
54	0.0408	0.0190
55	0.0407	0.0190
56	0.0406	0.0187
57	0.0406	0.0187
58	0.0404	0.0186
59	0.0403	0.0180
60	0.0402	0.0180
61	0.0398	0.0179
62	0.0397	0.0178
63	0.0394	0.0177
64	0.0390	0.0177
65	0.0388	0.0175
66	0.0388	0.0173
67	0.0387	0.0170
68	0.0384	0.0170
69	0.0384	0.0170
70	0.0377	0.0166
71	0.0375	0.0163
72	0.0373	0.0160
73	0.0370	0.0151
74	0.0369	0.0148
75	0.0365	0.0148
76	0.0364	0.0148
77	0.0363	0.0147
78	0.0361	0.0146
79	0.0360	0.0146
80	0.0356	0.0146

81	0.0353	0.0146
82	0.0343	0.0146
83	0.0342	0.0146
84	0.0336	0.0145
85	0.0336	0.0144
86	0.0333	0.0142
87	0.0329	0.0142
88	0.0323	0.0142
89	0.0323	0.0141
90	0.0321	0.0141
91	0.0320	0.0141
92	0.0318	0.0141
93	0.0310	0.0141
94	0.0308	0.0141
95	0.0308	0.0141
96	0.0305	0.0141
97	0.0304	0.0140
98	0.0303	0.0139
99	0.0303	0.0139
100	0.0302	0.0139
101	0.0295	0.0139
102	0.0290	0.0139
103	0.0289	0.0139
104	0.0285	0.0138
105	0.0282	0.0137
106	0.0282	0.0137
107	0.0278	0.0136
108	0.0275	0.0136
109	0.0268	0.0136
110	0.0262	0.0135
111	0.0258	0.0135
112	0.0257	0.0135
113	0.0254	0.0132
114	0.0253	0.0132
115	0.0246	0.0130
116	0.0242	0.0129
117	0.0238	0.0129
118	0.0238	0.0128
119	0.0229	0.0128
120	0.0229	0.0128
121	0.0228	0.0127
122	0.0228	0.0126
123	0.0224	0.0126
124	0.0224	0.0126
125	0.0223	0.0125
126	0.0219	0.0124
127	0.0213	0.0124
128	0.0207	0.0123
129	0.0207	0.0123
130	0.0203	0.0122
131	0.0202	0.0120
132	0.0199	0.0120
133	0.0199	0.0119
134	0.0197	0.0119
135	0.0196	0.0119
136	0.0195	0.0118
137	0.0186	0.0117
138	0.0181	0.0117

139	0.0180	0.0117
140	0.0178	0.0116
141	0.0170	0.0116
142	0.0168	0.0116
143	0.0166	0.0114
144	0.0164	0.0113
145	0.0160	0.0113
146	0.0158	0.0113
147	0.0158	0.0111
148	0.0157	0.0110
149	0.0149	0.0109
150	0.0146	0.0109
151	0.0145	0.0109
152	0.0127	0.0108
153	0.0124	0.0107
154	0.0121	0.0105
155	0.0097	0.0104
156	0.0050	0.0097
157	0.0039	0.0096
158	0.0025	0.0083

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0182	56896	54392	95	Pass
0.0189	52453	44791	85	Pass
0.0196	48398	35118	72	Pass
0.0203	44647	26044	58	Pass
0.0210	41246	21241	51	Pass
0.0217	38260	19972	52	Pass
0.0224	35495	18581	52	Pass
0.0231	32974	16958	51	Pass
0.0238	30531	15501	50	Pass
0.0245	28443	14072	49	Pass
0.0252	26504	13152	49	Pass
0.0259	24747	12454	50	Pass
0.0266	23135	11800	51	Pass
0.0273	21678	11224	51	Pass
0.0280	20326	10792	53	Pass
0.0287	19069	10415	54	Pass
0.0294	17856	10094	56	Pass
0.0301	16714	9800	58	Pass
0.0308	15606	9512	60	Pass
0.0315	14620	9152	62	Pass
0.0322	13717	8814	64	Pass
0.0329	12881	8504	66	Pass
0.0336	12099	8227	67	Pass
0.0343	11379	7972	70	Pass
0.0350	10665	7728	72	Pass
0.0357	9994	7507	75	Pass
0.0364	9363	7257	77	Pass
0.0371	8753	7047	80	Pass
0.0378	8199	6825	83	Pass
0.0385	7728	6582	85	Pass
0.0392	7246	6316	87	Pass
0.0399	6792	6061	89	Pass
0.0406	6421	5812	90	Pass
0.0413	6111	5623	92	Pass
0.0420	5834	5443	93	Pass
0.0427	5557	5255	94	Pass
0.0434	5267	5065	96	Pass
0.0441	5005	4837	96	Pass
0.0448	4782	4613	96	Pass
0.0455	4531	4410	97	Pass
0.0462	4339	4215	97	Pass
0.0469	4154	4045	97	Pass
0.0476	3937	3905	99	Pass
0.0483	3713	3730	100	Pass
0.0490	3536	3542	100	Pass
0.0497	3360	3380	100	Pass
0.0504	3227	3228	100	Pass
0.0511	3083	3092	100	Pass
0.0518	2964	2957	99	Pass
0.0525	2850	2808	98	Pass
0.0532	2738	2627	95	Pass
0.0539	2599	2417	92	Pass
0.0546	2477	2251	90	Pass

0.0553	2359	2132	90	Pass
0.0560	2266	1997	88	Pass
0.0567	2159	1888	87	Pass
0.0574	2057	1764	85	Pass
0.0581	1947	1666	85	Pass
0.0588	1837	1544	84	Pass
0.0595	1749	1413	80	Pass
0.0602	1659	1308	78	Pass
0.0609	1577	1189	75	Pass
0.0616	1510	1055	69	Pass
0.0623	1442	935	64	Pass
0.0630	1367	838	61	Pass
0.0637	1296	779	60	Pass
0.0644	1241	707	56	Pass
0.0651	1182	599	50	Pass
0.0658	1129	522	46	Pass
0.0665	1079	427	39	Pass
0.0672	1026	334	32	Pass
0.0679	976	267	27	Pass
0.0686	922	201	21	Pass
0.0693	871	154	17	Pass
0.0700	819	143	17	Pass
0.0707	771	141	18	Pass
0.0714	717	140	19	Pass
0.0721	668	139	20	Pass
0.0728	629	138	21	Pass
0.0735	586	136	23	Pass
0.0742	549	131	23	Pass
0.0749	507	128	25	Pass
0.0756	472	126	26	Pass
0.0763	428	126	29	Pass
0.0770	392	125	31	Pass
0.0777	363	125	34	Pass
0.0784	329	125	37	Pass
0.0791	300	124	41	Pass
0.0798	281	123	43	Pass
0.0805	264	122	46	Pass
0.0812	248	121	48	Pass
0.0819	233	120	51	Pass
0.0826	218	118	54	Pass
0.0833	205	118	57	Pass
0.0840	186	117	62	Pass
0.0847	162	116	71	Pass
0.0854	142	116	81	Pass
0.0861	129	116	89	Pass
0.0868	117	116	99	Pass
0.0875	105	115	109	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Trapezoidal Pond 1 POC	☐	441.15			☐	0.00			
retention 1	☐	441.20			☐	0.00			
Total Volume Infiltrated		882.35	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

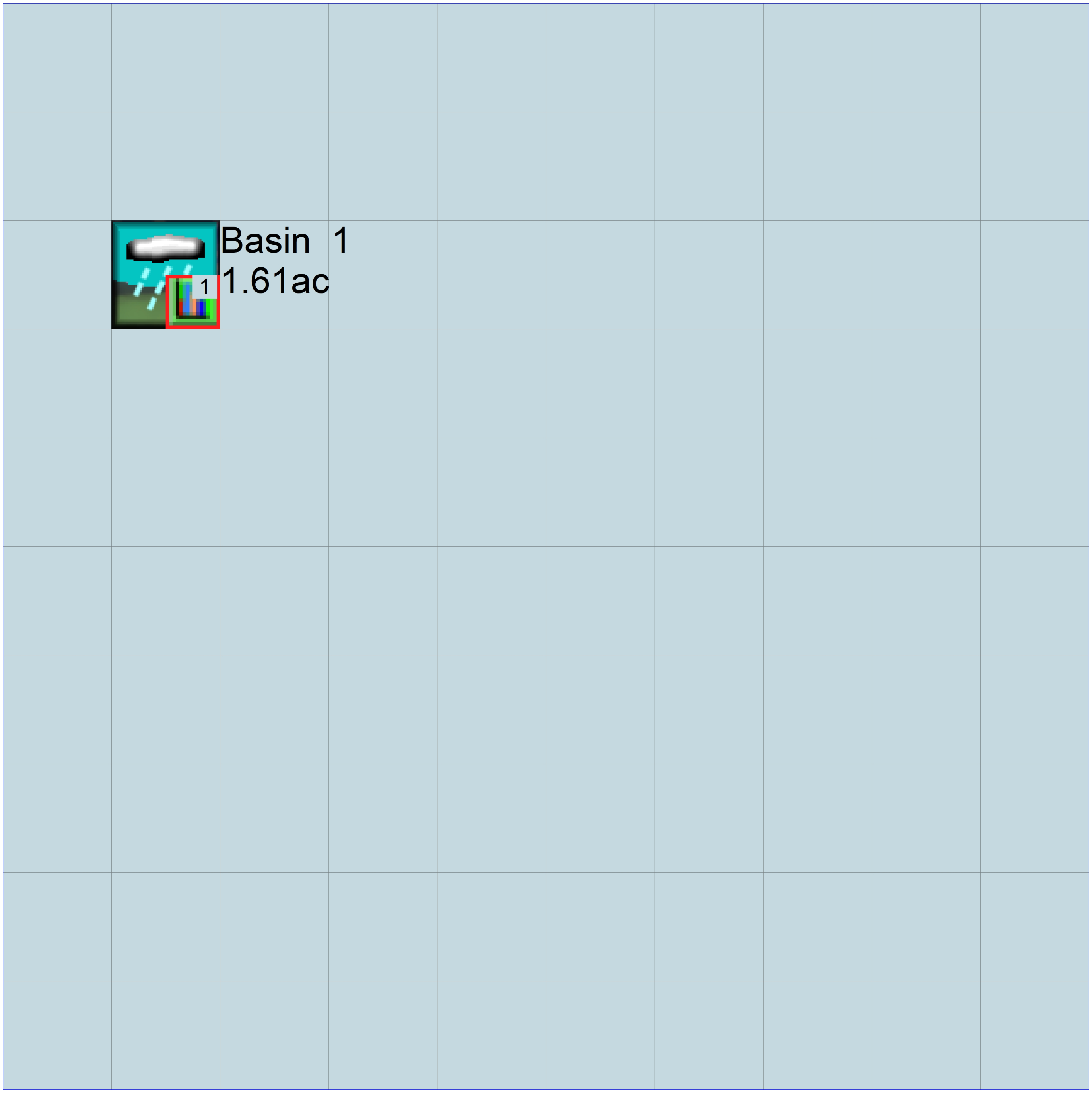
PERLND Changes

No PERLND changes have been made.

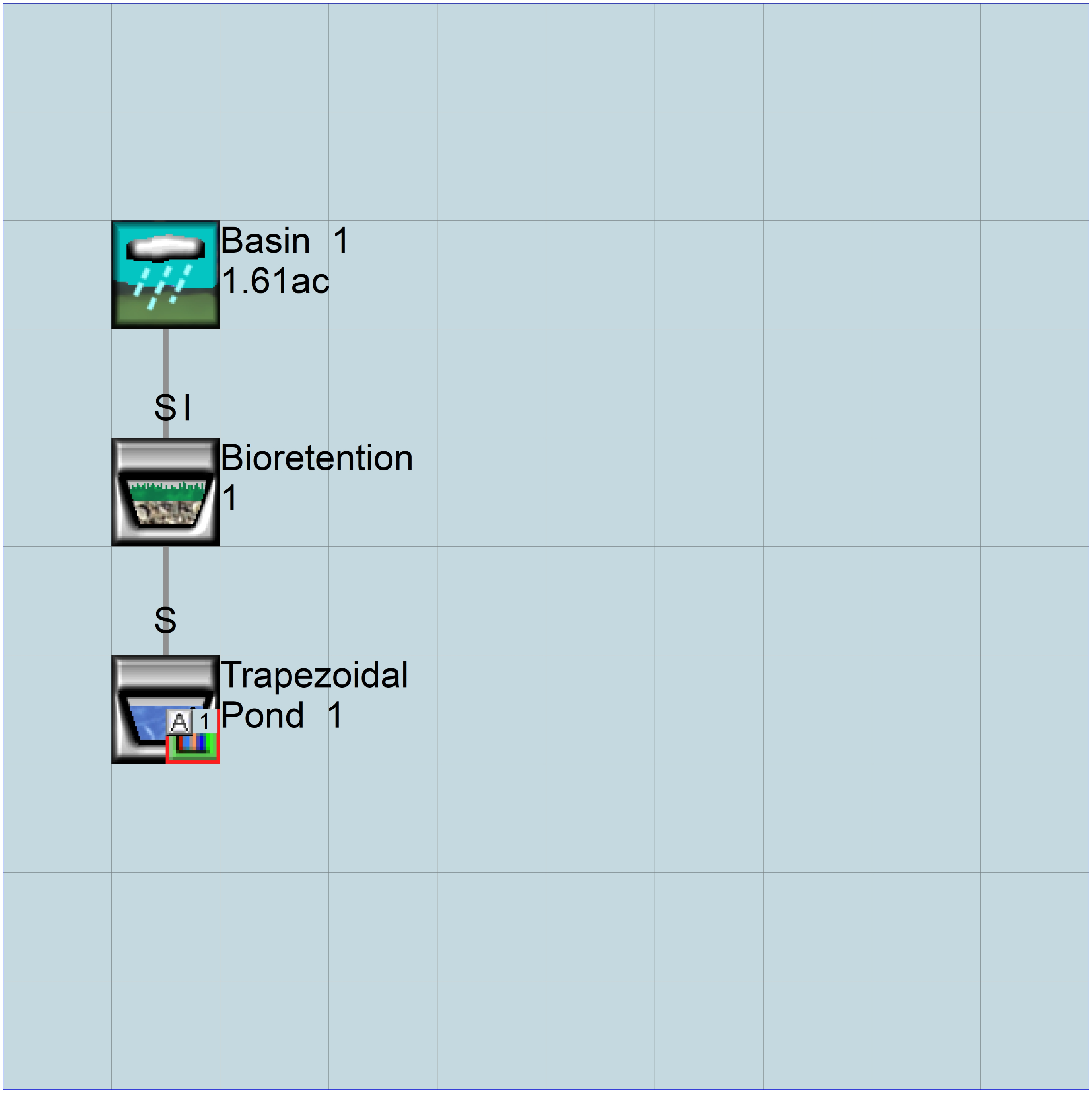
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



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Local (360)943-0304

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WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 20230919 WetlandProtection

Site Name:	
Site Address:	
City:	
Report Date:	1/3/2024
Gage:	42 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/03/31
Version:	4.2.19

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	8.86
C, Lawn, Flat	22.03
Pervious Total	30.89
Impervious Land Use	acre
ROADS FLAT	42.6
Impervious Total	42.6
Basin Total	73.49

Mitigated Land Use

Basin 1

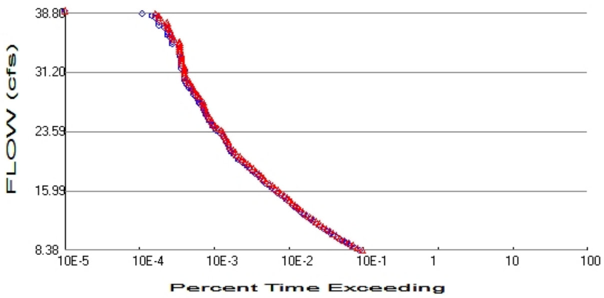
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	22.81
C, Forest, Flat	7.22
Pervious Total	30.03
Impervious Land Use	acre
ROADS FLAT	43.46
Impervious Total	43.46
Basin Total	73.49

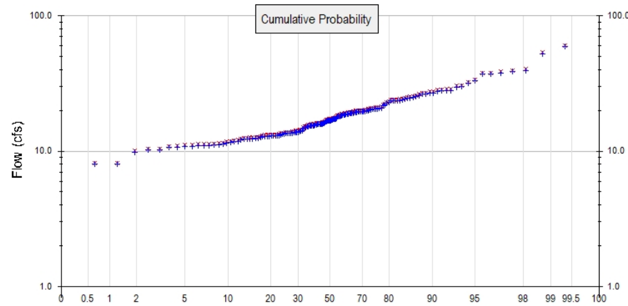
Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results

POC 1





\+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 30.89
Total Impervious Area: 42.6

Mitigated Landuse Totals for POC #1
Total Pervious Area: 30.03
Total Impervious Area: 43.46

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	16.766903
5 year	22.915367
10 year	27.446625
25 year	33.717942
50 year	38.800996
100 year	44.249318

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	17.105362
5 year	23.38482
10 year	28.013669
25 year	34.421222
50 year	39.615536
100 year	45.183825

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	18.562	18.937
1903	20.597	21.016
1904	27.629	28.202
1905	10.872	11.098
1906	11.544	11.777
1907	18.042	18.385
1908	13.815	14.089
1909	15.840	16.160
1910	17.208	17.534
1911	18.708	19.104

1912	36.963	37.694
1913	12.414	12.667
1914	59.262	60.571
1915	11.255	11.473
1916	19.798	20.200
1917	7.972	8.133
1918	15.736	16.054
1919	10.615	10.821
1920	14.621	14.919
1921	12.448	12.674
1922	20.223	20.641
1923	13.489	13.753
1924	22.488	22.944
1925	10.169	10.374
1926	18.234	18.603
1927	15.627	15.943
1928	12.114	12.341
1929	24.728	25.264
1930	23.589	24.072
1931	12.220	12.465
1932	13.096	13.352
1933	13.040	13.283
1934	23.502	23.978
1935	10.733	10.950
1936	15.805	16.133
1937	19.547	19.942
1938	11.052	11.274
1939	13.007	13.273
1940	24.163	24.660
1941	23.874	24.358
1942	20.190	20.604
1943	18.414	18.801
1944	28.049	28.662
1945	19.588	19.995
1946	16.536	16.875
1947	11.731	11.972
1948	16.603	16.951
1949	24.579	25.082
1950	14.078	14.362
1951	20.851	21.272
1952	29.976	30.585
1953	26.924	27.458
1954	13.705	13.971
1955	12.291	12.541
1956	11.015	11.238
1957	13.262	13.531
1958	18.427	18.796
1959	18.688	19.045
1960	13.010	13.278
1961	39.430	40.287
1962	15.855	16.183
1963	11.169	11.395
1964	37.067	37.877
1965	16.737	17.105
1966	12.970	13.229
1967	19.964	20.379
1968	15.276	15.593
1969	14.150	14.429

1970	16.854	17.184
1971	17.056	17.386
1972	52.237	53.382
1973	27.891	28.455
1974	21.967	22.426
1975	26.412	26.948
1976	25.844	26.385
1977	9.815	10.018
1978	19.664	20.046
1979	18.676	19.077
1980	19.378	19.786
1981	16.847	17.198
1982	13.343	13.619
1983	19.463	19.859
1984	19.057	19.453
1985	22.913	23.397
1986	10.863	11.057
1987	18.012	18.333
1988	11.029	11.234
1989	11.125	11.349
1990	14.065	14.331
1991	19.753	20.177
1992	18.116	18.481
1993	20.373	20.785
1994	16.093	16.402
1995	11.506	11.734
1996	16.328	16.654
1997	13.854	14.129
1998	17.643	17.986
1999	17.304	17.656
2000	15.880	16.199
2001	12.354	12.603
2002	26.922	27.480
2003	13.491	13.756
2004	19.581	19.988
2005	37.901	38.685
2006	17.209	17.562
2007	20.439	20.874
2008	16.730	17.073
2009	11.812	12.051
2010	15.875	16.205
2011	14.986	15.289
2012	15.908	16.229
2013	15.534	15.862
2014	13.809	14.088
2015	28.083	28.694
2016	13.563	13.842
2017	23.731	24.224
2018	16.891	17.169
2019	25.305	25.762
2020	18.907	19.292
2021	15.495	15.787
2022	24.946	25.471
2023	29.825	30.432
2024	38.767	39.534
2025	15.376	15.686
2026	21.559	22.020
2027	18.961	19.349

2028	7.412	7.561
2029	13.325	13.580
2030	26.447	26.996
2031	8.005	8.159
2032	12.885	13.146
2033	16.053	16.377
2034	12.598	12.853
2035	18.515	18.844
2036	12.851	13.112
2037	16.973	17.316
2038	19.014	19.395
2039	33.078	33.751
2040	13.603	13.873
2041	17.173	17.535
2042	19.560	19.949
2043	20.614	21.032
2044	14.903	15.209
2045	12.340	12.575
2046	13.538	13.814
2047	15.566	15.880
2048	12.823	13.083
2049	19.132	19.520
2050	15.486	15.796
2051	23.514	23.996
2052	15.204	15.511
2053	12.866	13.127
2054	31.622	32.324
2055	15.399	15.715
2056	20.732	21.154
2057	10.220	10.422
2058	19.342	19.732
2059	23.625	24.102

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	**Predeveloped**	**Mitigated**
1	59.2616	60.5706
2	52.2370	53.3822
3	39.4297	40.2871
4	38.7670	39.5341
5	37.9009	38.6854
6	37.0673	37.8772
7	36.9630	37.6935
8	33.0781	33.7507
9	31.6217	32.3239
10	29.9760	30.5849
11	29.8249	30.4321
12	28.0830	28.6944
13	28.0488	28.6621
14	27.8905	28.4547
15	27.6290	28.2023
16	26.9240	27.4798
17	26.9220	27.4577
18	26.4474	26.9955
19	26.4119	26.9480
20	25.8442	26.3847
21	25.3052	25.7618
22	24.9462	25.4705

23	24.7278	25.2639
24	24.5792	25.0816
25	24.1625	24.6597
26	23.8738	24.3584
27	23.7312	24.2241
28	23.6245	24.1016
29	23.5889	24.0722
30	23.5136	23.9958
31	23.5017	23.9778
32	22.9130	23.3970
33	22.4880	22.9438
34	21.9667	22.4255
35	21.5590	22.0201
36	20.8506	21.2716
37	20.7316	21.1539
38	20.6143	21.0317
39	20.5972	21.0157
40	20.4390	20.8740
41	20.3731	20.7854
42	20.2233	20.6408
43	20.1896	20.6035
44	19.9644	20.3789
45	19.7982	20.2004
46	19.7533	20.1767
47	19.6639	20.0462
48	19.5882	19.9953
49	19.5806	19.9877
50	19.5603	19.9489
51	19.5469	19.9415
52	19.4634	19.8586
53	19.3776	19.7856
54	19.3419	19.7324
55	19.1321	19.5198
56	19.0568	19.4531
57	19.0141	19.3951
58	18.9614	19.3487
59	18.9072	19.2921
60	18.7077	19.1035
61	18.6875	19.0773
62	18.6758	19.0450
63	18.5617	18.9373
64	18.5146	18.8438
65	18.4272	18.8013
66	18.4143	18.7956
67	18.2342	18.6026
68	18.1156	18.4813
69	18.0424	18.3853
70	18.0118	18.3328
71	17.6428	17.9859
72	17.3042	17.6559
73	17.2094	17.5618
74	17.2081	17.5353
75	17.1726	17.5336
76	17.0564	17.3855
77	16.9732	17.3163
78	16.8914	17.1984
79	16.8544	17.1839
80	16.8473	17.1685

81	16.7371	17.1050
82	16.7299	17.0733
83	16.6033	16.9512
84	16.5364	16.8745
85	16.3277	16.6537
86	16.0928	16.4018
87	16.0532	16.3773
88	15.9075	16.2286
89	15.8804	16.2051
90	15.8753	16.1992
91	15.8550	16.1825
92	15.8395	16.1600
93	15.8046	16.1326
94	15.7360	16.0544
95	15.6271	15.9432
96	15.5655	15.8797
97	15.5339	15.8622
98	15.4951	15.7959
99	15.4856	15.7870
100	15.3987	15.7153
101	15.3758	15.6863
102	15.2759	15.5928
103	15.2043	15.5113
104	14.9861	15.2887
105	14.9026	15.2087
106	14.6212	14.9189
107	14.1503	14.4292
108	14.0776	14.3617
109	14.0646	14.3305
110	13.8541	14.1291
111	13.8153	14.0893
112	13.8093	14.0880
113	13.7047	13.9705
114	13.6034	13.8732
115	13.5632	13.8419
116	13.5383	13.8137
117	13.4909	13.7560
118	13.4891	13.7527
119	13.3426	13.6189
120	13.3252	13.5800
121	13.2621	13.5314
122	13.0955	13.3517
123	13.0398	13.2834
124	13.0098	13.2776
125	13.0074	13.2726
126	12.9702	13.2286
127	12.8848	13.1457
128	12.8660	13.1270
129	12.8511	13.1124
130	12.8234	13.0829
131	12.5984	12.8529
132	12.4480	12.6736
133	12.4143	12.6667
134	12.3543	12.6034
135	12.3399	12.5753
136	12.2910	12.5405
137	12.2203	12.4651
138	12.1141	12.3413

139	11.8119	12.0506
140	11.7314	11.9723
141	11.5435	11.7774
142	11.5062	11.7343
143	11.2546	11.4731
144	11.1691	11.3948
145	11.1254	11.3485
146	11.0515	11.2739
147	11.0291	11.2376
148	11.0152	11.2336
149	10.8723	11.0977
150	10.8633	11.0568
151	10.7334	10.9498
152	10.6152	10.8212
153	10.2201	10.4224
154	10.1693	10.3737
155	9.8150	10.0175
156	8.0045	8.1588
157	7.9722	8.1333
158	7.4118	7.5614

Duration Flows

The Development Failed :duration increase for more than 50% of the flows.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
8.3835	4890	5274	107	Fail
8.6907	4220	4559	108	Fail
8.9979	3692	3970	107	Fail
9.3052	3246	3500	107	Fail
9.6124	2834	3059	107	Fail
9.9197	2521	2691	106	Fail
10.2269	2265	2432	107	Fail
10.5342	2010	2160	107	Fail
10.8414	1805	1940	107	Fail
11.1487	1613	1737	107	Fail
11.4559	1459	1559	106	Fail
11.7632	1320	1420	107	Fail
12.0704	1182	1284	108	Fail
12.3777	1076	1163	108	Fail
12.6849	968	1047	108	Fail
12.9922	874	946	108	Fail
13.2994	788	860	109	Fail
13.6067	722	774	107	Fail
13.9139	667	714	107	Fail
14.2212	610	662	108	Fail
14.5284	571	605	105	Fail
14.8357	520	568	109	Fail
15.1429	483	517	107	Fail
15.4502	433	477	110	Fail
15.7574	394	429	108	Fail
16.0646	358	393	109	Fail
16.3719	330	359	108	Fail
16.6791	301	329	109	Fail
16.9864	265	302	113	Fail
17.2936	248	269	108	Pass
17.6009	233	249	106	Pass
17.9081	215	234	108	Pass
18.2154	197	219	111	Fail
18.5226	179	200	111	Fail
18.8299	165	183	110	Pass
19.1371	152	167	109	Pass
19.4444	141	155	109	Pass
19.7516	129	143	110	Pass
20.0589	115	131	113	Fail
20.3661	110	121	110	Pass
20.6734	102	111	108	Pass
20.9806	93	105	112	Fail
21.2879	90	99	110	Pass
21.5951	87	91	104	Pass
21.9024	85	88	103	Pass
22.2096	79	86	108	Pass
22.5169	78	81	103	Pass
22.8241	75	79	105	Pass
23.1314	71	76	107	Pass
23.4386	66	73	110	Pass
23.7458	58	69	118	Fail
24.0531	56	62	110	Pass
24.3603	52	57	109	Pass

24.6676	50	53	105	Pass
24.9748	47	52	110	Pass
25.2821	46	48	104	Pass
25.5893	44	47	106	Pass
25.8966	42	45	107	Pass
26.2038	41	44	107	Pass
26.5111	39	41	105	Pass
26.8183	39	41	105	Pass
27.1256	36	39	108	Pass
27.4328	34	39	114	Fail
27.7401	33	36	109	Pass
28.0473	31	34	109	Pass
28.3546	29	33	113	Fail
28.6618	29	31	106	Pass
28.9691	27	29	107	Pass
29.2763	25	29	116	Fail
29.5836	24	27	112	Fail
29.8908	23	25	108	Pass
30.1981	22	25	113	Fail
30.5053	22	23	104	Pass
30.8125	22	22	100	Pass
31.1198	22	22	100	Pass
31.4270	22	22	100	Pass
31.7343	20	22	110	Pass
32.0415	20	22	110	Pass
32.3488	20	20	100	Pass
32.6560	20	20	100	Pass
32.9633	20	20	100	Pass
33.2705	19	20	105	Pass
33.5778	19	20	105	Pass
33.8850	19	19	100	Pass
34.1923	19	19	100	Pass
34.4995	19	19	100	Pass
34.8068	15	19	126	Fail
35.1140	15	19	126	Fail
35.4213	15	16	106	Pass
35.7285	14	15	107	Pass
36.0358	13	15	115	Fail
36.3430	13	14	107	Pass
36.6503	13	14	107	Pass
36.9575	12	13	108	Pass
37.2648	10	13	130	Fail
37.5720	10	13	130	Fail
37.8793	10	11	110	Pass
38.1865	9	10	111	Fail
38.4937	8	10	125	Fail
38.8010	6	9	150	Fail

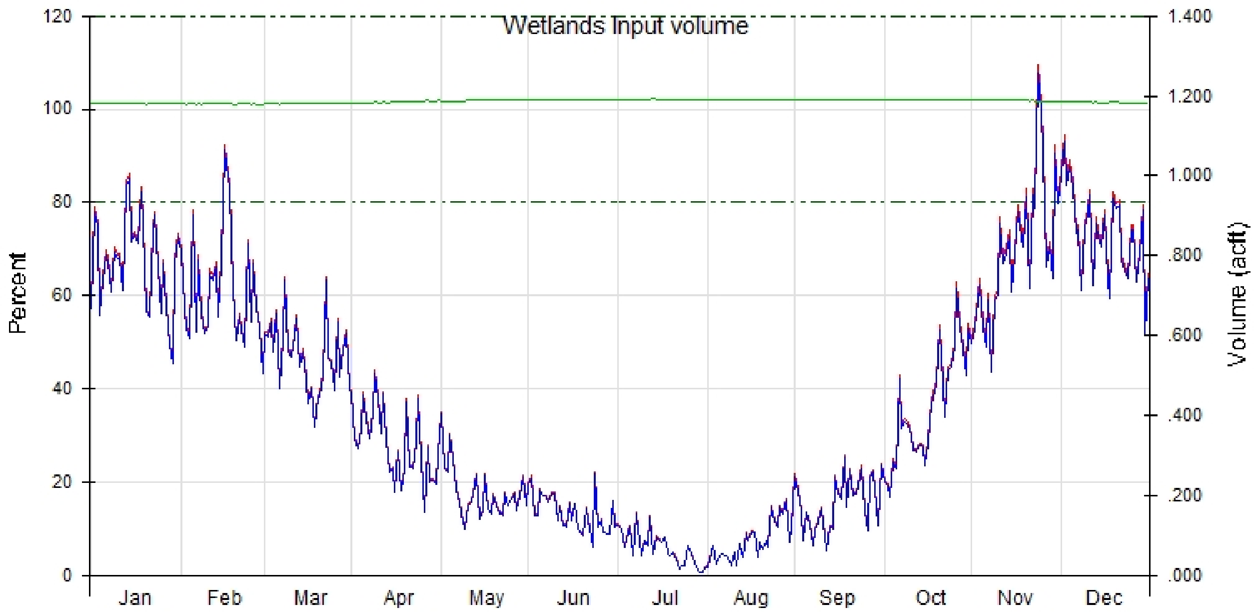
The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0 acre-feet
On-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.
Off-line facility target flow:	0 cfs.
Adjusted for 15 min:	0 cfs.

Wetland Input Volumes



- Percent - Predeveloped - Mitigated

Wetlands Input Volume for POC 1
Average Annual Volume (acft)
Series 1: 501 POC 1 Predeveloped flow
Series 2: 801 POC 1 Mitigated flow

Month	**Series 1**	**Series 2**	**Percent**	**Pass/Fail**
Jan	24.1357	24.4419	101.3	Pass
Feb	20.6547	20.8992	101.2	Pass
Mar	16.9628	17.1773	101.3	Pass
Apr	9.8927	10.0401	101.5	Pass
May	6.4619	6.5823	101.9	Pass
Jun	4.6869	4.7832	102.1	Pass
Jul	2.2306	2.2771	102.1	Pass
Aug	2.5236	2.5755	102.1	Pass
Sep	5.2658	5.3747	102.1	Pass
Oct	12.7693	13.0394	102.1	Pass
Nov	24.1942	24.6553	101.9	Pass
Dec	26.6105	27.0057	101.5	Pass

Day	**Predevel**	**Mitigated**	**Percent**	**Pass/Fail**
Jan1	0.6672	0.6758	101.3	Pass
2	0.9105	0.9234	101.4	Pass
3	0.8710	0.8822	101.3	Pass
4	0.6506	0.6580	101.1	Pass
5	0.7386	0.7482	101.3	Pass
6	0.8030	0.8137	101.3	Pass
7	0.7854	0.7959	101.3	Pass
8	0.7080	0.7176	101.4	Pass
9	0.8092	0.8205	101.4	Pass
10	0.7927	0.8034	101.4	Pass
11	0.7953	0.8058	101.3	Pass
12	0.7143	0.7236	101.3	Pass
13	0.9733	0.9869	101.4	Pass
14	0.9932	1.0062	101.3	Pass

15	0.8367	0.8467	101.2	Pass
16	0.8497	0.8604	101.3	Pass
17	0.8291	0.8394	101.2	Pass
18	0.9597	0.9715	101.2	Pass
19	0.8787	0.8885	101.1	Pass
20	0.6581	0.6640	100.9	Pass
21	0.6485	0.6559	101.1	Pass
22	0.8609	0.8726	101.4	Pass
23	0.9000	0.9118	101.3	Pass
24	0.7710	0.7800	101.2	Pass
25	0.6571	0.6647	101.2	Pass
26	0.7812	0.7908	101.2	Pass
27	0.6708	0.6785	101.2	Pass
28	0.5739	0.5803	101.1	Pass
29	0.5310	0.5373	101.2	Pass
30	0.7770	0.7881	101.4	Pass
31	0.8463	0.8574	101.3	Pass
Feb1	0.8109	0.8207	101.2	Pass
2	0.6660	0.6736	101.1	Pass
3	0.6178	0.6243	101.1	Pass
4	0.5934	0.6006	101.2	Pass
5	0.9031	0.9150	101.3	Pass
6	0.6076	0.6136	101.0	Pass
7	0.7909	0.8008	101.2	Pass
8	0.6558	0.6630	101.1	Pass
9	0.6070	0.6142	101.2	Pass
10	0.6201	0.6275	101.2	Pass
11	0.7560	0.7663	101.4	Pass
12	0.7391	0.7487	101.3	Pass
13	0.7731	0.7832	101.3	Pass
14	0.6471	0.6550	101.2	Pass
15	0.7865	0.7967	101.3	Pass
16	1.0636	1.0775	101.3	Pass
17	0.9975	1.0093	101.2	Pass
18	0.9707	0.9817	101.1	Pass
19	0.7174	0.7233	100.8	Pass
20	0.5893	0.5945	100.9	Pass
21	0.6486	0.6560	101.1	Pass
22	0.6124	0.6193	101.1	Pass
23	0.5735	0.5804	101.2	Pass
24	0.8290	0.8402	101.3	Pass
25	0.6356	0.6424	101.1	Pass
26	0.7801	0.7896	101.2	Pass
27	0.6700	0.6769	101.0	Pass
28	0.6206	0.6266	101.0	Pass
29	0.5033	0.5086	101.0	Pass
Mar1	0.6038	0.6114	101.3	Pass
2	0.5970	0.6045	101.3	Pass
3	0.6355	0.6436	101.3	Pass
4	0.5577	0.5642	101.2	Pass
5	0.6551	0.6635	101.3	Pass
6	0.4672	0.4722	101.1	Pass
7	0.5910	0.5992	101.4	Pass
8	0.7378	0.7482	101.4	Pass
9	0.5642	0.5709	101.2	Pass
10	0.5446	0.5514	101.2	Pass
11	0.5978	0.6052	101.2	Pass
12	0.6442	0.6525	101.3	Pass

13	0.5216	0.5277	101.2	Pass
14	0.5607	0.5675	101.2	Pass
15	0.4898	0.4955	101.2	Pass
16	0.4295	0.4345	101.2	Pass
17	0.4671	0.4732	101.3	Pass
18	0.3719	0.3764	101.2	Pass
19	0.4460	0.4518	101.3	Pass
20	0.4481	0.4539	101.3	Pass
21	0.4962	0.5029	101.3	Pass
22	0.7380	0.7484	101.4	Pass
23	0.5406	0.5473	101.2	Pass
24	0.5327	0.5396	101.3	Pass
25	0.4644	0.4701	101.2	Pass
26	0.6352	0.6443	101.4	Pass
27	0.4946	0.5009	101.3	Pass
28	0.5617	0.5693	101.4	Pass
29	0.6047	0.6127	101.3	Pass
30	0.4667	0.4720	101.1	Pass
31	0.4547	0.4601	101.2	Pass
Apr1	0.3430	0.3471	101.2	Pass
2	0.3152	0.3196	101.4	Pass
3	0.3609	0.3659	101.4	Pass
4	0.4518	0.4582	101.4	Pass
5	0.3917	0.3969	101.3	Pass
6	0.3439	0.3483	101.3	Pass
7	0.4037	0.4095	101.4	Pass
8	0.5053	0.5128	101.5	Pass
9	0.4426	0.4487	101.4	Pass
10	0.3562	0.3605	101.2	Pass
11	0.4541	0.4609	101.5	Pass
12	0.3412	0.3458	101.4	Pass
13	0.2570	0.2606	101.4	Pass
14	0.2681	0.2724	101.6	Pass
15	0.2095	0.2127	101.6	Pass
16	0.3077	0.3130	101.7	Pass
17	0.2143	0.2175	101.5	Pass
18	0.2612	0.2655	101.7	Pass
19	0.4354	0.4430	101.7	Pass
20	0.2709	0.2749	101.5	Pass
21	0.2680	0.2722	101.6	Pass
22	0.3286	0.3341	101.7	Pass
23	0.4432	0.4505	101.7	Pass
24	0.2903	0.2948	101.5	Pass
25	0.1592	0.1615	101.5	Pass
26	0.3193	0.3251	101.8	Pass
27	0.2324	0.2365	101.8	Pass
28	0.2375	0.2418	101.8	Pass
29	0.2302	0.2344	101.8	Pass
30	0.3005	0.3060	101.8	Pass
May1	0.4036	0.4106	101.7	Pass
2	0.2649	0.2692	101.6	Pass
3	0.2589	0.2631	101.6	Pass
4	0.3497	0.3557	101.7	Pass
5	0.2918	0.2968	101.7	Pass
6	0.2174	0.2210	101.7	Pass
7	0.1851	0.1883	101.7	Pass
8	0.1553	0.1579	101.7	Pass
9	0.1178	0.1199	101.7	Pass

10	0.1761	0.1794	101.9	Pass
11	0.1841	0.1875	101.9	Pass
12	0.2050	0.2090	101.9	Pass
13	0.2497	0.2546	102.0	Pass
14	0.1412	0.1440	102.0	Pass
15	0.1589	0.1621	102.0	Pass
16	0.2509	0.2558	102.0	Pass
17	0.1660	0.1692	101.9	Pass
18	0.1524	0.1554	102.0	Pass
19	0.2009	0.2049	102.0	Pass
20	0.1747	0.1781	101.9	Pass
21	0.1537	0.1567	102.0	Pass
22	0.1505	0.1535	102.0	Pass
23	0.2047	0.2087	101.9	Pass
24	0.1728	0.1762	101.9	Pass
25	0.1911	0.1948	101.9	Pass
26	0.2045	0.2084	101.9	Pass
27	0.1606	0.1638	102.0	Pass
28	0.2015	0.2056	102.0	Pass
29	0.2439	0.2488	102.0	Pass
30	0.1770	0.1806	102.0	Pass
31	0.2240	0.2286	102.1	Pass
Jun1	0.2434	0.2484	102.1	Pass
2	0.1513	0.1544	102.0	Pass
3	0.1501	0.1531	102.0	Pass
4	0.2104	0.2147	102.0	Pass
5	0.1979	0.2017	101.9	Pass
6	0.1962	0.2000	102.0	Pass
7	0.1831	0.1868	102.0	Pass
8	0.2024	0.2065	102.1	Pass
9	0.2059	0.2101	102.1	Pass
10	0.1352	0.1380	102.1	Pass
11	0.1694	0.1729	102.0	Pass
12	0.1267	0.1293	102.1	Pass
13	0.1222	0.1248	102.1	Pass
14	0.1806	0.1844	102.1	Pass
15	0.1362	0.1391	102.1	Pass
16	0.1771	0.1807	102.1	Pass
17	0.1144	0.1168	102.1	Pass
18	0.1057	0.1079	102.1	Pass
19	0.0991	0.1011	102.0	Pass
20	0.1668	0.1702	102.0	Pass
21	0.1161	0.1185	102.1	Pass
22	0.0695	0.0709	102.1	Pass
23	0.2522	0.2574	102.1	Pass
24	0.1191	0.1216	102.1	Pass
25	0.1375	0.1403	102.1	Pass
26	0.1069	0.1091	102.1	Pass
27	0.1020	0.1041	102.1	Pass
28	0.1020	0.1041	102.1	Pass
29	0.1855	0.1894	102.1	Pass
30	0.1215	0.1240	102.1	Pass
Jul1	0.1256	0.1283	102.1	Pass
2	0.1160	0.1184	102.1	Pass
3	0.0721	0.0736	102.1	Pass
4	0.0931	0.0950	102.1	Pass
5	0.1215	0.1240	102.1	Pass
6	0.0488	0.0499	102.1	Pass

7	0.1558	0.1590	102.1	Pass
8	0.1198	0.1223	102.1	Pass
9	0.0511	0.0522	102.1	Pass
10	0.0851	0.0869	102.0	Pass
11	0.0761	0.0777	102.1	Pass
12	0.1459	0.1490	102.1	Pass
13	0.0529	0.0541	102.3	Pass
14	0.0968	0.0988	102.1	Pass
15	0.0924	0.0943	102.1	Pass
16	0.0825	0.0842	102.1	Pass
17	0.0938	0.0958	102.1	Pass
18	0.0576	0.0588	102.1	Pass
19	0.0480	0.0490	102.1	Pass
20	0.0581	0.0593	102.0	Pass
21	0.0425	0.0434	102.1	Pass
22	0.0157	0.0161	102.2	Pass
23	0.0228	0.0233	102.1	Pass
24	0.0249	0.0254	102.0	Pass
25	0.0728	0.0742	102.0	Pass
26	0.0549	0.0561	102.0	Pass
27	0.0448	0.0457	102.0	Pass
28	0.0209	0.0213	102.1	Pass
29	0.0089	0.0091	102.1	Pass
30	0.0084	0.0085	102.0	Pass
31	0.0207	0.0211	102.0	Pass
Aug1	0.0222	0.0226	102.0	Pass
2	0.0591	0.0603	102.0	Pass
3	0.0744	0.0759	102.1	Pass
4	0.0290	0.0296	102.1	Pass
5	0.0479	0.0489	102.1	Pass
6	0.0521	0.0532	102.0	Pass
7	0.0500	0.0510	102.0	Pass
8	0.0460	0.0469	102.0	Pass
9	0.0235	0.0240	102.0	Pass
10	0.0566	0.0577	102.0	Pass
11	0.0251	0.0257	102.0	Pass
12	0.0770	0.0785	102.0	Pass
13	0.0438	0.0447	102.0	Pass
14	0.1045	0.1066	102.0	Pass
15	0.0886	0.0905	102.0	Pass
16	0.1091	0.1113	102.0	Pass
17	0.1070	0.1092	102.0	Pass
18	0.0443	0.0452	102.1	Pass
19	0.0811	0.0828	102.0	Pass
20	0.0669	0.0682	102.0	Pass
21	0.0853	0.0870	102.0	Pass
22	0.0715	0.0729	102.0	Pass
23	0.1697	0.1732	102.0	Pass
24	0.1345	0.1373	102.1	Pass
25	0.1217	0.1242	102.1	Pass
26	0.1718	0.1753	102.1	Pass
27	0.1534	0.1565	102.1	Pass
28	0.1888	0.1927	102.1	Pass
29	0.0811	0.0828	102.2	Pass
30	0.1176	0.1200	102.1	Pass
31	0.2471	0.2522	102.1	Pass
Sep1	0.2139	0.2184	102.1	Pass
2	0.1632	0.1666	102.1	Pass

3	0.0879	0.0898	102.1	Pass
4	0.1569	0.1602	102.1	Pass
5	0.1288	0.1314	102.0	Pass
6	0.0747	0.0763	102.0	Pass
7	0.1134	0.1157	102.0	Pass
8	0.1335	0.1363	102.1	Pass
9	0.1654	0.1688	102.1	Pass
10	0.1345	0.1373	102.1	Pass
11	0.0624	0.0637	102.1	Pass
12	0.1215	0.1240	102.0	Pass
13	0.1178	0.1202	102.0	Pass
14	0.2445	0.2495	102.0	Pass
15	0.2044	0.2085	102.0	Pass
16	0.1930	0.1970	102.0	Pass
17	0.2947	0.3008	102.0	Pass
18	0.1708	0.1743	102.1	Pass
19	0.2625	0.2678	102.0	Pass
20	0.2008	0.2050	102.1	Pass
21	0.2035	0.2077	102.1	Pass
22	0.2254	0.2301	102.1	Pass
23	0.2685	0.2742	102.1	Pass
24	0.1636	0.1670	102.1	Pass
25	0.1119	0.1142	102.1	Pass
26	0.2459	0.2510	102.0	Pass
27	0.2589	0.2642	102.1	Pass
28	0.1740	0.1777	102.1	Pass
29	0.1244	0.1270	102.1	Pass
30	0.2733	0.2789	102.1	Pass
Oct1	0.2323	0.2372	102.1	Pass
2	0.2240	0.2287	102.1	Pass
3	0.1954	0.1995	102.1	Pass
4	0.2847	0.2906	102.1	Pass
5	0.2666	0.2721	102.1	Pass
6	0.4910	0.5010	102.0	Pass
7	0.3664	0.3738	102.0	Pass
8	0.3823	0.3903	102.1	Pass
9	0.3760	0.3839	102.1	Pass
10	0.3489	0.3564	102.1	Pass
11	0.3119	0.3185	102.1	Pass
12	0.3070	0.3135	102.1	Pass
13	0.3241	0.3309	102.1	Pass
14	0.3194	0.3261	102.1	Pass
15	0.2740	0.2799	102.1	Pass
16	0.3312	0.3382	102.1	Pass
17	0.4283	0.4374	102.1	Pass
18	0.4439	0.4535	102.2	Pass
19	0.4779	0.4882	102.1	Pass
20	0.6126	0.6255	102.1	Pass
21	0.4776	0.4879	102.1	Pass
22	0.3944	0.4029	102.1	Pass
23	0.5115	0.5225	102.1	Pass
24	0.5205	0.5317	102.1	Pass
25	0.5733	0.5855	102.1	Pass
26	0.7190	0.7343	102.1	Pass
27	0.6232	0.6365	102.1	Pass
28	0.5658	0.5778	102.1	Pass
29	0.5020	0.5125	102.1	Pass
30	0.6162	0.6290	102.1	Pass

31	0.5802	0.5918	102.0	Pass
Nov1	0.6166	0.6291	102.0	Pass
2	0.6887	0.7032	102.1	Pass
3	0.7280	0.7435	102.1	Pass
4	0.6194	0.6327	102.1	Pass
5	0.5697	0.5819	102.1	Pass
6	0.6907	0.7052	102.1	Pass
7	0.5080	0.5187	102.1	Pass
8	0.6826	0.6968	102.1	Pass
9	0.7052	0.7196	102.1	Pass
10	0.8815	0.8995	102.0	Pass
11	0.7814	0.7974	102.1	Pass
12	0.8061	0.8225	102.0	Pass
13	0.8485	0.8659	102.1	Pass
14	0.7099	0.7242	102.0	Pass
15	0.7998	0.8154	102.0	Pass
16	0.9104	0.9276	101.9	Pass
17	0.8469	0.8634	101.9	Pass
18	0.8243	0.8403	101.9	Pass
19	0.9491	0.9670	101.9	Pass
20	0.7186	0.7317	101.8	Pass
21	0.9507	0.9684	101.9	Pass
22	0.9168	0.9333	101.8	Pass
23	1.2556	1.2775	101.7	Pass
24	1.1615	1.1812	101.7	Pass
25	1.0568	1.0737	101.6	Pass
26	0.7734	0.7855	101.6	Pass
27	0.8208	0.8345	101.7	Pass
28	0.7435	0.7555	101.6	Pass
29	1.0582	1.0764	101.7	Pass
30	0.9301	0.9455	101.7	Pass
Dec1	1.0028	1.0198	101.7	Pass
2	1.0843	1.1026	101.7	Pass
3	0.9775	0.9930	101.6	Pass
4	1.0229	1.0391	101.6	Pass
5	0.9692	0.9842	101.6	Pass
6	0.8562	0.8692	101.5	Pass
7	0.8621	0.8753	101.5	Pass
8	0.7157	0.7264	101.5	Pass
9	0.8669	0.8811	101.6	Pass
10	0.9025	0.9166	101.6	Pass
11	0.9508	0.9657	101.6	Pass
12	0.7260	0.7364	101.4	Pass
13	0.8826	0.8961	101.5	Pass
14	0.8466	0.8587	101.4	Pass
15	0.8224	0.8340	101.4	Pass
16	0.9033	0.9160	101.4	Pass
17	0.7392	0.7494	101.4	Pass
18	0.6921	0.7023	101.5	Pass
19	0.9436	0.9584	101.6	Pass
20	0.9180	0.9318	101.5	Pass
21	0.9280	0.9414	101.4	Pass
22	0.7887	0.7994	101.4	Pass
23	0.7643	0.7753	101.4	Pass
24	0.7418	0.7524	101.4	Pass
25	0.8645	0.8768	101.4	Pass
26	0.8663	0.8772	101.3	Pass
27	0.7350	0.7442	101.3	Pass

28	0.8026	0.8135	101.4	Pass
29	0.9123	0.9249	101.4	Pass
30	0.6001	0.6074	101.2	Pass
31	0.7480	0.7581	101.4	Pass

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

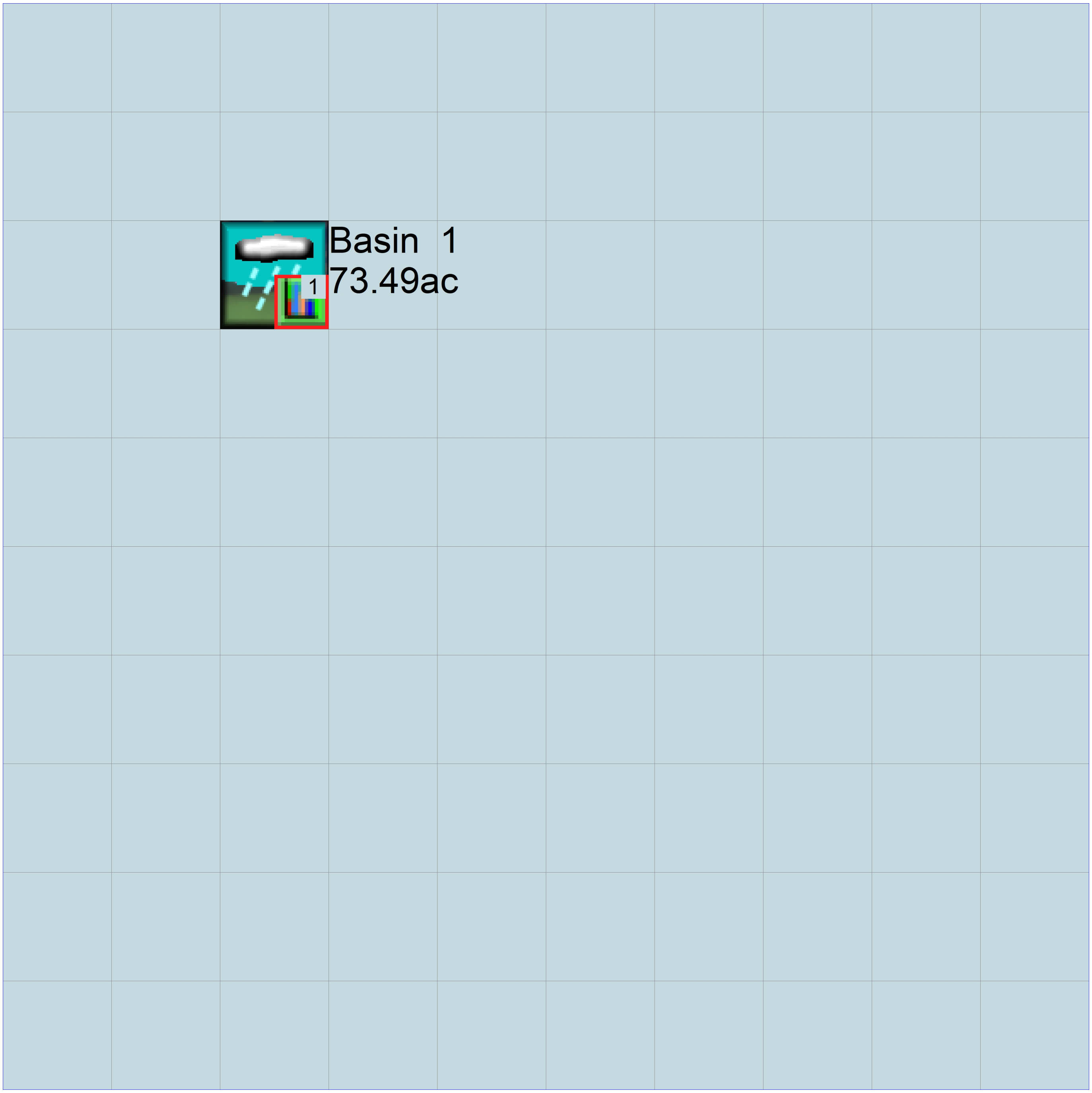
PERLND Changes

No PERLND changes have been made.

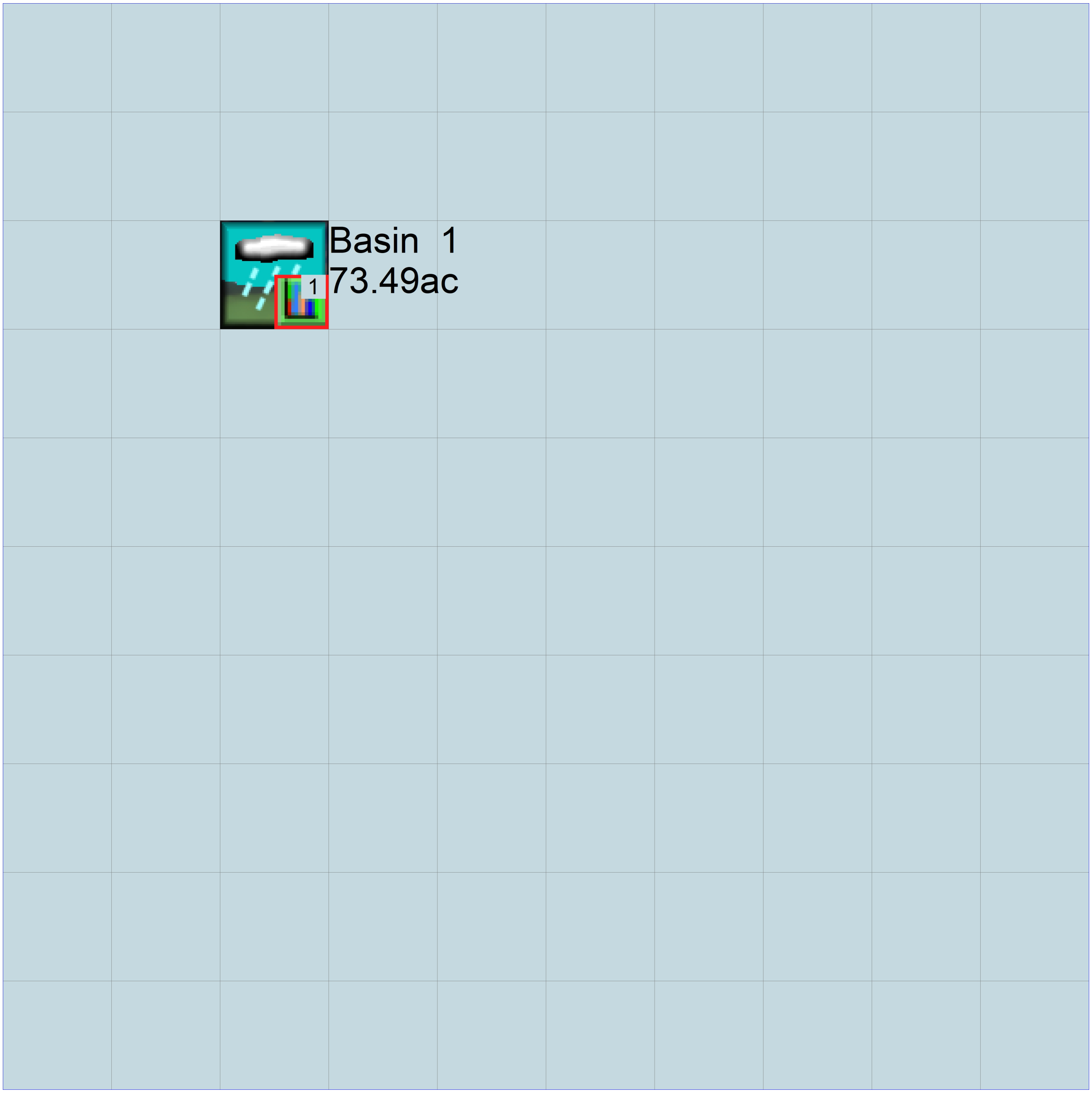
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



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Using Manning's equation, the maximum flow through a 12" CPEP pipe at 0.5% slope is 2.985 CFS

Pipe Capacity Calculation

12" Storm Line Outfall from Detention Pond

Inputs:		
Pipe Diameter, d_o	1.000	ft
Manning Roughness, n	0.011	CPEP
Pipe Slope, s_o	0.005	rise/run
Percent of (or ratio to) full depth (100% or 1 if flowing full)	1.000	fraction

Results:		
Maximum Flow Through Pipe, Q	2.985	ft^3/s
Velocity, v	3.801	ft/s
Velocity head, hv	0.225	ft
Flow Area, A	0.785	ft^2/s
Wetted Perimeter, P	3.142	ft
Hydraulic Radius	0.250	ft

$$Q = VA \qquad V = \frac{k}{n}\left(\frac{A}{P}\right)^{2/3} S^{1/2}$$

Parking Lot A has been modeled for the 100 year flow conveyance capacity to be conservative. The 100-year WWHM peak flow using 15-minute time steps (Q_{100}) is 0.8020 CFS.

WWHM Outflow to POC 1 Mitigated for Parking Lot A:

WWHM Inputs:

Basin Area	Rain Gage:	Precip Factor:
= 0.88 ac (impervious)		
= 0.48 ac (pervious)	*40 IN EAST*	*1.000*

```
Flow Frequency
Flow(cfs)  Predeveloped  Mitigated
2 Year   =     0.0307      0.3217
5 Year   =     0.0473      0.4317
10 Year  =     0.0568      0.5116
25 Year  =     0.0672      0.6209
50 Year  =     0.0739      0.7087
100 Year =     0.0797      0.8020
```

2.985 CFS capacity is larger than the 0.8020 CFS peak flow.
The storm drain is adequately sized and will not surcharge.

AHBL
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The bottom area of the bioretention facility is 250 ft * 1.1 ft = 275 ft^2 = 39,600 in^2
The depth of the bioretention facility when full is 0.50 ft.

If the bioretention facility is full, the volume of the column of water above the bottom is
= 275 ft^2 * 0.5 ft
= 137.5 ft^3
Within the side slopes, the volume of water along the long edges is
= 1.5 ft * 0.5 ft * 250 ft
= 187.5 ft^3
Within the side slopes, the volume of water along the short edges is
= 1.5 ft * 0.5 ft * 1.1 ft
= 0.825 ft^3
Therefore, the total volume of water within the bioretention facility is
= 137.5 ft^3 + 187.5 ft^3 + 0.825 ft^3
= 325.825 ft^3
= 563,025.6 in^3

The infiltration rate of the bioretention soil mix is 12 in/hr, which can also be written as 12 in^3/hr*in^2

The drawdown time within the bioretention facility can be calculated as
= 563,025.6 in^3 * (hr*in^2 /12 in^3)
= 46,918.8 hr*in^2
which is then divided by the bottom area of the bioretention facility
= 46,918.8 hr*in^2 / 39,600 in^2
= 1.18 hr

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According to BMP D.1: Detention Ponds in the 2019 *SWMMWW,* the width of the emergency overflow spillway is determined be the equation below:

$$L = [Q_{100}/(3.21H^{3/2})] - 2.4H$$

or

6 feet minimum

Where H is 0.2 feet minimum, and Q(100) is the 100-year 15 minute flow rate, 0.168973 cfs.

L = (0.168973 / 3.21*0.2^(3/2)) - 2.4*0.2
L = 0.11 ft
Since this is less than 6 feet, the spillway will be 6 feet wide.

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Appendix C

Special Reports and Studies

Geotechnical Engineering Services Report

Pierce College Puyallup – Parking Lot Additions
Puyallup, Washington

for
Washington State Department of Enterprise Services

January 31, 2022

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services Report

Pierce College Puyallup – Parking Lot Additions
Puyallup, Washington

for
Washington State Department of Enterprise Services

January 31, 2022

GeoEngineers

1101 South Fawcett Avenue, Suite 200
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253.383.4940

Geotechnical Engineering Services Report

Pierce College Puyallup – Parking Lot Additions Puyallup, Washington

File No. 21342-003-00

January 31, 2022

Prepared for:

Washington State Department of Enterprise Services
Division of Engineering & Architectural Services
206 General Administration Building
Olympia, Washington 98504-1012

Attention: Christopher Gizzi

Prepared by:

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APPENDICES

1.0 INTRODUCTION AND PROJECT UNDERSTANDING

This report presents the results of our geotechnical engineering services for the Pierce College Puyallup – Parking Lot Additions project. The project site is located at 1601 39th Avenue SE in Puyallup, Washington, as shown on the Vicinity Map, Figure 1. This report is preceded by a draft report dated August 16, 2021.

Our project understanding is based on discussions with you and AHBL, Inc. (project civil engineer) and review of Design Development Plans dated June 19, 2021 and prepared by AHBL, Inc. (Development Plans). Specific plan sheets reviewed include C0.1, C2.1 through C2.4, and C3.1 through C3.3.

Parking lot additions are proposed in the northwest, southwest and southeast portions of campus. For the purposes of this report, we refer to these additions individually as the "NW Parking Lot," "SW Parking Lot," and "SE Parking Lot." The parking lots will be surfaced with asphalt concrete pavement (ACP). New luminaire poles are also planned for the parking lots.

Other site improvements include stormwater management facilities. A detention pond is planned for the NW Parking Lot, detention pipes for the SW Parking Lot, and a dispersion trench for the SE Parking Lot. Bioretention cell(s) are also planned for these parking lot additions. It is our understanding that these proposed stormwater management facilities will be designed in accordance with the Washington State Department of Ecology's 2014 Stormwater Management Manual for Western Washington (SWMMWW).

2.0 SCOPE OF SERVICES

Our services have been provided in general accordance with our proposal for this project dated May 17, 2021 and our Signed Agreement No. 2020-546 C(3) dated June 13, 2021. A complete list of our scope or services is provided in this proposal.

During this study, it was determined that additional services and information not included in the above scope was required to assess the presence of groundwater and groundwater elevations near the proposed NW Parking Lot detention pond. A groundwater monitoring well was installed near this location on January 3, 2022 in order to collect groundwater data during the wet weather months (defined by the City of Puyallup as December 21 through April 1). A summary well log and data collected from the monitoring well will be presented in a supplemental report that will be presented around spring, after collection of groundwater data.

3.0 SITE CONDITIONS

3.1. Surface Conditions

The proposed NW Parking Lot area is currently occupied by undeveloped forest land in the northwest portion of the campus, generally north-northwest of the Health Education Center building. The proposed SW Parking Lot area currently consists of a grass field and is located east of the Garnero Child Development Center building. The proposed SE Parking Lot area is in the southeast corner of campus and currently consists of paved driveways, parking stalls, and vegetated planters.

Site vegetation in forested areas of the site generally consists of mature coniferous and deciduous trees and a dense understory layer, including brush, small trees, fallen trees, and forest duff. Developed parts of the site are generally vegetated with grass, plants, and shrubs. Campus site topography generally slopes upward toward the south-southeast from approximate Elevation 509 feet in the northwest campus corner to Elevation 551 feet in the southeast campus corner. Elevations are referenced to the North American Vertical Datum of 1988 (NAVD88).

3.2. Literature Review

3.2.1. Geologic Maps

Our understanding of the site geology is based on review of the *Geologic Map of the Tacoma 1:100,000-scale Quadrangle, Washington* (Schuster, et al. 2015). The geologic map indicates the campus is mostly underlain by "Vashon Till" (Q_{gt}). "Recessional outwash" (Q_{go}) is also mapped along the eastern edge of campus and surrounds the Vashon till (glacial till) and project vicinity. Glacial till is glacially consolidated and is described as a low permeability, highly compact mixture of sand, gravel, silt, and clay that can contain cobbles and boulders dispersed throughout. Recessional outwash is generally described as variably sorted silt, clay, sand, and gravel deposited by receding glacial ice, and is typically underlain at some depth by glacial till. Recessional outwash deposits are not glacially consolidated and are generally medium dense.

3.2.2. Soil Survey

We reviewed the Natural Resources Conservation Service (NRCS) Web Soil Survey (accessed June 23, 2021). According to the survey, the site is underlain by three subunits of Kapowsin gravelly ashy loam: 0 to 6 percent slopes; 6 to 15 percent slopes; and 30 to 65 percent slopes. Kapowsin gravelly ashy loam is described as moderately well drained with a very low capacity of the most limiting layer to transmit water and categorized as Hydrologic Soil Group B.

3.2.3. Water Well Information

We searched the Washington State Department of Natural Resources Interactive Geologic Information Portal on May 4, 2021 for water well log reports in the project vicinity. Based on our search, we found a water well log report dated May 28, 2002 (Ecology Well ID Tag No. AFR 833) near the southwest corner of the campus property. This well log reported the static groundwater level at about 411 feet below the top of the well. We interpret this static groundwater level to be representative of the regional groundwater table in the project vicinity.

3.3. Subsurface Conditions

3.3.1. Subsurface Explorations and Laboratory Testing

We explored subsurface conditions at the proposed parking lot areas described above by excavating eight test pits (TP-1 through TP-8). Three test pits (TP-1 through TP-3) were located in the NW Parking Lot area, two test pits (TP-4 and TP-5) were located in the SW Parking Lot area, and three test pits (TP-6 through TP-8) were located in the SE Parking Lot area. The approximate locations of the proposed parking lot areas and the test pits are shown on the attached Site Plan, Figure 2. A description of our subsurface exploration program and summary exploration logs are provided in Appendix A. Two small-scale pilot infiltration tests (PITs) were completed in TP-2 (PIT-1) and TP-6 (PIT-2). The test results and methodology for the PITs are discussed in further detail in the "Stormwater Infiltration" section of this report.

Selected samples collected from our test pits were tested in our laboratory to confirm field classifications and to evaluate pertinent engineering properties. Our laboratory testing program included grain-size distribution analyses and moisture content determinations. A summary of our laboratory testing program and the test results are provided in Appendix A.

3.3.2. Soil Conditions

We observed about 12 inches of forest duff and/or organic-rich soil at the surface in test pits TP-1 through TP-3. Approximately 6 inches of sod was observed at the surface in the remaining test pits (TP-4 through TP-8). Descriptions of soils encountered below these surface materials in each parking lot area are discussed in the sections below.

3.3.2.1. NW Parking Lot Area

Below the forest duff and/or organic-rich soil in TP-1 through TP-3, we observed what we interpret to be glacial till. Glacial till was typically comprised of silty sand with variable gravel content and gravel with silt and sand. The upper approximately 3 feet of glacial till was observed to be in a weathered, medium dense condition. Roots up to about 1½-inch diameter were noted in the upper 2 to 3 feet of the glacial till. Below the weathered zone, glacial till generally included occasional cobbles and was observed to be dense to very dense. Test pits TP-1 through TP-3 were completed in glacial till soils at depths ranging from about 5½ to 11½ feet below ground surface (bgs). TP-2 (PIT-1) was terminated in hard, sandy silt.

3.3.2.2. SW Parking Lot Area

Below the sod in TP-4 and TP-5, we observed silty sand with variable gravel and cobbles content and occasional deleterious debris. Debris observed included nails, rubber particles, asphalt fragments and plastic waste. We interpret this material as fill. Fill was typically in a medium dense to dense condition and extended to depths between 2 and 3½ feet bgs.

Underlying the fill, we observed what we interpret to be glacial till. Glacial till typically consisted of silty sand with variable gravel and cobbles content and sand. The upper approximately 1½ to 3 feet of glacial till was observed to be weathered and generally in the medium dense to dense range. Underlying the weathered zone, very dense conditions were observed. Test pits TP-4 and TP-5 were completed in glacial till soils at depths of about 9 and 10½ feet bgs, respectively.

3.3.2.3. SE Parking Lot Area

Below the sod in TP-6 (PIT-2) through TP-8, we observed what we interpret to be fill material extending to about 1 to 4 feet bgs. Fill material typically consisted of loose, silty sand to medium stiff, sandy silt with gravel and occasional deleterious debris including asphalt fragments, metal cans and carbonized wood. Underlying the fill in TP-7, we observed what we interpret to be an old topsoil horizon from about 3 to 3½ feet bgs, which consisted of silty sand with organic matter (roots). TP-8 was completed in fill material at a depth of approximately 4 feet bgs.

Underlying the fill in TP-6 (PIT-2) and the old topsoil horizon in TP-7, we observed what we interpret to be glacial till. Glacial till typically consisted of silty sand with variable gravel and cobbles content. The upper approximate 1½ feet in TP-6 (PIT-2) was observed to be weathered and in a medium dense condition. Dense soil conditions were observed beneath the weathered zone to the completed depth of about 4¼ feet bgs. The glacial till in TP-7 was observed to be weathered and in a medium dense to dense condition to the completed depth of about 8½ feet bgs.

3.3.3. Groundwater Conditions

We did not observe what we interpret to be the regional groundwater table in our explorations. However, we observed moderate seepage in TP-5 beginning around 3 feet bgs. The seepage rate was observed to increase to rapid at about 9½ feet bgs. Moderate seepage is defined as 1 to 3 gallons per minute (gpm) and rapid seepage is greater than 3 gpm. We interpret the seepage observed in TP-5 to be perched groundwater.

Based on our experience, it is not uncommon for glacial soils to contain isolated zones of perched groundwater. We anticipate that perched groundwater could be present in other areas at the proposed parking lots depending on soil conditions, rainfall amounts, irrigation activities and other factors. We anticipate that perched groundwater levels will generally be highest during the wet season, typically October through May. Static groundwater is not anticipated at excavation depths proposed.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1. Primary Geotechnical Considerations

Based on our understanding of the project, the explorations performed for this study, review of subsurface information near or within the project vicinity and our experience, it is our opinion that the proposed improvements can be designed and constructed generally as envisioned with regards to geotechnical considerations. A summary of the primary geotechnical considerations for the project is provided below and is followed by our detailed recommendations.

- Clearing and stripping depths for forest duff in the NW Parking Lot area will typically be on the order of about 12 inches. Abundant roots were observed to a depth of about 2 to 3 feet bgs, which may require greater clearing and stripping efforts when establishing subgrades. In the SW and SE Parking Lots, clearing and stripping depths will be on the order of 6 inches to remove sod.
- Most of the soils observed at the proposed parking lot areas contain a significant quantity of fines and, therefore, could be difficult or impossible to work with when wet or become easily disturbed if exposed to wet weather. Depending on the intended use of the material and the moisture/weather conditions, it may be difficult to re-use on-site soils as structural fill.
- Based on our experience, subsurface conditions observed in our explorations, and results from our infiltration testing, it is our opinion that stormwater infiltration within proposed development areas related to this study is generally infeasible. We provide additional discussion in the "Stormwater Infiltration" section below.

4.2. Luminaire Poles

4.2.1. Design Parameters

We understand that luminaire poles are planned for parking lot improvements. It is our opinion that Washington State Department of Transportation (WSDOT) Standard Plans may be used, as applicable, for design of luminaire poles. Recommended soil properties and design parameters are provided in Table 1 below. These values are based on our experience in the area and review of the 2021 WSDOT Geotechnical Design Manual (WSDOT GDM), Chapter 17, "Foundation Design for Signals, Signs, Noise Barriers, Culverts, and Buildings," specifically referencing Table 17.2. We recommend that this document be referenced and reviewed during the design and selection process for luminaire pole foundations. The WSDOT GDM, Chapter 17 also provides design guidance if foundations other than indicated in the Standard Plans are required.

The allowable lateral bearing pressure listed below is for foundations constructed in relatively flat ground conditions, which is anticipated for this project. Special design considerations for foundations constructed on or near slopes are provided in WSDOT GDM, Chapter 17. We should be consulted further if sloping conditions are anticipated around luminaire poles.

TABLE 1. LUMINAIRE POLE DESIGN PARAMETERS

Proposed Parking Lot	Soil Unit Weight (pcf)	Soil Friction Angle (deg)	Allowable Lateral Bearing Pressure (psf)
Northwest	125	34	2,500
Southwest	125	34	2,500
Southeast	120	32	1,900

4.2.2. Construction and Additional Design Considerations

We present two conditions to consider when designing and constructing luminaire pole foundations (pole foundations).

- Condition #1, an excavation the same dimension of the designed pole foundation is developed, and the foundation is cast directly against undisturbed earth. Or,
- Condition #2, an excavation larger than the designed dimension of the pole foundation is developed, a corrugated metal pipe is placed into the excavation and the foundation concrete is cast inside the metal pipe. The corrugated metal pipe is left in place after pouring the foundation concrete. Any overexcavated area outside of the corrugated metal pipe is backfilled with controlled density fill (CDF) or structural fill.

Construction of foundation Condition #1 requires the sidewalls of the excavation to stay stable and not cave into the excavation. In the case of drilling installation methods, temporary steel casing or drill slurry can also be used if caving soil conditions are encountered. Excavations made for foundation Condition #2 should be in accordance with the “Temporary Excavations and Cut Slopes” section of this report if workers are expected to enter the excavation. Recommendations regarding backfilling around pole foundations are included in the “Backfill Placement and Compaction Around Luminaire Pole Foundations” section of this report.

In general, we expect that the majority of the luminaire pole foundations will be constructed in fill and/or weathered soil overlying glacial till. We expect that the majority of the excavations for the foundations will remain open for a short period of time. There could be sloughing and raveling in the upper approximate 5 feet or so, in the fill and/or weathered soils. The contractor should be prepared to use casing, as necessary, to stabilize the hole, especially within the upper approximate 5 feet.

4.3. Site Development and Earthwork

4.3.1. General

We anticipate that site development and earthwork will include clearing and grubbing, site grading, excavating for utilities and other improvements, establishing subgrades for structures and roadways, and placing and compacting fill and backfill materials. We expect that site grading and earthwork can be accomplished with conventional earthmoving equipment. The following sections provide specific recommendations for site development and earthwork.

4.3.2. Clearing and Stripping

We anticipate that clearing and stripping depths at the proposed NW Parking Lot area will be on the order of about 12 inches to remove forest duff and/or organic-rich soil. Roots were observed to about 3 feet bgs and mature trees were present in this area; therefore, it is likely that greater stripping depths will be required in areas of trees, heavier vegetation, or relatively lower lying areas. Clearing and stripping depths in the proposed SW and SE Parking Lot areas are anticipated to be on the order of about 6 inches to remove the sod.

During stripping operations excessive disturbance of surficial soils can occur, especially if left exposed to wet conditions. The site soils expected to be exposed after clearing and stripping have a relatively high fines content and can be easily disturbed during wet weather. Clearing and stripping at the site should be performed during dry weather and/or exposed soils should be promptly covered and protected to avoid excessive disturbance. Disturbed soils may require additional compaction or remediation during construction and grading.

Cobbles were encountered in our explorations. Although boulders were not encountered in our explorations, boulders are commonly present in glacial till soils in the project area. The contractor should be prepared to remove cobbles and boulders if encountered during grading or excavation. Boulders may be removed from the site or used in landscape areas. Voids caused by boulder removal should be backfilled with structural fill.

4.3.3. Erosion and Sedimentation Control

Erosion and sedimentation rates and quantities can be influenced by construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. Implementing an Erosion and Sedimentation Control Plan will reduce impacts to the project where erosion-prone areas are present. The plan should be designed in accordance with applicable city, county and/or state standards. The plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure;
- Re-vegetating or mulching denuded areas;
- Directing runoff away from exposed soils;
- Reducing the length and steepness of slopes with exposed soils;
- Decreasing runoff velocities;
- Preparing drainage ways and outlets to handle concentrated or increased runoff;

- Confining sediment to the project site; and
- Inspecting and maintaining control measures frequently.

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce erosion and reduce transport of sediment to adjacent areas and receiving waters. Permanent erosion protection should be provided by paving, structure construction or landscape planting.

Until the permanent erosion protection is established, and the site is stabilized, site monitoring may be required by qualified personnel to evaluate the effectiveness of the erosion control measures and to repair and/or modify them as appropriate. Provisions for modifications to the erosion control system based on monitoring observations should be included in the Erosion and Sedimentation Control Plan. Where sloped areas are present, some sloughing and raveling of exposed or disturbed soil on slopes should be expected. We recommend that disturbed soil be restored promptly so that surface runoff does not become channeled.

4.3.4. Temporary Excavations and Cut Slopes

Based on observations made during excavation of our test pits and our experience with other projects in similar soil conditions, we anticipate that shallow or even moderately deep (about 10-foot) excavations that do not encounter groundwater seepage could maintain vertical slopes for extended periods of time with only minor caving. However, excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Shoring and temporary slope inclinations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under Washington Industrial Safety and Health Act (WISHA). We recommend contract documents specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety, and providing shoring, as required, to protect personnel and structures.

In general, we recommend that for planning purposes all temporary cut slopes be inclined no steeper than about 1½H to 1V (horizontal to vertical) if workers are required to enter the excavation. This guideline assumes all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope and that seepage is not present on the slope face. Flatter cut slopes will be necessary where seepage occurs or if surface surcharge loads are anticipated. Temporary covering with heavy plastic sheeting should be used to protect these slopes during periods of wet weather.

4.3.5. Permanent Cut and Fill Slopes

We recommend permanent slopes be constructed at a maximum inclination of 2H to 1V to manage erosion. Where 2H to 1V permanent slopes are not feasible, protective facings and/or retaining structures should be considered.

To achieve uniform compaction, we recommend fill slopes be overbuilt and subsequently cut back to expose well-compacted fill. Fill placement on existing slopes steeper than 5H to 1V should be benched into the slope face. The configuration of benches depends on the equipment being used and the inclination of the existing slope. Bench excavations should be level and extend into the slope face at least half the width of the compaction equipment used.

Exposed areas should be re-vegetated as soon as practical to reduce surface erosion and sloughing. Temporary protection should be used until permanent protection is established.

4.3.6. Groundwater Handling Considerations

It is common within glacial deposits encountered at this campus and in general, sites with similar soil conditions, to encounter perched groundwater. The interface between more permeable and less permeable soil types such as the contact between fill and/or weathered glacial till and glacial till are common conditions where perched groundwater can be present, as such, perched groundwater could be encountered in other excavations outside of our test pit explorations, especially where more permeable sand and gravel seams may overlie less permeable materials.

Groundwater handling needs will typically be lower during the summer and early fall months. We anticipate that shallow perched groundwater can be handled adequately with sumps, pumps, and/or diversion ditches, as necessary. Ultimately, we recommend that the contractor performing the work be made responsible for controlling and collecting groundwater encountered.

Based on our understanding of the proposed site improvements, we do not anticipate that the regional static groundwater table will be encountered during excavations for this project. Perched groundwater was observed in test pit TP-5 beginning around 3 feet bgs. Perched water or the presence of water was not noted in the other explorations. If it becomes necessary to complete deeper excavations near or around TP-5 and for the SW parking lot area, it may be necessary to consider higher volumes of water depending on the amount of rainfall and time of year. The use of larger pumps, storage tanks, and discharge permits could be necessary.

4.3.7. Surface Drainage

Surface water from driveways and landscape areas should be collected and controlled. Curbs or other appropriate measures such as sloping pavements, sidewalks and landscape areas should be used to direct surface flow away from buildings, erosion sensitive areas and from behind retaining structures. Roof and catchment drains should not be connected to wall or foundation drains.

4.3.8. Subgrade Preparation

Subgrades that will support structures, hardscapes and roadways should be thoroughly compacted to a uniformly firm and unyielding condition on completion of stripping and before placing structural fill. We recommend that subgrades for hardscapes and roadways be evaluated, as appropriate, to identify areas of yielding or soft soil. Probing with a steel probe rod or proof-rolling with a heavy piece of wheeled construction equipment are appropriate methods of evaluation.

If soft or otherwise unsuitable subgrade areas are revealed during evaluation that cannot be compacted to a stable and uniformly firm condition, we recommend that: (1) the unsuitable soils be scarified (e.g., with a ripper or farmer's disc), aerated and recompacted, if practical; or (2) the unsuitable soils be removed and replaced with compacted structural fill, as needed.

4.3.9. Subgrade Protection and Wet Weather Considerations

Near-surface soils observed at the proposed parking lot areas contain a significant quantity of fines and will be susceptible to disturbance during periods of wet weather. The wet weather season generally begins in October and continues through May in western Washington; however, periods of wet weather can occur during any month of the year. It may be possible to conduct earthwork at the site during wet weather months provided appropriate measures are implemented to protect exposed soil. If earthwork is scheduled during the wet weather months, we offer the following recommendations:

- Measures should be implemented to remove or eliminate the accumulation of surface water from work areas. The ground surface in and around the work area should be sloped so that surface water is directed away and graded so that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches.
- Earthwork activities should not take place during periods of heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and other soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting, sumps with pumps and grading. The site soils should not be left uncompacted and exposed to moisture. Sealing exposed soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent to which these soils become wet or unstable.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with working pad materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.
- Protective surfacing such as placing asphalt-treated base (ATB), or haul roads made of quarry spalls or a layer of free-draining material such as well-graded pit-run sand and gravel may be considered to limit disturbance to completed areas. Minimum quarry spall thicknesses should be on the order of 12 to 18 inches. Typically, minimum gravel thicknesses on the order of 24 inches are necessary to provide adequate subgrade protection.

4.4. Fill Materials

4.4.1. Structural Fill

The workability of material for use as structural fill will depend on the gradation and moisture content of the soil. Material used for structural fill should be free of debris, organic contaminants and rock fragments larger than 6 inches. For most applications, structural fill consisting of material similar to “Select Borrow” or “Gravel Borrow” as described in Section 9-03.14 of the WSDOT Standard Specifications will be appropriate.

Weather and site conditions should be considered when determining the type of import fill materials purchased and brought to the site for use as structural fill. If earthwork activities are scheduled during the wet weather months or during prolonged periods of wet weather, we recommend that washed crushed rock or select granular fill, as described below, be used for structural fill.

If prolonged dry weather prevails during the earthwork phase of construction, materials with a somewhat higher fines content may be acceptable.

4.4.2. Select Granular Fill

Select granular fill should consist of well-graded sand and gravel or crushed rock with a maximum particle size of 6 inches and less than 5 percent fines by weight based on the minus ¾-inch fraction. Organic matter, debris or other deleterious material should not be present. In our opinion, material with gradation characteristics similar to WSDOT Specification 9-03.9 (Aggregates for Ballast and Crushed Surfacing), or 9-03.14 (Borrow) is suitable for use as select granular fill, provided that the fines content is less than 5 percent (based on the minus ¾-inch fraction) and the maximum particle size is 6 inches.

4.4.3. Pipe Bedding

Trench backfill for the bedding and pipe zone should consist of well-graded granular material similar to "Gravel Backfill for Pipe Zone Bedding" described in Section 9-03.12(3) of the WSDOT Standard Specifications. The material must be free of roots, debris, organic matter and other deleterious material. Other materials may be appropriate depending on manufacturer specifications and/or local jurisdiction requirements.

4.4.4. Trench Backfill

Trench backfill must be free of debris, organic material and rock fragments larger than 6 inches. We recommend that trench backfill material consist of material similar to "Select Borrow" or "Gravel Borrow" as described in Section 9-03.14 of the WSDOT Standard Specifications.

4.4.5. On-Site Soil

Based on our subsurface explorations and experience, it is our opinion that existing site soils, excluding the forest duff and/or organic-rich soil and sod, may be considered for use as structural fill and trench backfill, provided that it can be adequately moisture conditioned, placed and compacted as recommended and does not contain organic or other deleterious material. Based on our experience, the fill material and glacial till at the site are extremely moisture sensitive and will be very difficult or impossible to properly compact when wet.

In addition, it is likely that existing soils will be above optimum moisture content (OMC) when excavated, unless earthwork activities take place in the middle of summer. Even then, the soil could still be above OMC when excavated. Soils placed and compacted above OMC are typically difficult to work with and may have trouble achieving adequate compaction. If earthwork occurs during a typical wet season, or if the soils are persistently wet and cannot be dried back due to prevailing wet weather conditions or lack of drying space/time, we recommend the use of imported structural fill or select granular fill, as described above. We suggest we be contacted again should on-site material be considered for use as fill so that we can provide more specific review of the work and area being developed. Overall, we suggest that a provision for imported material be included in the project budget to account for the presence of fine-grained soil that is over-wet and cannot achieve compaction. We expect that this may be most prevalent for utility trench backfill but may also be relevant for general fills to achieve design grade.

4.5. Fill Placement and Compaction

4.5.1. General

To obtain proper compaction, fill and backfill soil should be compacted near the OMC and in uniform horizontal lifts. Lift thickness and compaction procedures will depend on the moisture content and gradation characteristics of the soil and the type of equipment used. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction. Generally, 8- to 12-inch loose lifts are appropriate for steel-drum vibratory roller compaction equipment. Compaction should be achieved by mechanical means. During fill and backfill placement, sufficient testing of in-place density should be conducted to check that adequate compaction is being achieved.

4.5.2. Area Fills and Pavement Bases

Fill placed to raise site grades and materials under pavements and should be placed on subgrades prepared as previously recommended. Fill material placed shallower than 2 feet below pavement sections should be compacted to at least 95 percent of the maximum dry density (MDD). Fill placed deeper than 2 feet below pavement sections should be compacted to at least 90 percent of the MDD. Fill material placed in landscaping areas should be compacted to a firm condition that will support construction equipment, as necessary, typically around 85 to 90 percent of the MDD.

4.5.3. Trench Backfill

For utility excavations, we recommend that the initial lift of fill over the pipe be thick enough to reduce the potential for damage during compaction, but generally should not be greater than about 18 inches above the pipe. In addition, rock fragments greater than about 1 inch in maximum dimension should be excluded from this lift.

Trench backfill material placed below structures and footings should be compacted to at least 95 percent of the MDD. In paved areas, trench backfill should be uniformly compacted in horizontal lifts to at least 95 percent of the MDD in the upper 2 feet below subgrade. Fill placed below a depth of 2 feet from subgrade in paved areas must be compacted to at least 90 percent of the MDD. In non-structural areas, trench backfill should be compacted to a firm condition that will support construction equipment as necessary.

4.5.4. Backfill Placement and Compaction Around Luminaire Pole Foundations

Backfill in overexcavated areas and around pole foundations must be compacted in accordance with WSDOT Standard Specifications Section 2-09.3(1)E. If the overexcavated area is large enough for compaction equipment to access, import fill material or on-site material conforming to the specifications and discussion outlined above can be used to backfill the excavations. Backfill material around pole foundations must be compacted to at least 95 percent of the theoretical MDD per ASTM International (ASTM) D 1557.

Alternatively, CDF could be used to backfill the excavation in accordance with WSDOT Standard Specification Section 2-09.3(1)E. CDF is a self-compacting, cementitious, flowable material requiring no subsequent vibration or tamping to achieve consolidation. CDF is included as an option for backfilling around pole foundations in the WSDOT Standard Signal Foundation Plans. If the area to backfill is too small for compaction equipment to access, CDF should also be used. Additionally, we recommend that CDF be used to backfill any large voids created during excavation if compaction equipment cannot access the void area.

4.6. Stormwater Infiltration

4.6.1. General

It is our understanding that stormwater infiltration facilities will be designed in general accordance with the Washington State Department of Ecology's 2014 SWMMWW. According to the SWMMWW, design infiltration rates in glacially consolidated soils (i.e., glacial till) should be determined via in-situ infiltration testing such as a PIT. The sections below further describe our methodology and provide recommended infiltration rates for design.

We developed design stormwater infiltration rates for the proposed NW and SE Parking Lots following general methodology presented in the SWMMWW and completed two small-scale PITs, PIT-1 and PIT-2. PIT-1 was completed during excavation of TP-2 and PIT-2 was completed during excavation of TP-6. PIT-1 was located approximately within the basal footprint of the planned detention pond for the proposed NW Parking Lot area. PIT-2 was located within a landscape planter in the vicinity of a planned bioretention cell for the proposed SE Parking Lot area.

A PIT was planned for TP-5 within the approximate basal footprint of the proposed detention pipes for the SW Parking Lot area; however, due to moderate to rapid groundwater seepage observed in the excavation, the PIT was unable to be completed. We provide further discussion on these detention pipes in the "Proposed SW Parking Lot Detention Pipe Design" section below.

The proposed dispersion trench in the SE Parking Lot area is currently located at the top of a slope near the east edge of College Way. We provide further discussion on this dispersion trench in the "Proposed SE Parking Lot Dispersion Trench" section below.

4.6.2. Pilot Infiltration Tests

4.6.2.1. Methodology

We completed the PITs generally following GeoEngineers' standard methodology for PITs, which is a synthesis of best practices and, in our opinion, meets the intended procedures for small-scale PITs set forth in the SWMMWW. Per the direction of the project civil engineer (AHBL), PIT-1 and PIT-2 were completed at depths of about 11 and 4 feet bgs, respectively. The approximate areas of the base of the PIT excavations were at least 16 square feet. Upon reaching the target depth for PIT-1, an extension ladder with a piezoelectric pressure transducer secured to near the bottom was lowered to the floor of the test pit to record water level readings during the PIT. Similarly, upon reaching the target depth for PIT-2, a graduated yard stick was driven into the floor of the test pit and a piezoelectric pressure transducer was secured to near the bottom of the yard stick. The piezoelectric pressure transducers were programmed to record water level readings at 20-second intervals.

GeoEngineers' PIT procedure consists of a 6-hour (minimum) saturation period where the water depth in the PIT is raised and lowered, over a small 1- to 3-inch interval, in a series of falling-head stages. Water level measurements collected by the pressure transducer during each falling-head stage are used to calculate the apparent infiltration rate for each stage. Manual water level measurements are also recorded in the event a transducer malfunctions during the test. The falling-head stage methodology is intended to fully saturate the soils below the base of the PIT while allowing for a direct measurement of when saturated or near-saturated conditions have been achieved. This is usually manifested by a progressive decline in the apparent infiltration rate until the rate approximately stabilizes. The stabilized rate corresponds to the saturated infiltration rate or the measured (initial) infiltration rate of the soil.

Generally, once a stabilized infiltration rate is observed and a minimum of 6 hours of saturation time has elapsed, the PIT is continued for one or more falling-head cycles or is left undisturbed until the water drains away completely. If left to drain away completely, the final drain-down period shows how infiltration changes over a continuous range of declining water depths.

Water was pumped into the PIT-1 excavation from a water truck, while a hose attached to a water hydrant was used to fill the PIT-2 excavation. PIT-1 and PIT-2 were filled with water to depths of about 16½ and

16 inches, respectively. The PITs completed for this study were only filled for one falling-head stage as they were observed to drain very slowly. At approximately 6 hours into each test, PIT-1 and PIT-2 had dropped about ½ inch and 1¾ inches, respectively. Based on the limited water level drops observed in the PITs over approximately 6 hours we elected to conclude the tests.

4.6.2.2. Test Results

We were able to download the transducer water level data from PIT-1, but the transducer used for PIT-2 did not record any water level data. Instead, we used our manual water level measurement to estimate the measured (initial) infiltration rate for PIT-2.

The SWMMWW recommends that correction factors be applied to the measured (initial) infiltration rate determined in the PIT to establish a long-term design infiltration rate. The correction factors account for uncertainties in site variability, testing procedures, and long-term reduction in permeability due to plugging. Table 2 below provides a summary of the correction factors outlined in the SWMMWW that are, in our opinion, appropriate for use at this site. The total correction factor is equal to the product of the individual factors.

TABLE 2. CORRECTION FACTORS FOR FIELD INFILTRATION MEASUREMENTS

Correction Factor	Recommended Value
Site Variability and Number of Locations Tested	CF_v=0.33 Selected because of number of test locations
Test Method	Small-scale PIT, CF_t = 0.50
Degree of Influent Control to Prevent Siltation and Bio-buildup	CF_m= 0.9
Total Correction Factor (CF_v x CF_t x CF_m)	CF_T= 0.15

The long-term design infiltration rate (K_{sat_design}) is obtained by multiplying the measured (initial) infiltration rate ($K_{sat\_initial}$) by the total correction factor:

$$K_{sat\_design} = K_{sat\_initial} * CF_T$$

Table 3 summarizes the measured (initial) and long-term design infiltration rates for the PITs.

TABLE 3. INFILTRATION RATE SUMMARY

Pilot Infiltration Test Number	Proposed Parking Lot	Approximate Depth of PIT (feet bgs)	Approximate Elevation of PIT[1] (feet; NAVD88)	Measured (Initial) Infiltration Rate ($K_{sat\_initial}$; in/hr)	Long-Term Design Infiltration Rate[2] (K_{sat_design}; in/hr)
TP-2 (PIT-1)	Northwest	11	504	0.10	0.015
TP-6 (PIT-2)	Southeast	4	532	0.29	0.043

Notes:

[1] Elevation should be considered approximate.

[2] Long-term design infiltration rate with appropriate correction factors applied.

4.6.2.3. Discussion of PIT Results and Stormwater Infiltration Feasibility

Based on the subsurface conditions observed in our explorations and the results of the PITs, it is our opinion that stormwater infiltration is generally infeasible at the proposed parking lot areas for this project. We take no issue with preliminary use of the long-term design infiltration values listed in Table 3 at this time, corresponding to the areas studied; however, it is our understanding that values below 0.3 inches per hour are also considered infeasible for infiltration, according to the City of Puyallup. Similar soil conditions were also noted within the other explorations completed for the project. As such, we ultimately recommend that infiltration not be considered as an option for stormwater management on this project. If a small amount of infiltration is absolutely necessary, we recommend we be consulted first to review proposed location, the proposed design, and overall use before final determination of design.

4.6.3. Additional Considerations

4.6.3.1. General

The SWMMWW indicates PITs should be completed between December 1st and April 1st (wet season). Testing during this time range is to help provide an accurate representation of soil saturation and groundwater information. However, based on previous explorations and work in the project vicinity and our review of regional groundwater conditions, the static groundwater levels are reported and expected to be well below the project excavation depths, even during the wet season. In addition, subsurface soils are fine-grained and dense at proposed infiltration locations and not expected to be different during the wet season. While there is a potential for the presence of seepage to be greater during the wetter times of the year, we conclude that the presence and condition of the glacial till is the primary controlling factor in infiltration rate design for depths proposed at this project. Because of this and based on review of groundwater data nearby, it is our opinion that the time of year of PIT completion is not a controlling factor for stormwater design.

We did not investigate the suitability of site soils for stormwater treatment purposes as part of this study. If soils at the site are to be used for stormwater treatment, additional testing and/or the use of soil amendments may be necessary.

4.6.3.2. Proposed SW Parking Lot Detention Pipe Design

TP-5 was completed approximately within the basal footprint of the proposed detention pipes area. Groundwater seepage was encountered about 3 feet bgs to the depth explored. Based on conditions observed in TP-5 and our other explorations, we expect that there could be times of year where the detention pipes may be constructed in the presence of seepage and at depths where there is a potential for the pipes to be surrounded by water. As such, we recommend that the proposed detention pipes be considered and checked for buoyancy effects. For the SW parking lot detention pipe design, we recommend the following considerations for review:

- Groundwater elevation assumed to be at 534 feet (NAVD88);
- Total soil unit weight (above groundwater): 125 pounds per cubic foot (pcf);
- Effective soil unit weight (below groundwater): 62.6 pcf;
- Follow detention pipe system manufacturer recommendations for mitigating buoyancy effects.

Based on our explorations, we conclude that design for this groundwater elevation and this condition is conservative and that seepage in this area will be intermittent, discontinuous, and variable in depth and location. As such, we do not expect the pipe in this area to become submerged and the soil to become fully saturated enough to represent the buoyant condition. If buoyancy becomes an issue at this elevation, we recommend that we re-evaluate our design and considerations presented above, including the effects of multiple groundwater depths, alternative backfill options and/or anchors or weight options for the pipe, should it be determined necessary.

4.6.3.3. Proposed SE Parking Lot Dispersion Trench

Per sheet C2.4 of the Development Plans, two dispersion trenches that are 50 and 20 feet long (system), respectively, are proposed on the east edge of College Way. This system will be located near the top of a slope that is more than 20 feet in height. The slope grade in the vicinity of the proposed trenches ranges between about 4H to 1V and 2.4H to 1V, which equates to about a 25 to 42 percent slope. The slope is densely forested and based on literature and our experience on campus, soils are likely to consist of dense glacial till or recessional outwash. We understand that this slope area east of College Way is regulated and not expected to be built upon or cleared.

We reviewed the "Design Criteria for Dispersion Trenches" subsection under section "3.1.2 Downspout Dispersion Systems (BMP T5.10B)" of the SWMMWW. Per criterion number 5, discharge points of these trenches should not be placed on or above slopes that are greater than 15 percent "without evaluation by a geotechnical engineer or qualified geologist and jurisdiction approval."

Based on our understanding of the subsurface and geologic conditions in the project vicinity, inclinations of the slope, and provided that the current vegetation of the down slope portion of the slope remains intact and the area remains uninhabited, it is our opinion that these proposed dispersion trenches can be constructed as envisioned at the top of the slope with limited risk. We provide the following additional considerations and recommendations:

- Based on nearby explorations, site geology, and review of the system, it is our opinion that the location and proposed use of the infiltration trench will not cause global instability or deep-seated slope failure.
- The current configuration of the slope is less steep than our recommendations for permanent slope construction; 2H to 1V.
- Near surface slope erosion and saturation at the outlets within the trench and downhill flooding could occur from the system. This will ultimately depend on volume, frequency, and flow rate of discharging stormwater from the trenches. Based on site review, slope inclinations and dense vegetative nature of the forest and the expected limited use and long term limited disturbance of the slope area, it is our opinion that this area can accommodate the additional influx of proposed dispersion trench water without causing excessive or significant surface or shallow failures.
- We recommend that this area be inspected yearly and maintained. We also suggest at a minimum that inspections be completed during the rainy season after periods of heavy precipitation to evaluate if maintenance is necessary. There could be some repairs and slope surface care that will need to be addressed over time. Options for additional slope surface care, should some erosion or issues be observed, could include placement of straw wattles or other similar erosion control products. Re-planting, energy dissipaters such as quarry spalls and/or silt fencing could also be placed near drain inlets/outlets to further slow water and the effects of erosion, should it seem to be an issue. Ultimately, we recommend that the SWMMWW be reviewed for guidance on incorporating permanent erosion control measures for the slope and the dispersion trench system.

4.7. Pavement Recommendations

4.7.1. General

Pavements for the proposed improvements will include new parking areas and driveways. Our recommended pavement sections provided below are based on our explorations and experience in the area. We understand ACP is planned for the proposed improvements.

The recommended pavement sections below may not be adequate for heavy construction traffic loads such as those imposed by concrete transit mixers, dump trucks or cranes. Additional pavement thickness may be necessary to prevent pavement damage during construction. An ATB section can also be used during construction to protect partially constructed pavement sections and pavement subgrades. The recommended sections assume final improvements surrounding the pavement areas will be designed and constructed such that stormwater or excess irrigation water from landscape areas does not accumulate below the pavement section or pond on pavement surfaces. If pavements in parking areas slope inward (toward the center of the parking area) full depth curbs or other measures should be used to prevent water from entering and ponding on the subgrade and within the base section.

4.7.2. Construction Considerations

Existing pavements, hardscaping or other structural elements should be removed prior to placement of new pavement sections. Pavement subgrade should be prepared to a uniformly firm, dense and unyielding condition as previously described. Crushed surfacing base course (CSBC) and subbase should be moisture conditioned to near optimum moisture content and compacted to at least 95 percent of the MDD (ASTM D 1557).

Crushed surfacing base course should conform to applicable sections of 4-04 and 9-03.9(3) of the WSDOT Standard Specifications. Hot mix asphalt should conform to applicable sections of 5-04, 9-02 and 9-03 of the WSDOT Standard Specifications.

Some areas of pavement may exhibit settlement and subsequent cracking over time. Cracks in the pavement will allow water to infiltrate to the underlying base course, which could increase the amount of pavement damage caused by traffic loads. To prolong the effective life of the pavement, cracks should be sealed as soon as possible.

4.7.3. Asphalt Concrete Pavement Design

4.7.3.1. Standard-Duty ACP – Automobile Driveways and Parking Areas

- 2 inches of hot mix asphalt, class ½ inch, PG 58-22
- 4 inches of CSBC
- 6 inches of subbase consisting of select granular fill, previously described, to provide a uniform grading surface, to provide pavement support, to maintain drainage, and to provide separation from subgrade soil.
- Subgrade consisting of proof-compacted firm and unyielding conditions, or structural fill prepared in accordance with the "Subgrade Preparation" and "Area Fills and Pavement Bases" sections of this report.

4.7.3.2. Areas Subject to Occasional Heavy Truck Traffic

- 3 inches of hot mix asphalt, class ½ inch, PG 58-22
- 6 inches of CSBC
- 6 inches of subbase consisting of select granular fill, previously described, to provide a uniform grading surface, to provide pavement support, to maintain drainage, and to provide separation from subgrade soil.
- Subgrade consisting of proof-compacted firm and unyielding conditions, or structural fill prepared in accordance with the "Subgrade Preparation" and "Area Fills and Pavement Bases" sections of this report.

4.7.3.3. Temporary Construction Surfacing

A temporary surfacing of ATB can be used to protect partially constructed pavement sections and pavement subgrades during construction. This can provide a relatively clean working surface, prevent construction traffic from damaging final paving surfaces and reduce subgrade repairs required for final paving. A 2-inch-thick section of ATB can be substituted for the upper 2 inches of CSBC in either the light-duty or heavy-duty pavement sections. Prior to placement of the final pavement surface sections, we recommend that any areas of ATB pavement failure be removed, and the subgrade repaired. If ATB is used and is serviceable when final pavements are constructed, the design asphalt concrete pavement thickness can be placed directly over the ATB.

Cement treatment of subgrades is sometimes used to create construction surfacing or to control soil moisture during wet weather construction. In our opinion cement treatment would not likely be cost effective for creating a wet weatherproof construction surface due to the high fines content in the soil. Cement treatment or cement stabilization would likely only be cost effective as an emergency or contingency action for reducing soil moisture in the on-site material if excavated and re-used as a structural fill. We estimate that it would take a significant amount of cement, likely on the order of 12 percent by weight, to create a firm and stable working surface that could handle wet weather construction. If used as a structural fill, likely on the order of 6 to 8 percent cement by weight would be required.

5.0 LIMITATIONS

We have prepared this report for the Washington State Department of Enterprise Services (DES) for the Pierce College Puyallup – Parking Lot Additions project located in Puyallup, Washington. DES may distribute copies of this report to owner's authorized agents and regulatory agencies as may be required for the Project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty, express or implied, applies to the services or this report.

Please refer to Appendix B titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.

FIGURES

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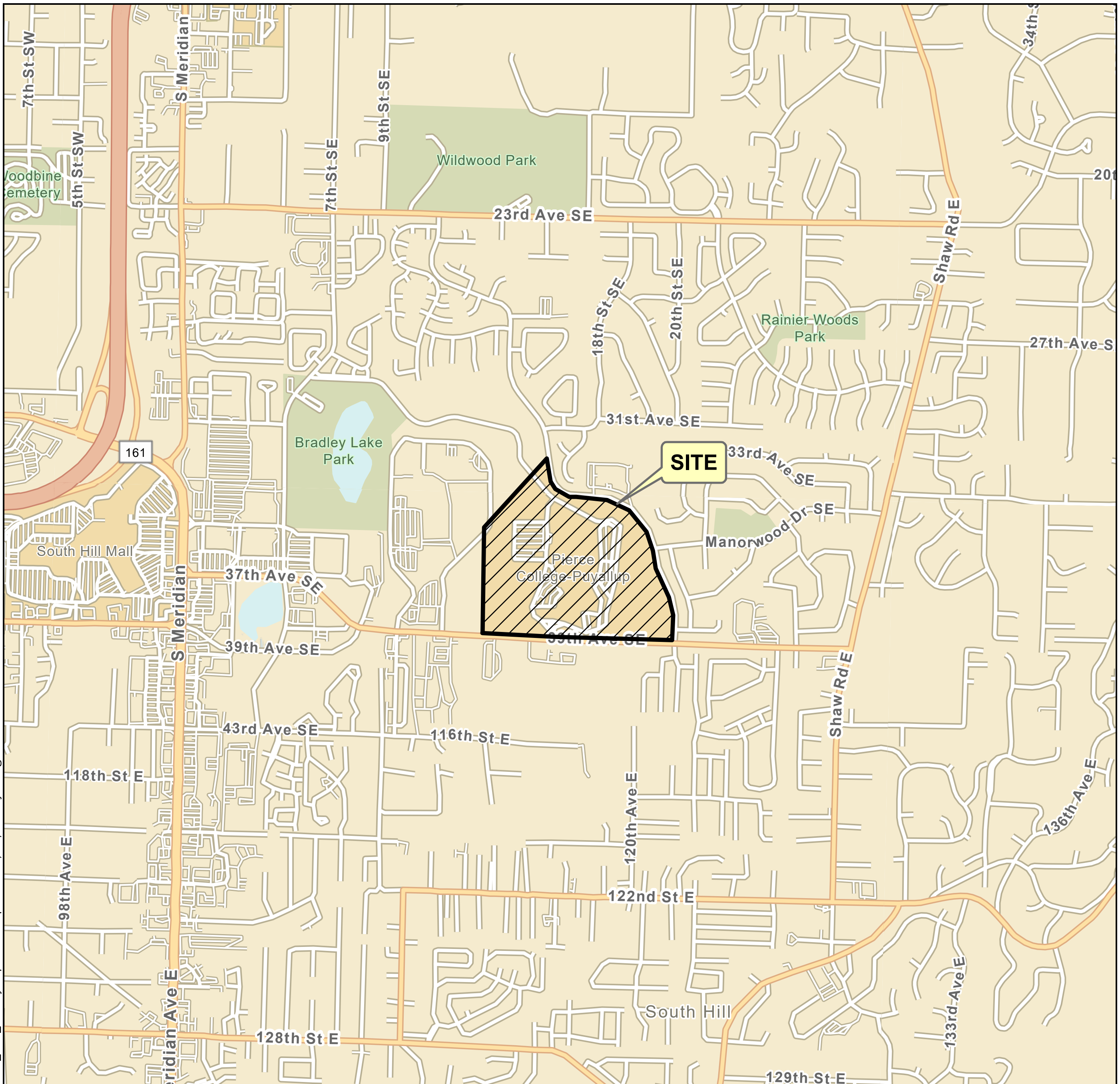

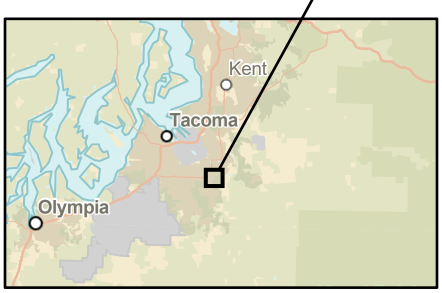

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Feet

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: ESRI

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Vicinity Map	
Pierce College Puyallup - Parking Lot Additions Puyallup, Washington	
GEOENGINEERS	Figure 1

P:\21\2134200300\GIS\2134200300_Project\2134200300_Project.aprx\2134200300_F01_VicinityMap Date Exported: 07/26/21 by maugust

Legend

TP-1 Test Pit by GeoEngineers, Inc., 2021

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Background from AHBL, Inc., dated 06/24/2021.
Aerial from Google Earth Pro dated 08/14/2020.

Projection: Washington State Plane, South Zone, NAD83, US Foot

N W E S

250 0 250
Feet

Site Plan

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

GEOENGINEERS

Figure 2

APPENDIX A
Subsurface Explorations and Laboratory Testing

APPENDIX A
SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

Subsurface Explorations

Subsurface conditions for the proposed Pierce College Puyallup – Parking Lot Additions project were explored by excavating eight test pits between June 17 and June 21, 2021 at the approximate locations shown on the Site Plan, Figure 2. Pilot infiltration tests (PITs) were completed at about 11 feet and 4 feet below ground surface (bgs) at TP-2 (PIT-1) and TP-6 (PIT-2), respectively. The test pits were excavated to depths between about 4 and 11½ feet bgs using an excavator provided and operated by Kelly's Excavating, Inc. under subcontract to GeoEngineers. After each test pit was completed, the excavation was backfilled using the generated material and compacted using the bucket of the excavator.

During the exploration program, our field representative obtained soil samples, classified the soils encountered, and maintained a detailed log of each exploration. The relative densities noted on the test pit logs are based on the difficulty of excavation and our experience and judgment. The samples were collected and retained in sealed plastic bags and then transported back to our office. The soils were classified visually in general accordance with the system described in Figure A-1, which includes a key to the exploration logs. Summary logs of the explorations are included as Figures A-2 through A-9.

The locations of the test pits were determined using an electronic tablet equipped with global positioning system (GPS) software. The locations of the explorations should be considered approximate.

Laboratory Testing

Soil samples obtained from the explorations were transported to GeoEngineers' laboratory. Representative soil samples were selected for laboratory tests to evaluate the pertinent geotechnical engineering characteristics of the site soils and to confirm our field classifications.

Our testing program consisted of the following:

- Three grain-size distribution analyses (sieve analyses [SA])
- Eight moisture content determinations (MC)

Tests were performed in general accordance with test methods of ASTM International (ASTM) or other applicable procedures. The following sections provide a general description of the tests performed.

Sieve Analysis (SA)

Grain-size distribution analyses were completed on selected samples in general accordance with ASTM Test Method C 136. This test method covers the quantitative determination of the distribution of particle sizes in soils. Typically, the distribution of particle sizes larger than 75 micrometers (µm) is determined by sieving. The results of the tests were used to verify field soil classifications and determine pertinent engineering characteristics. Figure A-10 presents the results of our sieve analyses.

Moisture Content (MC)

The moisture content of selected samples was determined in general accordance with ASTM Test Method D 2216. The test results are used to aid in soil classification and correlation with other pertinent engineering soil properties. The results are presented on the test pit logs at the depth tested.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	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
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES
		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
				SP	POORLY-GRADED SANDS, GRAVELLY SAND
		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% PASSING NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, ROCK FLOUR, 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 SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS AND SILTS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel / Dames & Moore (D&M)
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure A-1

Date Excavated	6/17/2021	Total Depth (ft)	6.5	Logged By	OA	Excavator	Kelly's Excavating	Groundwater not observed
				Checked By	CRN	Equipment	Komatsu PC120 Excavator	Caving not observed

Surface Elevation (ft)	509	Easting (X)	1198929	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	671191	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				DUFF	12 inches forest duff			
508	1				SM	Orange silty fine to medium sand with occasional gravel and organic matter (roots) (medium dense, moist) (weathered glacial till)			Roots up to 1½-inch diameter
507	2		1 MC				17		
506	3				SM	Gray silty fine to medium sand with gravel (dense, moist) (glacial till)			
505	4								
504	5					Grades to with occasional cobbles			
503	6		2						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit TP-1

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

Date Excavated: 6/17/2021	Total Depth (ft): 11.5	Logged By: OA Checked By: CRN	Excavator: Kelly's Excavating Equipment: Komatsu PC120 Excavator	Groundwater not observed Caving not observed

Surface Elevation (ft): 515 Vertical Datum: NAVD88	Easting (X): 1198837 Northing (Y): 671027	Coordinate System: WA State Plane South Horizontal Datum: NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample / Sample Name Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
515 – 514	0 – 1		DUFF	12 inches forest duff			
514 – 512	1 – 3	1 MC (approx. 1.5–2 ft)	SM	Orange silty fine to medium sand with occasional gravel and organic matter (roots) (medium dense, moist) (weathered glacial till)	16		Roots ¼- to 1½-inch diameter
512 – 510	3 – 5		SM	Gray silty fine sand with occasional gravel (dense, moist) (glacial till)			
510 – 505	5 – 10	2 (approx. 5.5–6 ft)	SM	Gray silty fine to medium sand with gravel and occasional cobbles (dense, moist)			
	~8			Grades to very dense			Increased excavation resistance
	~9			Grades to with occasional gravel			
505 – 503.5	10 – 11.5	3 SA (approx. 11–11.5 ft)	ML	Dark gray sandy silt with occasional gravel (hard, moist)	18	56	PIT completed at approximately 11 feet bgs

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit TP-2 (PIT-1)

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

Figure A-3
Sheet 1 of 1

Date Excavated	6/17/2021	Total Depth (ft)	5.5	Logged By	OA	Excavator	Kelly's Excavating	Groundwater not observed
				Checked By	CRN	Equipment	Komatsu PC120 Excavator	Caving not observed

Surface Elevation (ft)	509	Easting (X)	1199017	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	671023	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0–1				DUFF	12 inches forest duff			
508	1				SM	Orange silty fine to medium sand with occasional gravel and organic matter (roots) (medium dense, moist) (weathered glacial till)			Roots ¼- to ½-inch diameter to approximately 2 feet bgs
507	2		1 / MC				15		
506	3				GP-GM	Gray fine to coarse gravel with silt, sand and occasional cobbles (dense, moist) (glacial till)			
505	4								3-inch lense of iron-oxide stained soil
504	5		2						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit TP-3

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

Date Excavated	6/18/2021	Total Depth (ft)	9	Logged By OA Checked By CRN	Excavator Kelly's Excavating Equipment Komatsu WB140 Backhoe	Groundwater not observed Caving not observed	

Surface Elevation (ft) Vertical Datum	537 NAVD88	Easting (X) Northing (Y)	1198927 670105	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				SOD	Approximately 6 inches sod			
536	1				SM	Brownish-gray silty fine to coarse sand with gravel, occasional cobbles and deleterious debris (dense, moist) (fill)			
535	2		1 MC				11		Deleterious debris consists of nails and rubber particles
534	3								
533	4				SM	Gray with occasional iron-oxide staining silty fine sand with occasional gravel (dense, moist) (weathered glacial till)			
532	5		2		SM	Brownish-gray silty fine to medium sand with gravel and occasional cobbles (very dense, moist) (glacial till)			
531	6		3						
530	7								
529	8								
528	9								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit TP-4

Date Excavated	6/18/2021	Total Depth (ft)	10.5	Logged By OA / Checked By CRN	Excavator: Kelly's Excavating / Equipment: Komatsu WB140 Backhoe	See "Remarks" section for groundwater observed / See "Remarks" section for caving observed

Surface Elevation (ft)	539	Easting (X)	1199070	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	670068	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				SOD	Approximately 6 inches sod			
538	1				SM	Brown silty fine to coarse sand with gravel, occasional cobbles and deleterious debris (medium dense, moist) (fill)			Deleterious debris consists of asphalt fragments and plastic waste
537	2		1 MC				10		
			2		SM	Gray silty fine sand with occasional gravel (medium dense, moist) (weathered glacial till)			
536	3					Grades to wet			Moderate groundwater seepage observed from approximately 3 feet bgs to 9½ feet bgs
535	4					Grades to dense			
534	5		3		SM	Gray silty fine sand with occasional gravel (very dense, wet) (glacial till)			Minor caving observed at approximately 5 feet bgs
533	6								
532	7								
531	8				SP	Dark gray fine sand, trace silt (very dense, wet)			
530	9		4 SA				22	2	Rapid groundwater seepage observed at approximately 9½ feet bgs
529	10								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit TP-5

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

Date Excavated	6/21/2021	Total Depth (ft)	4.25	Logged By	OA	Excavator	Kelly's Excavating	Groundwater not observed
				Checked By	CRN	Equipment	Komatsu WB140 Backhoe	Caving not observed

Surface Elevation (ft)	536	Easting (X)	1199935	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	669625	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
					SOD	Approximately 6 inches sod			
535	1		1 / MC		ML	Dark brown sandy silt with gravel and occasional deleterious debris (medium stiff, moist) (fill)	18		Deleterious debris consists of asphalt fragments and metal cans Fine roots (<¼-inch diameter) observed to bottom of test pit
534	2				SM	Brownish-gray silty fine to medium sand with gravel, occasional cobbles and organic matter (roots) (medium dense, moist) (weathered glacial till)			
533	3		2		SM	Gray silty fine to medium sand with gravel, occasional cobbles and organic matter (roots) (dense, moist) (glacial till)			
532	4		3 / SA				19	40	PIT completed at approximately 4 feet bgs

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Date:1/28/22 Path:P:\21\21342003\GINT\2134200300.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Log of Test Pit TP-6 (PIT-2)

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

Date Excavated	6/21/2021	Total Depth (ft)	8.5	Logged By	OA	Excavator	Kelly's Excavating	Groundwater not observed
				Checked By	CRN	Equipment	Komatsu WB140 Backhoe	Caving not observed

Surface Elevation (ft)	545	Easting (X)	1199872	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	669433	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				SOD	Approximately 6 inches sod			
544	1				SM	Brown silty fine to medium sand with gravel (loose, moist) (fill)			
543	2		1 MC				10		
542	3		2		SM	Dark brown to black silty fine to medium sand with organic matter (roots) (loose, moist) (old topsoil horizon)			
541	4		3		SM	Orangish-brown with occasional iron-oxide staining silty fine sand with occasional gravel and cobbles (medium dense, moist) (weathered glacial till)			
540	5								
539	6								
538	7		4			Grades to gray with iron-oxide staining, dense			
537	8								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Test Pit TP-7

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

Figure A-8
Sheet 1 of 1

Date Excavated	6/21/2021	Total Depth (ft)	4	Logged By	OA	Excavator	Kelly's Excavating	Groundwater not observed
				Checked By	CRN	Equipment	Komatsu WB140 Backhoe	Caving not observed

Surface Elevation (ft)	546	Easting (X)	1199869	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	669367	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0–0.5				SOD	Approximately 6 inches sod			
545	1				SM	Brown silty fine to medium sand with gravel, occasional cobbles, deleterious debris (wood fragments) and organic matter (roots) (loose, moist) (fill)			Roots (<¼-inch diameter) to approximately 3 feet bgs
544	2								
543	3	▯	1 / MC				19		
542	4								3-inch-diameter carbonized wood log observed at approximately 3½ feet bgs

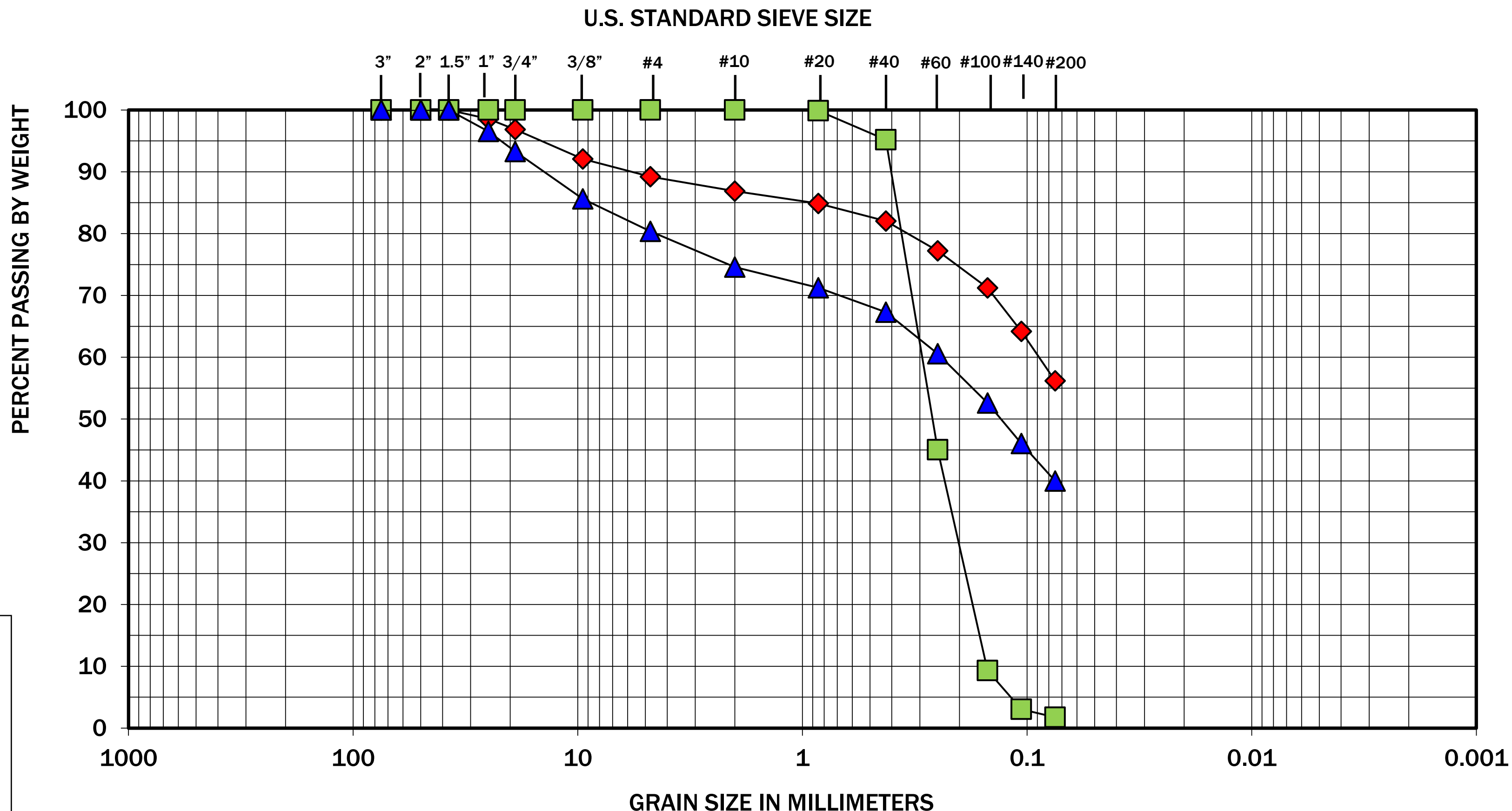
Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Date:1/28/22 Path:P:\21\21342003\GINT\2134200300.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Log of Test Pit TP-8

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Test Pit Number	Depth (feet)	Moisture (%)	Soil Description
◆	TP-2	11	18	Sandy silt (ML)
■	TP-5	9	22	Poorly graded sand (SP)
▲	TP-6	4	19	Silty sand with gravel (SM)

AASHTO ACCREDITED

Note: This report may not be reproduced, except in full, without written approval of GeoEngineers, Inc. Test results are applicable only to the specific sample on which they were performed, and should not be interpreted as representative of any other samples obtained at other times, depths or locations, or generated by separate operations or processes.

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

Sieve Analysis Results

Pierce College Puyallup - Parking Lot Additions

Puyallup, Washington

GEOENGINEERS

Figure A-10

APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) rely on professional judgment and opinion to a greater extent than other engineering and natural science disciplines, where more precise and/or readily observable data may exist. To help clients better understand how this difference pertains to our services, GeoEngineers includes the following explanatory "limitations" provisions in its reports. Please confer with GeoEngineers if you need to know more how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for Washington State Department of Enterprise Services (DES) and for the Project(s) specifically identified in the report. The information contained herein is not applicable to other sites or projects.

GeoEngineers structures its services to meet the specific needs of its clients. No party other than the party to whom this report is addressed may rely on the product of our services unless we agree to such reliance in advance and in writing. Within the limitations of the agreed scope of services for the Project, and its schedule and budget, our services have been executed in accordance with our Agreement with DES signed on June 22, 2021 and generally accepted geotechnical practices in this area at the time this report was prepared. We do not authorize, and will not be responsible for, the use of this report for any purposes or projects other than those identified in the report.

A Geotechnical Engineering or Geologic Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for the Pierce College Puyallup – Parking Lot Additions project in Puyallup, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- Not prepared for you,
- Not prepared for your project,
- Not prepared for the specific site explored, or
- Completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

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[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

- The function of the proposed structure;
- Elevation, configuration, location, orientation or weight of the proposed structure;
- Composition of the design team; or
- Project ownership.

If changes occur after the date of this report, GeoEngineers cannot be responsible for any consequences of such changes in relation to this report unless we have been given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Environmental Concerns are Not Covered

Unless environmental services were specifically included in our scope of services, this report does not provide any environmental findings, conclusions, or recommendations, including but not limited to, the likelihood of encountering underground storage tanks or regulated contaminants.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, new information or technology that becomes available subsequent to the report date, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Information Provided by Others

GeoEngineers has relied upon certain data or information provided or compiled by others in the performance of our services. Although we use sources that we reasonably believe to be trustworthy, GeoEngineers cannot warrant or guarantee the accuracy or completeness of information provided or compiled by others.

Geotechnical and Geologic Findings are Professional Opinions

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies the specific subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied its professional judgment to render an informed opinion about subsurface conditions at other locations. Actual subsurface conditions may differ, sometimes significantly, from the opinions presented in this report. Our report, conclusions and interpretations are not a warranty of the actual subsurface conditions.

Geotechnical Engineering Report Recommendations are Not Final

We have developed the following recommendations based on data gathered from subsurface investigation(s). These investigations sample just a small percentage of a site to create a snapshot of the subsurface conditions elsewhere on the site. Such sampling on its own cannot provide a complete and accurate view of subsurface conditions for the entire site. Therefore, the recommendations included in this report are preliminary and should not be considered final. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for the recommendations in this report if we do not perform construction observation.

We recommend that you allow sufficient monitoring, testing and consultation during construction by GeoEngineers to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes if the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective means of managing the risks associated with unanticipated conditions. If another party performs field observation and confirms our expectations, the other party must take full responsibility for both the observations and recommendations. Please note, however, that another party would lack our project-specific knowledge and resources.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

Misinterpretation of this report by members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. The logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Photographic or electronic reproduction is acceptable, but separating logs from the report can create a risk of misinterpretation.

Give Contractors a Complete Report and Guidance

To help reduce the risk of problems associated with unanticipated subsurface conditions, GeoEngineers recommends giving contractors the complete geotechnical engineering or geologic report, including these "Report Limitations and Guidelines for Use." When providing the report, you should preface it with a clearly written letter of transmittal that:

- Advises contractors that the report was not prepared for purposes of bid development and that its accuracy is limited; and

- Encourages contractors to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

Contractors are Responsible for Site Safety on Their Own Construction Projects

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings or conclusions regarding the detecting, assessing, preventing or abating of Biological Pollutants, and no conclusions or inferences should be drawn regarding Biological Pollutants as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria and viruses, and/or any of their byproducts.

A Client that desires these specialized services is advised to obtain them from a consultant who offers services in this specialized field.

PIERCE COLLEGE – PUYALLUP: PARKING LOT EXPANSION PROJECT

CRITICAL AREAS REPORT

Grette Associates LLC
ENVIRONMENTAL CONSULTANTS

PEIRCE COLLEGE – PUYALLUP
PARKING LOT EXPANSION PROJECT

CRITICAL AREAS REPORT

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ENVIRONMENTAL CONSULTANTS

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1 INTRODUCTION

Grette Associates is under contract to prepare a critical areas report that summarizes the critical areas reconnaissance performed at Pierce College's Puyallup Campus[1] (Figure 1).

The purpose of this critical areas report is to document all wetlands that are located within 300 feet of the proposed parking lot expansion project locations (Appendix A) for conformance with Chapter 21.06 of the Puyallup Municipal Code (PMC).

2 FEATURE SUMMARY

A Grette Associates qualified wetland professional and a Grette Associates biologist visited the campus on November 17, 2021 to identify any wetlands or wildlife habitat conservation areas (FWHCAs) within 300 feet of the proposed project sites.

Grette Associates collected wetland delineation data and delineated two wetland features (Wetland A and Wetland B; Appendix A) that contained all three wetland criteria defined in the U.S. Army Corps of Engineers (USACE) *Federal Wetland Delineation Manual* (1987), and the USACE's *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (2010).

In addition, one probable wetland feature (Wetland C) was identified north of College Way. Wetland C was visually assessed for rating purposes only, given that a substantial development (College Way) is located between the wetland and the project sites which serves as a buffer interruption[2].

Wetlands were rated according to PMC 21.06.910 and the Washington State Department of Ecology's (Ecology) *Washington State Wetland Rating System for Western WA – 2014 Update* (Hruby 2014). Field datasheets and wetland rating forms are presented in Appendices B and C, respectively. A summary of the delineated wetlands is provided in Table 1.

No FWHCAs, as defined by PMC 21.06.1010, were identified within 300 feet of the proposed project sites.

Table 1. Wetland delineation summary

Feature	Cowardin Class[1]	Hydrology Modifier	HGM Class	Wetland Category	Buffer Width[2]
A	PEM/FO	Seasonally Saturated	Slope	IV	50 ft.
B	PFO	Seasonally Flooded and Saturated	Depressional	III	80 ft.
C	PEM/FO	Seasonally Flooded and Saturated	Depressional	III	150 ft.

[1] Classification based on Cowardin et al. (1979).
[2] Buffers are based on PMC 21.06.930 and high land use intensity.

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[1] The critical area assessment occurred within Pierce County parcels 0419034018, 0419023011, 0419023012, and 0419023013.

[2] While Chapter 21.06 of the PMC does not address buffer interruptions, Grette Associates was informed by the City's Planning Division (C. Beale, personal communication, December 13, 2021). According to the City's peer-review specialist, it is best available science that substantial development (e.g., paved roads) serve as a buffer interruption.

3 BACKGROUND

3.1 Local Critical Areas Inventory

The City of Puyallup's Public Data Viewer was queried to determine if there are any wetlands mapped in the vicinity of the proposed project sites. According the City's database, there is a wetland mapped in the vicinity of each proposed project site location (Appendix D).

3.2 National Wetlands Inventory

The U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) was queried to determine if previously-identified wetlands are present within 300 feet of the proposed project sites (USFWS 2022). According to the NWI Interactive Online Mapper, there is a wetland feature mapped north of College Way in the general area where Wetland C was identified (Appendix D). No additional wetland features were identified in the vicinity of the proposed project sites.

3.3 Sensitive Wildlife and Plants

The Washington Department of Fish and Wildlife's (WDFW) Priority Habitats and Species (PHS) database on-line mapper was queried to determine if state or federally listed fish or wildlife species occur near the proposed project sites (WDFW 2022). According to the PHS database, the wetland feature identified by NWI is the only mapped wetland in the vicinity of the proposed project sites (Appendix D).

The Washington Department of Natural Resources' (WDNR) Wetlands of High Conservation Value mapper was queried to determine if the general campus area occurs in a location reported to contain high quality natural heritage wetland occurrences or occurrences of natural heritage features commonly associated with wetlands (WDNR 2022a). According to WDNR's mapper, there are no records of rare plants or high-quality native ecosystems occurring on or in the vicinity of the campus (Appendix D).

3.4 State Water Classification System

The Washington Department of Natural Resources' (WDNR) Mapping Tool on-line mapper was queried to identify the water typing of any streams mapped by WDNR (WDNR 2022b). According to WDNR, no stream features are mapped in the vicinity of the campus (Appendix D).

3.5 Soil Information

According to the Natural Resources Conservation Service's (NRCS) Web Soil Survey (NRCS 2022a), the soils within the general assessed area consist of Everett very gravelly sandy loam (0-8 percent slopes), Kapowsin gravelly ashy loam (0-6 percent slopes), Kapowsin gravelly ashy loam (6-15 percent slopes), and Kapowsin gravelly ashy loam (30-65 percent slopes). According to the NRCS, these mapped soils are not listed as hydric.

4 METHODS

The areas in the vicinity of the project sites were traversed and data were collected to confirm wetland boundaries. The identified wetlands were delineated according to the procedures described in the USACE's *Federal Wetland Delineation Manual* (1987), and the USACE's *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (2010). Paired data plots and soil test pits were excavated to evaluate wetland and upland conditions. Guidance from the USACE's *Regional Supplement* was used to evaluate the data at each data point.

The boundary of the wetlands were established based on changes in vegetation, field indicators of hydric soils, water levels at or below 12 inches, topographic changes, and best professional judgment. Data plots were established in and adjacent to the wetlands. The locations of the wetland boundaries were defined by placement of florescent orange flagging tape. The location of each data plot was defined by the placement of pink flagging tape. The wetland boundary flagging was labeled alpha-numerically (i.e. A-2), where the letter designates the wetland and the number designates the specific flag angle point.

Plants were determined to be more or less associated with wetlands based on their wetland indicator (FAC) status. The percent dominance for each plant strata was determined using the 50-20 Rule, which is the recommended method for selecting dominant species from a plant community in instances where quantitative data are available (USACE 2010). In utilizing this rule, dominants are the most abundant species that individually or collectively accounts for more than 50 percent of the total coverage of vegetation in the stratum plus any other species that, by itself accounts for at least 20 percent of the total.

4.1 Hydrophytic Vegetation

The U.S. Fish and Wildlife Service (USFWS) and the NWI have established a rating system that has been applied to commonly occurring plant species on the basis of their frequency of occurrence in wetlands (Table 2). Species indicator status expresses the range in which plants may occur in wetlands and non-wetlands (uplands). Under this system, vegetation is considered hydrophytic when there is an indicator status of facultative (FAC), facultative wetland (FACW) or obligate wetland (OBL) (Table 2). The hydrophytic vegetation criterion for wetland determination is met when ***more than*** 50 percent of the dominant species in the plant community are FAC or wetter. The USACE's *National Wetland Plant List* (USACE 2020) was used to determine vegetation indicator status.

Table 2. Definitions for USFWS plant indicator status

Plant Indicator Status Category	Indicator Status Abbreviation	Definition (Estimated Probability of Occurrence)
Obligate Upland	UPL	Occur rarely (<1 percent) in wetlands, and almost always (>99 percent) in uplands
Facultative Upland	FACU	Occur sometimes (1 percent to <33 percent) in wetlands, but occur more often (>67 percent to 99 percent) in uplands
Facultative	FAC	Similar likelihood (33 percent to 67 percent) of occurring in both wetlands and uplands
Facultative Wetland	FACW	Occur usually in wetlands (>67 percent to 99 percent), but also occur in uplands (1 percent to 33 percent)
Obligate Wetland	OBL	Occur almost always (>99 percent) in wetlands, but rarely occur in uplands (<1 percent)
Not Listed	NL	Not listed due to insufficient information to determine status

4.2 Wetland Hydrology

Evidence of permanent or periodic inundation (water marks, drift lines, drainage patterns), or soil saturation to the surface for 14 consecutive days or more during the growing season meets the hydrology criterion. Oxidized root channels in the top 12 inches and hydrogen sulfide are primary indicators and water-stained leaves and geomorphic position are secondary indicators of wetland hydrology.

4.3 Hydric Soils

Soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper soil horizons are considered hydric soils. Field indicators include histosols, the presence of a histic epipedon, a sulfidic odor, low soil chroma, and gleying. Soil conditions were compared to the Field Indicators of Hydric Soils detailed in the USACE's *Regional Supplement*.

5 PRECIPITATION ANALYSIS

The McMillin Reservoir National Weather Station (NWS Station 455224) did not record any precipitation during the site assessment (NOAA 2022). In the 14 days preceding the site assessment, 6.54 inches of rainfall was recorded at the station (NOAA 2022).

The total precipitation recorded at the McMillin Reservoir station from October 1, 2021 through November 17, 2021 (15.98 inches) was approximately 147 percent of the normal rainfall (10.85 inches) that occurs during the same time (NOAA 2022).

Table 3 below presents an analysis of the appropriate NRCS WETS table (NRCS 2022b) for the three months preceding the field investigation.

Table 3. WETS precipitation analysis

Preceding Month	WETS Rainfall Percentile (inches)		Measured Rainfall[1] (inches)	Conditions[2]	Condition Value[3]	Month Weight	Value
	30%	70%					
November	4.63	7.74	10.12	Wet	3	3	9
October	2.04	4.13	5.86	Wet	3	2	6
September	0.80	2.36	1.77	Normal	2	1	2
						Sum:	17

[1] Observed rainfall for the month (NOAA 2022b)
[2] Dry conditions are below 30% WETS table value, Normal conditions are between 30% and 70% of the WETS table values, Wet conditions are above 70% of the WETS table value.
[3] Dry equals a value of 1, normal equals a value of 2, wet equals a value of 3
[4] Due to the timing of the site assessment, November precipitation results were included in this analysis.

Bins were established to determine the overall rainfall period during the field investigation; drier (sum is 6-9), normal (sum is 10-14), wet (sum is 15-18). A sum of 17 indicates that hydrologic conditions are wetter than normal at the time of the site assessment.

6 WETLAND RESULTS

Three wetland features were identified within 300 feet of the proposed project sites (Appendix A). Wetlands A and B were delineated according to the criteria defined in the

USACE's *Regional Supplement* (2010). Based on its location being situated north of College Way which serves as a buffer interruption (C. Beale, personal communication, December 13, 2021), Wetland C was visually evaluated for rating purposes only.

Grette Associates also evaluated an area adjacent to College Way that appears to have been previously graded and intended to capture and collect stormwater runoff from College Way (Appendix A). This area is largely devoid of groundcover and predominantly consists of vine maple (*Acer cicinatum*) and beaked hazelnut (*Corylus cornuta*). Red alder and black cottonwood (*Populus balsamiferia*) are established along the margins of this depressional area. In summary, this area did not contain hydric soil indicators (SP-1 and SP-2; Appendix C) and no evidence was present to suggest that the soils were problematic; therefore, this area did not meet wetland criteria as defined in the USACE's *Regional Supplement* (2010).

6.1 Wetland A

Wetland A is a palustrine emergent/scrub-shrub wetland that is situated in the northwest portion of the campus (Appendix A). Wetland A is hydrogeomorphically classified as a slope wetland (Appendix D).

Vegetation within the wetland predominantly consists of salmonberry (*Rubus spectabilis*, FAC) and Himalayan blackberry (*Rubus armeniacus*, FAC). Beneath the shrub canopy predominantly consists of slough sedge (*Carux obnupta*, OBL) and reed canarygrass (*Phalaris arundinacea*, FACW). The portion of the wetland that extends across the existing utility easement largely consists of a monoculture of reed canarygrass.

Soils observed within Wetland A consisted of a very dark gray (7.5YR3/1) silty clay. While no hydric soil indicators were observed (e.g., redox concentrations), it is Grette Associates' professional opinion that the soils evaluated meet the technical definition of a hydric soil (NRCS 2018). The vegetation observed passed the FAC-Neutral Test (USACE 2010) and the wetland is situated in a sloped area that contains a seasonally high groundwater table. Given these observations, the soils within the wetland are likely saturated, at a minimum, within 12 inches of the soil surface long enough during the growing season to develop anaerobic conditions.

Shallow surface water, surface soil saturation, and a high groundwater table were observed within Wetland A.

6.2 Wetland B

Wetland B is a palustrine forested wetland that is situated within the western portion of campus (Appendix A). Hydrogeomorphically, Wetland B is classified as a depressional wetland. Vegetation within the wetland predominately consists of red alder (*Alnus rubra*, FAC) and western red cedar (*Thuja plicata*, FAC). Beneath the forest canopy consists predominantly consists of a mix of native shrubs and emergent species.

Similar to Wetland A, no hydric soil indicators were observed within Wetland B; however, given the obligate emergent species[3], dark upper soil layer (10YR2/2), and primary wetland hydrology indicators observed, the soils within the wetland are likely saturated, at a

[3] (Slough sedge and skunk cabbage (*Lysichiton americanus*, OBL) were observed throughout portions of Wetland B.

minimum, within 12 inches of the soil surface long enough during the growing season to develop anaerobic conditions (NRCS 2018).

6.3 Wetland C

Wetland C is a palustrine emergent/forested wetland that is situated north of Collage Way (Appendix A). This feature contains both slope and depressional areas and is therefore hydrogeomorphically classified as a depressional wetland (Hruby 2014). As noted above, Wetland C was visually evaluated for rating purposes only.

6.4 Wetland Categorization

To determine the categorization of the wetlands based on function, the wetland classification guidelines in Ecology's wetland rating system (Hruby 2014) were used. Based on this guidance, each wetland was given a score for each of three functions: Water Quality, Hydrology, and Habitat (Table 4).

Table 4. Wetland rating and categorization summary

Feature	Cowardin Class	HGM Class	Water Quality	Hydrology	Habitat	Total	Category
Wetland A	PEM/SS	Slope	6	4	5	15	IV
Wetland B	PFO	Depressional	7	5	5	17	III
Wetland C	PFO	Depressional	7	5	6	18	III

Per Chapter 21.06 of the PMC, wetlands are subject to a buffer to protect the integrity and function of said feature. According to PMC 21.06.930, Category III wetlands providing less than moderate habitat function and with high land use intensity are subject to an 80-foot buffer. Category IV wetlands with a high land use intensity are subject to a 50-foot buffer.

6.5 Project Compliance

The proposed parking lot expansion project was designed to avoid wetland impacts and adheres to the applicable buffer development standards defined in PMC 21.06.930. Please refer to Appendix A for a detailed project layout.

7 REGULATORY CONSIDERATIONS

Wetlands are regulated by agencies at the local, state, and federal levels. At the local level, wetlands and their associated buffers in the City of Puyallup are regulated under the City's critical areas ordinance (Chapter 21.06 of the PMC).

At the state level, wetlands are regulated by the Washington State Department of Ecology through the Federal Clean Water Act (Section 401). The requirement for a Water Quality Certification from Ecology for wetland impacts is triggered by an applicant's applying for a federal Clean Water Act Section 404 permit from the Corps. Ecology may also issue an Administrative Order pursuant to Chapter 90.48 RCW (Water Pollution Control Act), allowing them wetland regulatory authority over Waters of the State without a federal nexus.

At the federal level, impacts (specifically dredging or filling) to wetlands are regulated by the Environmental Protection Agency through the US Army Corps of Engineers. The

USACE administers the federal Clean Water Act (Section 404) for projects involving dredging or filling in Waters of the US (lakes, streams, marine waters, and most non-isolated wetlands).

While it is the regulatory agencies that make the final determination regarding jurisdictional status, project proponents can infer jurisdiction using the guidance provided by each agency or local government. This inference can be used to design a project based on the anticipated regulatory constraints within the project area. However, it is the project proponent's responsibility to contact each potential regulating agency and confirm their regulatory status and requirements.

8 DISCLAIMER

The findings and conclusions documented in this report have been prepared for specific application to this proposed project site. 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. Because of such changes, our observations and conclusions applicable to this site may need to be revised wholly or in part.

Wetland boundaries are based on conditions present at the time of the site visit and considered preliminary until the flagged wetland and/or drainage boundaries are validated by the appropriate jurisdictional agencies. Validation of the boundaries by the regulating agencies provide a certification, typically in writing, that the wetland boundaries verified are the boundaries that will be regulated by the agencies until a specific date or until the regulations are modified. Only the regulating agencies can provide this certification.

Since wetlands are dynamic communities affected by both natural and human activities, changes in wetland boundaries may be expected. Because of such changes, our observations and conclusions applicable to this site may need to be revised wholly or in part.

9 BIOLOGIST QUALIFICATIONS

9.1 Janae Dinkins

Janae Dinkins is a Biologist with training in wetland delineation and ecologic restoration. Janae also has professional experience in stream and buffer restoration, marine aquatic sampling, mitigation monitoring, and fish and wildlife assessments.

Janae has earned Bachelors of Science degrees in Wildlife & Fisheries and Soil & Crop Sciences from Texas A&M University.

For a list of representative projects, please contact her at Grette Associates.

9.2 Chad Wallin

Chad Wallin is a Biologist with extensive training in wetland science and ecology restoration. Chad also has professional experience in stream and fish restoration, marine monitoring, mitigation monitoring, and fish and wildlife assessments.

Chad has earned a Bachelor's of Arts degree in Environmental Studies from the University of Washington along with certificates in ecology restoration and wetland science.

For a list of representative projects, please contact him at Grette Associates.

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Pierce College – Puyallup Campus Parking Lot Expansion Project

Critical Areas Report

Appendix A: Wetland Delineation Map

Grette Associates LLC
ENVIRONMENTAL CONSULTANTS
2102 North 30th Street, Suite A
TACOMA, WA 98403
(253) 573-9300
gretteassociates.com

CLIENT: MCGRANAHAN ARCHT.

PROJECT #: 3054.001
DESIGNED BY: CW DATE: 01/27/22
CHECKED BY: SM DATE: 01/27/22

PIERCE COLLEGE - PUYALLUP CAMPUS PARKING LOT EXPANSION PROJECT CRITICAL AREAS REPORT

SITE ADDRESS: PUYALLUP, WA
DRAWING SCALE: 1"=100'

WETLAND DELINEATION MAP

SHEET 1 OF 3

PIERCE COLLEGE - PUYALLUP CAMPUS PARKING LOT EXPANSION PROJECT CRITICAL AREAS REPORT

WETLAND DELINEATION MAP

Grette Associates LLC
ENVIRONMENTAL CONSULTANTS
2102 North 30th Street, Suite A
TACOMA, WA 98403
(253) 573-9300
gretteassociates.com

CLIENT: MCGRANAHAN ARCHT.

PROJECT #: 3054.001

DESIGNED BY: CW DATE: 01/27/22

CHECKED BY: SM DATE: 01/27/22

DRAWING SCALE: 1"=100'

SITE ADDRESS: PUYALLUP, WA

SHEET 2 OF 3

SHEET 3 OF 3

OVERVIEW MAP

PIERCE COLLEGE - PUYALLUP CAMPUS
PARKING LOT EXPANSION PROJECT
CRITICAL AREAS REPORT

Grette Associates LLC
ENVIRONMENTAL CONSULTANTS
2102 North 30th Street, Suite A
TACOMA, WA 98403
(253) 573-9300
gretteassociates.com

SITE ADDRESS: PUYALLUP, WA	DRAWING SCALE: NOT TO SCALE	CLIENT: MCGRANAHAN ARCHT.	PROJECT #:3054.001	
			DESIGNED BY:CW	DATE:01/27/22
			CHECKED BY:SM	DATE:01/27/22

PIERCE COLLEGE – PUYALLUP CAMPUS
PARKING LOT EXPANSION PROJECT

CRITICAL AREAS REPORT

APPENDIX B: WETLAND DATASHEETS

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

Project/Site: Pierce College City/County: Pierce Puyallup Sampling Date: 11/17/21

Applicant/Owner: ______ State: WA Sampling Point: SP1

Investigator(s): JJD, CW Section, Township, Range: ______

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

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ 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 X

Remarks: Last 4/5 days has record rainfall + Flooding. Hydrology + soils may be presenting as false positives. Area appears to have been graded to collect runoff from Rd.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Cedar	10	Y	FAC
2. Cotton Wood	4	N	FAC
3. Alder	10	Y	FAC
4.			
50% 12 20% 4.8	24	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 ft)			
1. Willow Sitka	53	Y	FAC
2. Alder	12	N	FAC
3.			
4.			
5. 50% 32.5 20% 13			
	65	= Total Cover	
Herb Stratum (Plot size: 5 ft)			
1. Black Berry Himilayan	2	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	2	= Total Cover	
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum 80%

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

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

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - 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: Bare Ground covered by leaf litter. Nuscara on old wood pile did not veg. plot did not include.

SOIL

Sampling Point: SP1

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 %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/1	100					Loam	W/wood debris
6-16+	7.5YR 4/2	100					Silty Loam	Light gravel. NO redox observed

[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: ___________

Depth (inches): ___________

Hydric Soil Present? Yes ___ No ✓

Remarks:
Sample soils let out to dry for 20min
No redox observed lower soil layer

Layer 6-16+ no redox seen F3 + All worked and did not meet cr

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): ___
Water Table Present?	Yes ✓	No ___	Depth (inches): 1 in
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:
- High Water + Saturation could be false indicator due record high rainfall
- Area appears to have been graded to capture runoff from Rd.

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

Project/Site: Pierce College City/County: Puyallup Sampling Date: 11/17/21

Applicant/Owner: ______ State: WA Sampling Point: 3P2

Investigator(s): SD, CW Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Depressional area Local relief (concave, convex, none): Concave Slope (%): ______

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ 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 X

Remarks:
Hydric soils were not observed
No redox seen Possible false positive results due to record rainfall
yes given presence of 2 indicators but possible false positive

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Cedar Thuja plicata	15	Y	FAC
2. Alder Alnus rubra	15	Y	FAC
3. Cottonwood Populus balsamifera	8	Y	FAC
4.			
50% 19 20% 7.6	38	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 ft)			
1. Cedar	5	N	FAC
2. Vine Maple	60	Y	FAC
3. Beaked Hazelnut	3	N	FACU
4. Salmon Berry	5	N	FAC
5. 50% 36.5 20% 14.6			
	73	= Total Cover	
Herb Stratum (Plot size: 5 ft)			
1. Trailing Blackberry	15	Y	FACU
2. Sword Fern	5	Y	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11. 50% 10 20% 4			
	20	= Total Cover	
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
		= Total Cover	
% Bare Ground in Herb Stratum 80%			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	70	x 3 = 210
FACU species	23	x 4 = 92
UPL species		x 5 =
Column Totals:	93 (A)	302 (B)

Prevalence Index = B/A = 3.24

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - 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: Bare Ground Covered w/ leaf & Woody litter

~~Cedar Tree FAC~~
~~Vine maple Shrub FAC~~
~~Alder Tree FAC~~
~~Cottonwood Tree FAC~~
Trailing BB Herb FACU
Sword Fern Herb FACU

SOIL

Sampling Point: SP7

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 %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/1	100					Loam	
6-16+	7.5YR 4/2	100					Silty loam	Greater cobble, 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: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ___ No ✓

Remarks:
Exposed Soil to dry, no redox seen, Soil Saturated (±20min)
No redox observed
It would be expected to observe redox concentrations if hydro was persistent during the growing season

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): ___
Water Table Present?	Yes ✓	No ___	Depth (inches): 1in
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 observed but potentially false Positive due to Recent Rain fall
~~FAC-Neutral Test~~
Fac-Neutral Test ~~And~~ Prevalence Index would support the possibility of false positive
– Area appears to have been constructed to capture runoff from Rd.

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

Project/Site: Pierce College Wetland A City/County: Puyallup Pierce Sampling Date: 11/17/

Applicant/Owner: ______ State: WA Sampling Point: SP 3

Investigator(s): JLD Section, Township, Range: ______

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

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ 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 ______	Is the Sampled Area within a Wetland? Yes ✓ No ______
Hydric Soil Present?	Yes X No ______	
Wetland Hydrology Present?	Yes X No ______	

Remarks: Record Rain fall Within last 4/5 days

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alder	65	Y.	FAC
2. Cedar Western Red	15		FAC
3. ~~[illegible]~~			
4. 50% 40 20% 16			
	80% = Total Cover		

160 / 18 / 2

Sapling/Shrub Stratum (Plot size: 15)	Absolute % Cover	Dominant Species?	Indicator Status
1. Red Elderberry	10%		FAC
2. Salmon berry	45%	Y.	FAC
3. Ceder	25%	Y.	FAC
4. Snowberry	7%		FACU
5. 80% 43.5 20% 17.4			
	87 = Total Cover		

Herb Stratum (Plot size: 5)	Absolute % Cover	Dominant Species?	Indicator Status
1. Reed Canary	70%	Y.	FACW
2. Sword ferns	8%		FACU
3. Himalayan Black Berry	18		FAC
4. Goats Beard	2%		FACU
5. Carex spp	40%	Y.	FACW
6.			
7.			
8.			
9.			
10.			
11. 80% 69 20% 27.6			
	138 = Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
	______ = Total Cover		

% Bare Ground in Herb Stratum 10%

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	47	x 2 = 94
FAC species	250	x 3 = 750
FACU species	15	x 4 = 60
UPL species		x 5 =
Column Totals:	406 (A)	904 (B)

Prevalence Index = B/A = 2.2

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ✓ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - 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: leaf litter and woody debris covered ground

3

SOIL

Sampling Point: SP 3

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 %	Type[1]	Loc[2]	Texture	Remarks
0 - 12	7.5 YR 3/1	100					Silty clay	Sticky w/ Smooth texture throughout

[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) #5
- ___ 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)
- X Other (Explain in Remarks)

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

Restrictive Layer (if present):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes X No ✓

Remarks: Soils are over saturated record high rainfall within the area possible the features are washed out.

No Redox features observed

While soils were not observed to contain indicators, based on veg and secondary hydro indicators, it's assumed this area meets the tech. definition on a hydric soil

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): ______

Water Table Present? Yes ✓ No ___ Depth (inches): Surface

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:

Indicators are present,

Could be exaggerated by high rain fall of past 4/5 days

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

Project/Site: Pierce College City/County: Pierce Puyallup Sampling Date: 11/17/21

Applicant/Owner: ______ State: ______ Sampling Point: SP Upland 4

Investigator(s): SD Section, Township, Range: ______

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

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ 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 ✓	Is the Sampled Area within a Wetland?	Yes ______ No ✓
Hydric Soil Present?	Yes ______ No ✓		
Wetland Hydrology Present?	Yes ______ No ✓		

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Cedar	45	Y	FAC
2. Hemlock	30	Y	FACU
3. Alder	15		FAC
4. 50% 45 20% 18			
	90 = Total Cover		
Sapling/Shrub Stratum (Plot size: 15 ft)			
1. Salal	80	Y	FACU
2. cedar	25		FAC
3. Sword fern	30		FACU
4. Salmon Berry	25		FAC
5. Red Alder	15		FAC
50% 87.5 20% 35	175 = Total Cover		
Herb Stratum (Plot size: 5 ft)			
1. Trailing Black Berry	85	Y	FACU
2. Himalayan Black Berry	100	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% 92.5 20% 19	95 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
	______ = Total Cover		
% Bare Ground in Herb Stratum 30%			

Dominance Test worksheet:

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

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 40% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	185	x 3 = 555
FACU species	175	x 4 = 700
UPL species	______	x 5 = ______
Column Totals:	360 (A)	1255 (B)

Prevalence Index = B/A = 3.4

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ 5 - 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: Duff, woody debris, + leaf litter on ground
Failed Dominance test + Prevalence Index for confirmation

SOIL

Sampling Point: 3P4

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 %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 2/2	100					loam	
3-4	7.5YR 4/6	100					loam	
4-12+	10YR 4/6	100					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: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ___ No ✓

Remarks:

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): ____

Water Table Present? Yes ___ No ✓ Depth (inches): ____

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:

The top soil surface was moist could be due to recent record high rainfall of Past 4/5 days

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

Project/Site: Pierce College City/County: Puyallup Pierce Sampling Date: 11/17/21

Applicant/Owner: ______ State: WA Sampling Point: SP 5

Investigator(s): JLD Section, Township, Range: ______

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

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ 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: Record high Rainfall last 4/5 days
Skunk Cabbage good indicator of saturation ≥3 months

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30 ft)	Absolute % Cover	Dominant Species?	Indicator Status
1. Thuja plicata (western red cedar)	85	Y	FAC
2. Hemlock (Western) Tsuga Heterophylla	10	N	FACU
3. Alder (Red) Alnus Rubra	10		FAC
4. 50% 52.5 20% 21			
	105	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15 ft)			
1. Salmon Berry	25	Y	FAC
2. Cedar (Thuja plicata)	10	Y	FAC
3.			
4.			
5. 50% 17.5 20% 7			
	35	= Total Cover	
Herb Stratum (Plot size: 5 ft)			
1. Carex spp.	55	Y	OBL
2. Giant Horse tail	20	Y	FACW
3. Skunk Cabbage	5	N	OBL
4. Licorice Fern	1	N	UPL
5. Sword Fern	3	N	FACU
6.			
7.			
8.			
9.			
10.			
11. 50% 42 20% 16.8			
	84	= Total Cover	
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
		= Total Cover	

% Bare Ground in Herb Stratum ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

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

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - 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: Dominant FAC = 3 OBL/FACW = 2
FACU = Ø

14

SOIL Wetland B

Sampling Point: SP 5

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 %	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 4/3						Loam	
5-7	2.5YR 2/2						Silt loam	
7-16+	10YR 2/2						Sandy Clay 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: ___

Depth (inches): ___

Hydric Soil Present? Yes ✓ No ___

Remarks:
Based on the veg. and secondary hydro indicators observed, soils likely meet tech. definition of a hydric soil. Skunk cabbage and sedge throughout depression which suggests prolonged soil saturation during the growing season.

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): Surface

Water Table Present? Yes ✓ No ___ Depth (inches): 4in

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:
Record high rainfall within the last 4/5 days within the area. Could be exaggerating results but presence of Skunk cabbage good indicator of 73 months of saturated soils + high water table

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

Project Site: Pierce College - Puyallup City/County: Puyallup / WA Sampling Date: 11/17/21

Applicant/Owner: ______ State: ____ Sampling Point: SP6

Investigator(s): CW ______ Section, Township, Range: ______

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

Subregion (LRR): ______ Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: ______ 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 ☐	Is the Sampled Area within a Wetland? Yes ☐ No ☒
Hydric Soil Present?	Yes ☐ No ☒	
Wetland Hydrology Present?	Yes ☐ No ☒	

Remarks: Record rainfall w/ last 7 days.

VEGETATION – Use scientific names of plants

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. THPL	75%	Y	FAC
2. ALRU	10%	N	FAC
3.			
4.			
50% = ____, 20% = ____	85%	= Total Cover	
Sapling/Shrub Stratum (Plot size: 15')			
1. THPL	20%	Y	FAC
2.			
3.			
4.			
5.			
50% = ____, 20% = ____	20%	= Total Cover	
Herb Stratum (Plot size: 5')			
1. POMU	10%	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
50% = ____, 20% = ____	10%	= Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
50% = ____, 20% = ____		= Total Cover	
% Bare Ground in Herb Stratum 90%			

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: 66% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	____	x1 =	____
FACW species	____	x2 =	____
FAC species	____	x3 =	____
FACU species	____	x4 =	____
UPL species	____	x5 =	____
Column Totals:	____ (A)		____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ☐ 1 – Rapid Test for Hydrophytic Vegetation
- ☒ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ 5 - 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:

Project Site: ____

SOIL

Sampling Point: SP-6

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-18	10YR 4/4	100%					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: ____
Depth (inches): ____

Hydric Soils Present? Yes ☐ No ☒

Remarks:
Soils dry

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 Stresses 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:

	Yes	No	Depth (inches)
Surface Water Present?	☐	☒	—
Water Table Present?	☐	☒	—
Saturation Present? (includes capillary fringe)	☐	☒	—

Wetland Hydrology Present? Yes ☐ No ☒

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

Remarks:
Soils dry. Approx. 24" above elevation of SP5

PIERCE COLLEGE – PUYALLUP CAMPUS
PARKING LOT EXPANSION PROJECT

CRITICAL AREAS REPORT

APPENDIX C: WETLAND RATING FORM

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland A Date of site visit: 11/17/21

Rated by Wallin/Dinkins Trained by Ecology? ☑ Yes ☐ No Date of training 2014/2021

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 Google

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

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

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	

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 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 A

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 ☐	2
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 ☐	3
Total for S 1 Add the points in the boxes above	5

Rating of Site Potential If score is: ☐ **12 = H** ☐ **6-11 = M** ☑ **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: ☑ **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: ☑ **2-4 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

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** ☑ **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: ☑ **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	0
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	0

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

NOTES and FIELD OBSERVATIONS:

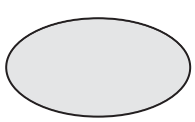
Wetland name or number A

These questions apply to wetlands of all HGM classes.

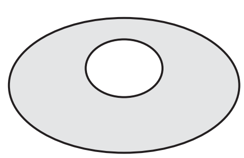
HABITAT FUNCTIONS - Indicators that site functions to provide important habitat

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

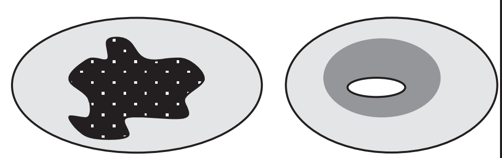
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the 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	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.*	1



None = 0 points ☐

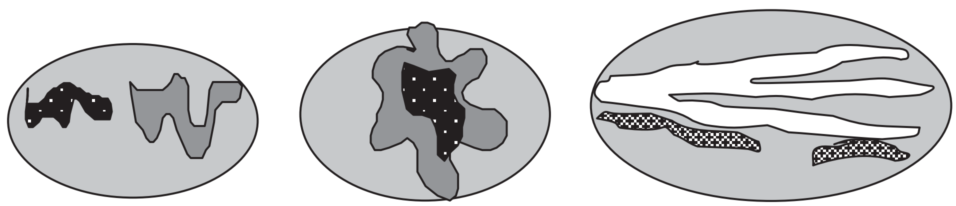


Low = 1 point ☑



Moderate = 2 points ☐

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



Wetland name or number 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*)	2
Total for H 1 — Add the points in the boxes above	5

Rating of Site Potential If score is: ☐ **15-18 = H** ☐ **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:* % undisturbed habitat___ **+** [(% moderate and low intensity land uses)/2]___ **=** 0.00 % 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	3
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat___ **+** [(% moderate and low intensity land uses)/2]___ **=** 0.00 % 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	2

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☑ **1-3 = M** ☐ **< 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** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

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.

— **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 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**	**Cat. I**
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**	**Cat. I** **Cat. 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**	**Cat. I**
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**	**Cat. I**

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**	**Cat. I**
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**	**Cat. I** **Cat. 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**	**Cat I** **Cat. II** **Cat. III** **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	N/A

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RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland B Date of site visit: 11/17/22

Rated by Wallin/Dinkins Trained by Ecology? ☑ Yes ☐ No Date of training 2014/2021

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 Google

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
☑ **Category III** – Total score = 16 - 19
☐ **Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
			Circle the appropriate ratings	
Site Potential	H ☐ M ☑ L ☐	H ☐ M ☑ L ☐	H ☐ M ☐ L ☑	
Landscape Potential	H ☐ M ☑ L ☐	H ☐ M ☑ L ☐	H ☐ M ☑ L ☐	
Value	H ☑ M ☐ L ☐	H ☐ M ☐ L ☑	H ☐ M ☑ L ☐	**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	☑

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 B

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 B

☑ 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 B

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 ☐	3
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 ☐	3
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 ☐	2
Total for D 1 Add the points in the boxes above	8

Rating of Site Potential If score is: ☐ **12-16 = H** ☑ **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	1
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
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	2

Rating of Landscape Potential If score is: ☐ **3 or 4 = H** ☑ **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: ☑ **2-4 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

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 outletpoints = 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 ☐	4
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 ☐	1
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 ☐	3
Total for D 4 Add the points in the boxes above	8

Rating of Site Potential If score is: ☐ **12-16 = H** ☑ **6-11 = M** ☐ **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	1
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	1
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	0
Total for D 5 Add the points in the boxes above	2

Rating of Landscape Potential If score is: ☐ **3 = H** ☑ **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* No outlet observed points = 0 ☑ There are no problems with flooding downstream of the wetland. points = 0 ☐	0
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	0

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

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**

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

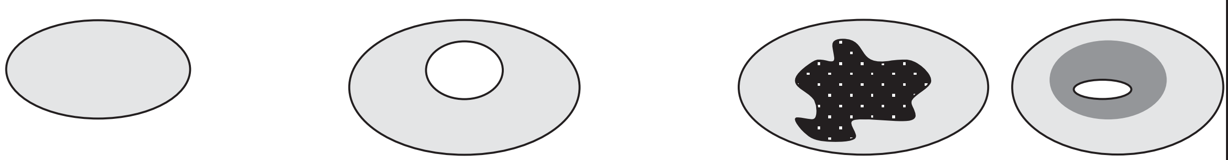
5 - 19 species — points = 1

< 5 species — points = 0

1

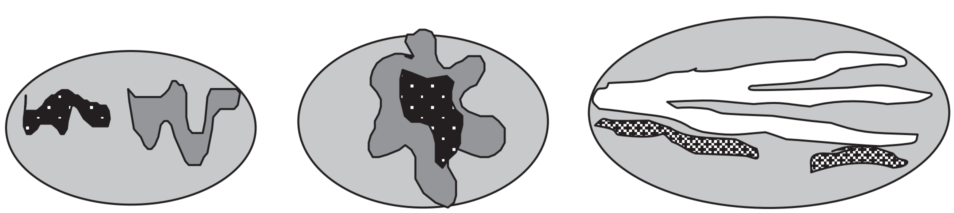
H 1.4. Interspersion of habitats

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 ☐



0

Wetland name or number B

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	5

Rating of Site Potential If score is: ☐ **15-18 = H** ☐ **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:* % undisturbed habitat 0.00 **+** [(% moderate and low intensity land uses)/2]___ **=** 0.00 % 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	3
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat___ **+** [(% moderate and low intensity land uses)/2]___ **=** 0.00 % 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	2

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☑ **1-3 = M** ☐ **< 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** ☐ **1 = M** ☐ **0 = L**   *Record the rating on the first page*

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.

— **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 B

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**	**Cat. I**
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**	**Cat. I** **Cat. 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**	**Cat. I**
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**	**Cat. I**

Wetland name or number B

SC 4.0. Forested Wetlands Does the wetland have at least <u>1 contiguous acre</u> 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**	**Cat. I**
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**	**Cat. I** **Cat. 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**	**Cat I** **Cat. II** **Cat. III** **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	N/A

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RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland C Date of site visit: 11/17/21

Rated by Wallin/Dinkins Trained by Ecology? ☑ Yes ☐ No Date of training 2014/2021

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 Google

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
☑ **Category III** – Total score = 16 - 19
☐ **Category IV** – Total score = 9 - 15

FUNCTION	Improving Water Quality	Hydrologic	Habitat	
			Circle the appropriate ratings	
Site Potential	H ☐ M ☑ L ☐	H ☐ M ☑ L ☐	H ☐ M ☑ L ☐	
Landscape Potential	H ☐ M ☑ L ☐	H ☐ M ☑ L ☐	H ☐ M ☑ L ☐	
Value	H ☑ M ☐ L ☐	H ☐ M ☐ L ☑	H ☐ M ☑ L ☐	**TOTAL**
Score Based on Ratings	7	5	6	18

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	☑

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	

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 C

☑ 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 C

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 ☐	2
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 ☐	3
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 ☐	2
Total for D 1 Add the points in the boxes above	7

Rating of Site Potential If score is: ☐ **12-16 = H** ☑ **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	1
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
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	2

Rating of Landscape Potential If score is: ☐ **3 or 4 = H** ☑ **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: ☑ **2-4 = H** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

Wetland name or number C

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 ☐	2
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 ☐	1
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 ☐	3
Total for D 4 Add the points in the boxes above	6

Rating of Site Potential If score is: ☐ **12-16 = H** ☑ **6-11 = M** ☐ **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	1
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	0
Total for D 5 Add the points in the boxes above	1

Rating of Landscape Potential If score is: ☐ **3 = H** ☑ **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* doesn't retain much surface water points = 0 ☑ There are no problems with flooding downstream of the wetland. points = 0 ☐	0
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	0

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

Wetland name or number C

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

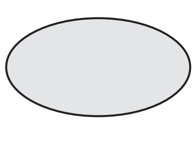
5 - 19 species — points = 1

< 5 species — points = 0

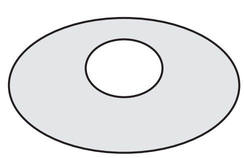
1

H 1.4. Interspersion of habitats

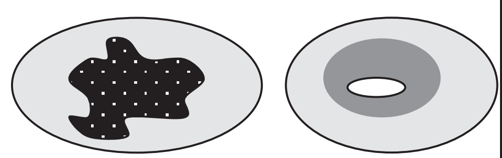
Decide from the diagrams below whether interspersion among Cowardin plants classes (described in H 1.1), or the classes and unvegetated areas (can include open water or mudflats) is high, moderate, low, or none. *If you have four or more plant classes or three classes and open water, the rating is always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



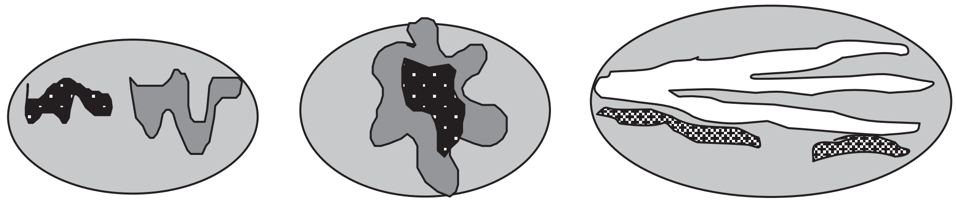
None = 0 points ☐



Low = 1 point ☑



Moderate = 2 points ☐



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

1

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	7

Rating of Site Potential If score is: ☐ **15-18 = H** ☑ **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:* % undisturbed habitat 0.00 **+** [(% moderate and low intensity land uses)/2]___ **=** 0.00 % 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	3
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland. *Calculate:* % undisturbed habitat___ **+** [(% moderate and low intensity land uses)/2]___ **=** 0.00 % 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	2

Rating of Landscape Potential If score is: ☐ **4-6 = H** ☑ **1-3 = M** ☐ **< 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** ☐ **1 = M** ☐ **0 = L** *Record the rating on the first page*

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.

— **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.

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**	**Cat. I**
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**	**Cat. I** **Cat. 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**	**Cat. I**
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**	**Cat. I**

SC 4.0. Forested Wetlands	
Does the wetland have at least <u>1 contiguous acre</u> 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**	**Cat. I**
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**	**Cat. I**
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**	**Cat. 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**	**Cat I**
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**	**Cat. II**
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**	**Cat. III**
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**	**Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	N/A

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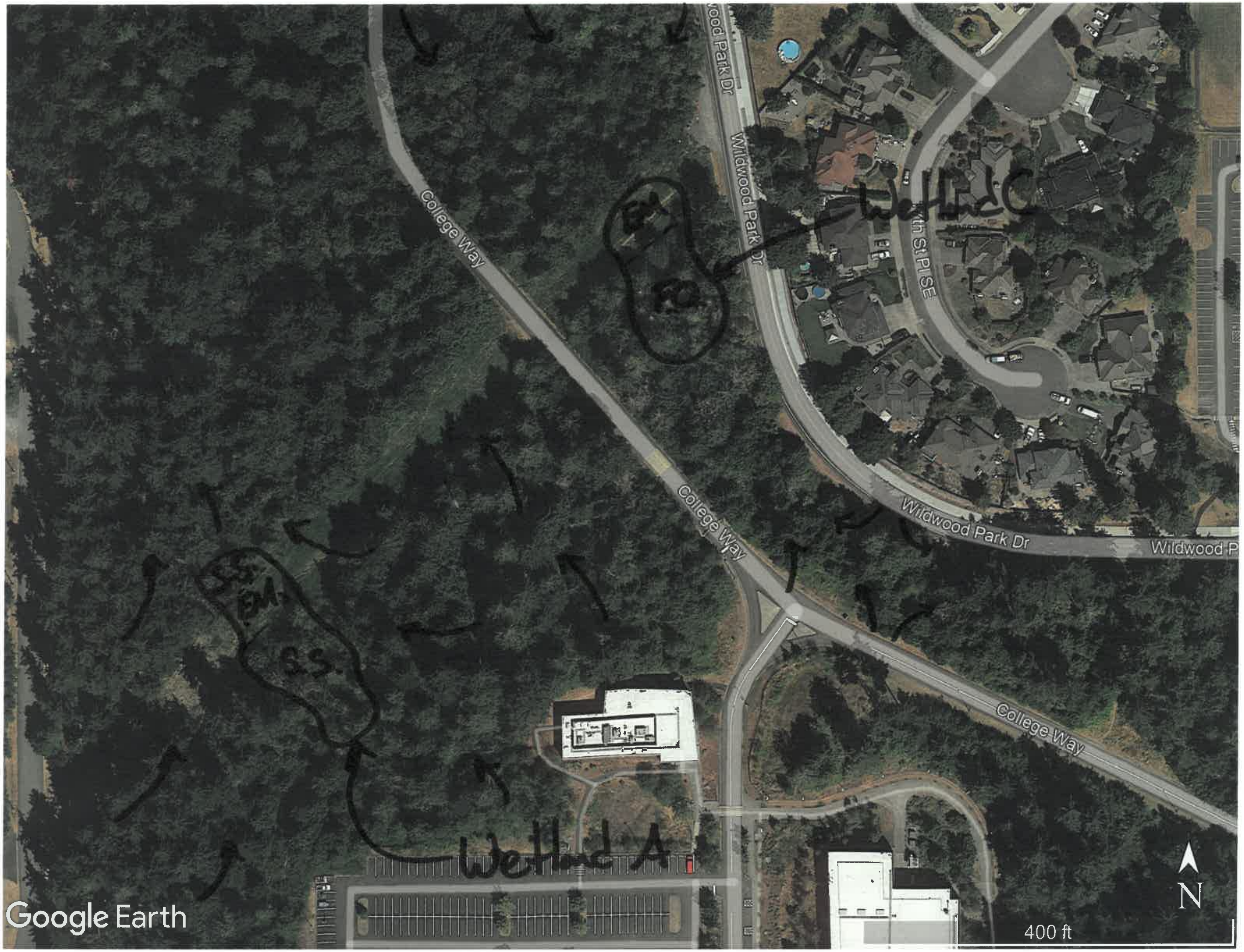

College Way
College Way
College Way
Wildwood Park Dr
Wildwood Park Dr
Wildwood P
th St Pl SE
Wetland C
EM
FO
S.S.
EM
S.S.
Wetland A
Google Earth
N
400 ft

Wetland B
FO
FO
College Way
Google Earth
400 ft
N


23rd Ave SE
23rd Ave SE
23rd Ave SE
512
Shaw Rd E
Shaw Rd E
37th Ave SE
39th Ave SE
9th Ave SW
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Well A
Well B
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Google Earth
4000 ft
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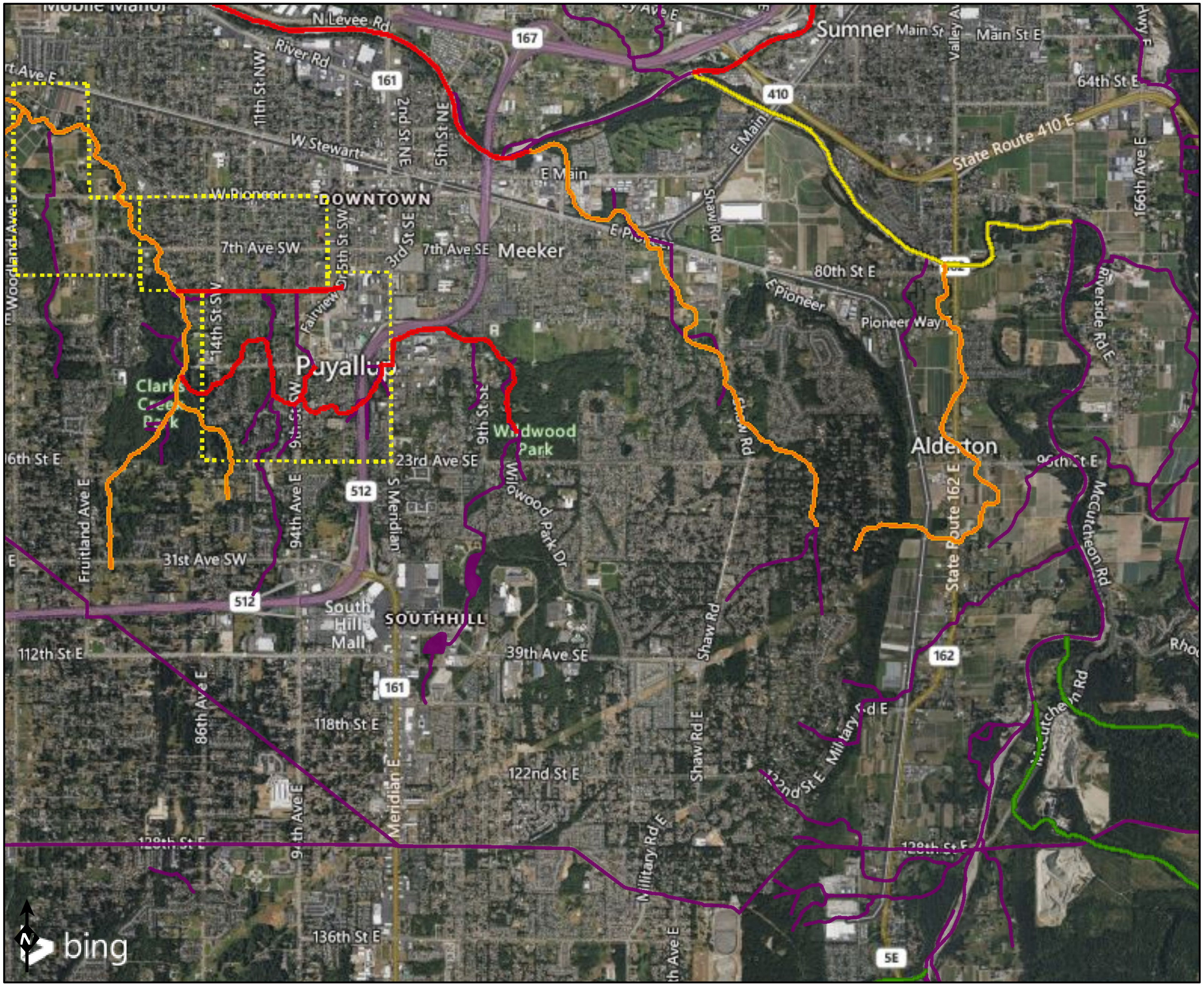
January 6, 2022

Water Quality Atlas



Assessed Water/Sediment

Water
- Category 5 - 303d
- Category 4C
- Category 4B
- Category 4A
- Category 2
- Category 1

Sediment
- Category 5 - 303d
- Category 4C
- Category 4B
- Category 4A
- Category 2
- Category 1

Water Quality Standards

- All Standards

Miles 0 0.5 1 2

DEPARTMENT OF ECOLOGY State of Washington

DEPARTMENT OF ECOLOGY State of Washington

Pierce County

Water quality improvement projects

Select the waterbody or pollutant name to find more information about the specific project.

Waterbody Name(s)	Pollutant(s)	Status	Project Lead(s)
Clarks and Meeker Creeks	Dissolved Oxygen Sediment Fecal Coliform	EPA approved and Has an implementation plan	Donovan Gray 360-407-6407
Clover Creek	Dissolved Oxygen Fecal Coliform Temperature	Under development	Donovan Gray 360-407-6407
Commencement Bay	Dioxin	EPA approved	Donovan Gray 360-407-6407
Nisqually Watershed Tributaries Tributaries: • McAllister Creek • Ohop Creek • Red Salmon Creek • Lynch Creek • Wash Creek • Unnamed Tributary to West Red Salmon Creek • Little McAllister Creek • Medicine Creek mouth	Fecal Coliform Dissolved Oxygen	EPA approved and Has an implementation plan	Donovan Gray 360-407-6407
Puyallup River	Fecal Coliform	EPA approved and	Donovan Gray

Watershed		Has implementation plan	360-407-6407
Puyallup River Watershed	Multi-parameter Ammonia-N BOD (5-day)	EPA approved	Donovan Gray 360-407-6407
Puyallup River: Upper White River	Sediment Temperature	EPA approved	Donovan Gray 360-407-6407
Puyallup River: Lower White River	pH	Under development	Donovan Gray 360-407-6407
South Prairie Creek	Fecal Coliform Temperature	EPA approved and Has an implementation plan	Donovan Gray 360-407-6407
Wapato Lake	Total Phosphorus	EPA approved	Donovan Gray 360-407-6407

To request ADA accommodation, call Ecology at 360-407-7668, 711 (relay service), or 877-833-6341 (TTY). More about our accessibility services.

PIERCE COLLEGE – PUYALLUP CAMPUS
PARKING LOT EXPANSION PROJECT

CRITICAL AREAS REPORT

APPENDIX D: QUERIED DATABASE FIGURES

City of Puyallup Public Data

Data layers

- Utilities
- Transportation
- Recreation
- Environment
  - City Maintained Street Trees
  - Regulated Flood plain
  - Seclusion Areas
  - General Habitat Areas
  - Potential Landslide

Maxar | Jennifer Recco, GIS Coordinator, City of Puyallup;… Powered by Esri

Legend

Environment

Wetlands

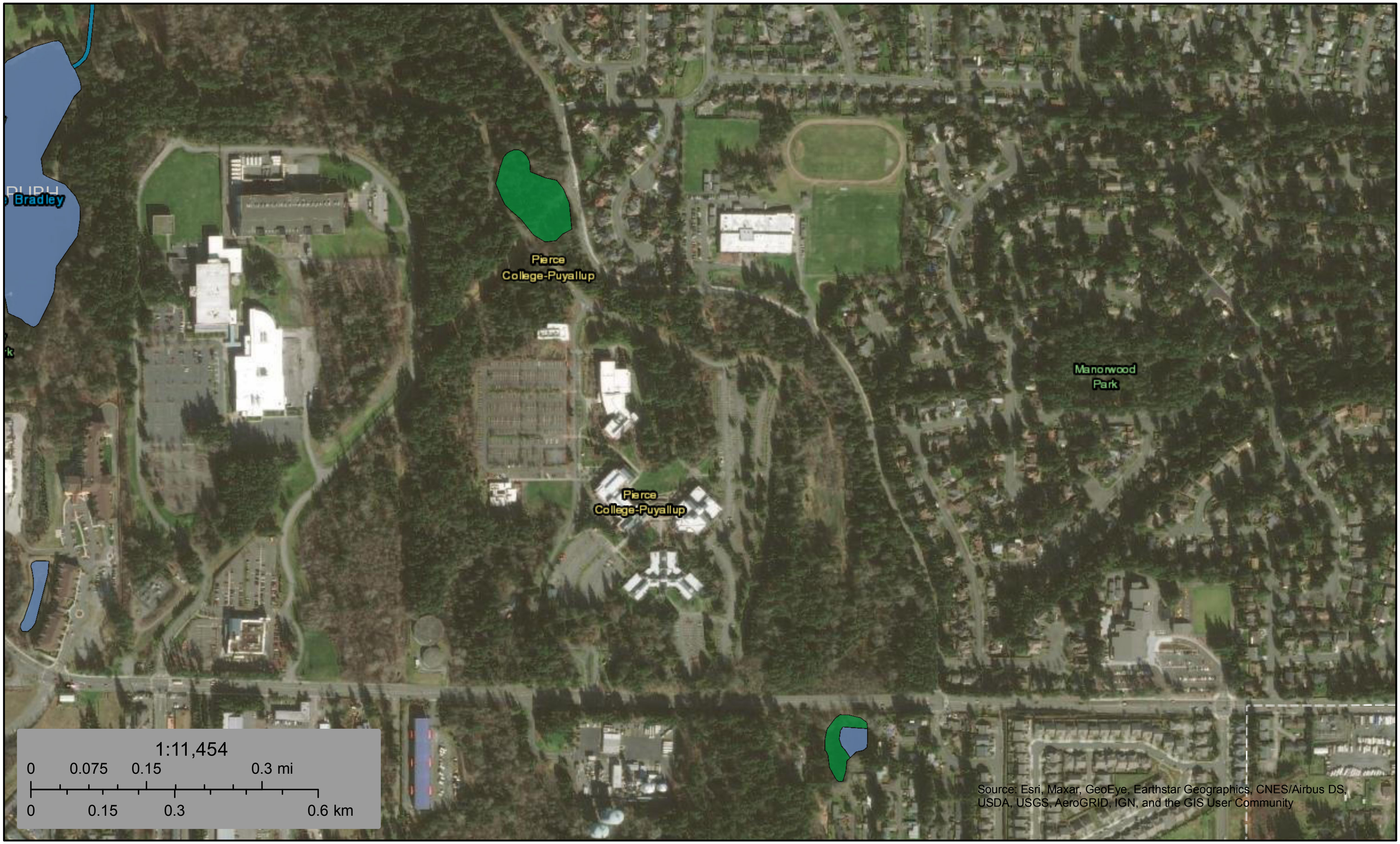
Status Code

- Field-verif Delineate
- Field-verif
- Unverified
- Unverified
- Unverified
- Buffer
- Mitigation

U.S. Fish and Wildlife Service

National Wetlands Inventory

Wetlands



January 26, 2022

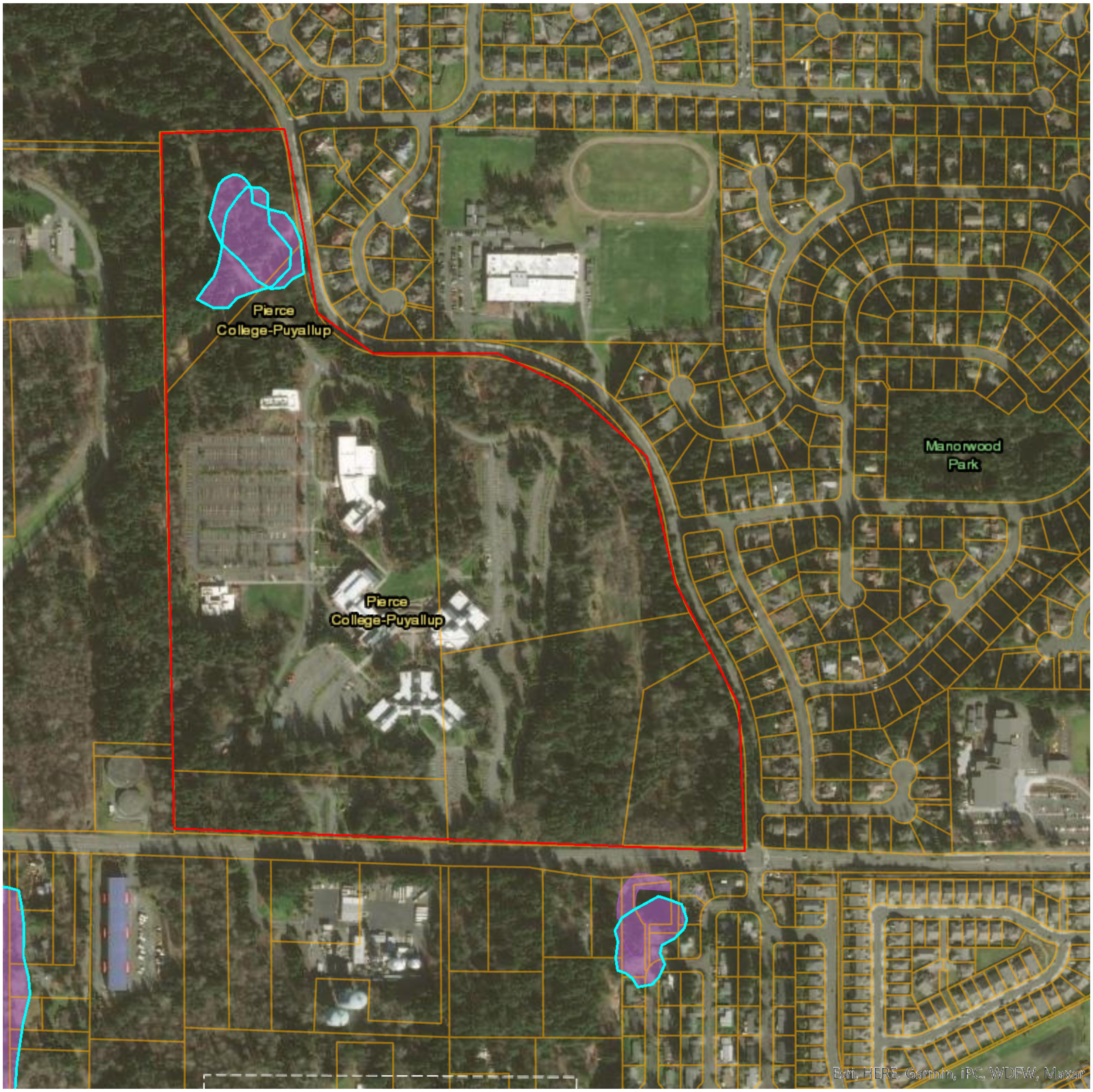
Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

Priority Habitats and Species on the Web



Report Date: 01/26/2022

PHS Species/Habitats Overview:

Occurence Name	Federal Status	State Status	Sensitive Location
Wetlands	N/A	N/A	No
Waterfowl Concentrations	N/A	N/A	No
Freshwater Forested/Shrub Wetland	N/A	N/A	No

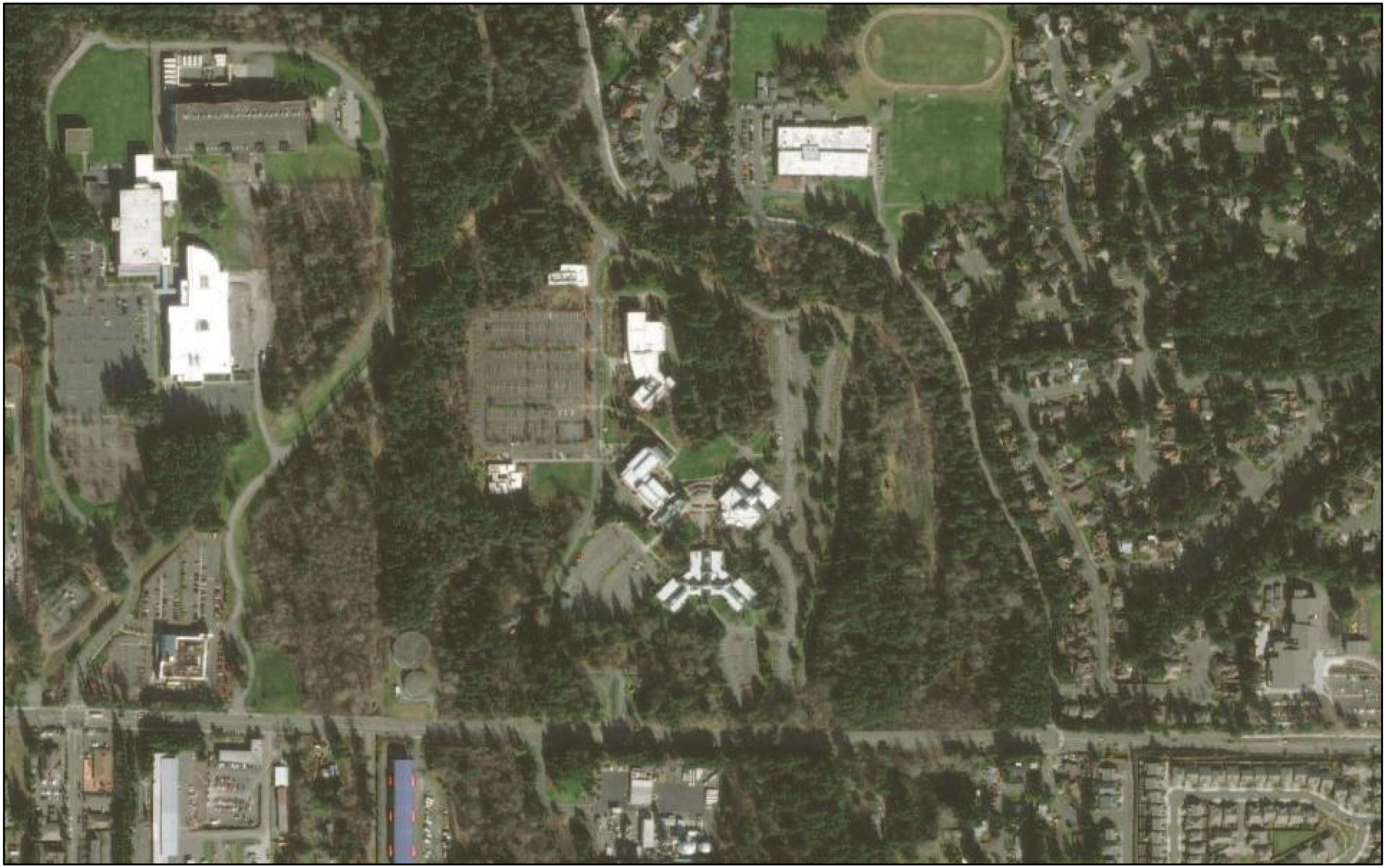
PHS Species/Habitats Details:

Wetlands	
Priority Area	Aquatic Habitat
Site Name	SOUTH PUYALLUP WETLANDS
Accuracy	1/4 mile (Quarter Section)
Notes	POTHOLE WETLANDS IN SOUTH PUYALLUP AREA
Source Record	902560
Source Dataset	PHSREGION
Source Name	NAUER, DON WDW
Source Entity	WA Dept. of Fish and Wildlife
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html
Geometry Type	Polygons

Waterfowl Concentrations	
Priority Area	Regular Concentration
Site Name	PIERCE COUNTY - NON FARM
Accuracy	1/4 mile (Quarter Section)
Notes	SMALL WATERFOWL CONCENTRATION AREAS, NON AGRICULTURAL.
Source Record	902564
Source Dataset	PHSREGION
Source Name	NAUER, DON WDW
Source Entity	WA Dept. of Fish and Wildlife
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS LISTED OCCURRENCE
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://wdfw.wa.gov/publications/pub.php?id=00026
Geometry Type	Polygons

Freshwater Forested/Shrub Wetland	
Priority Area	Aquatic Habitat
Site Name	N/A
Accuracy	NA
Notes	Wetland System: Freshwater Forested/Shrub Wetland - NWI Code: PFO1C
Source Dataset	NWIWetlands
Source Name	Not Given
Source Entity	US Fish and Wildlife Service
Federal Status	N/A
State Status	N/A
PHS Listing Status	PHS Listed Occurrence
Sensitive	N
SGCN	N
Display Resolution	AS MAPPED
ManagementRecommendations	http://www.ecy.wa.gov/programs/sea/wetlands/bas/index.html
Geometry Type	Polygons

WA Wetlands of High Conservation Value



1/26/2022, 3:14:04 PM

Counties

1:9,028

0 0.05 0.1 0.2 mi

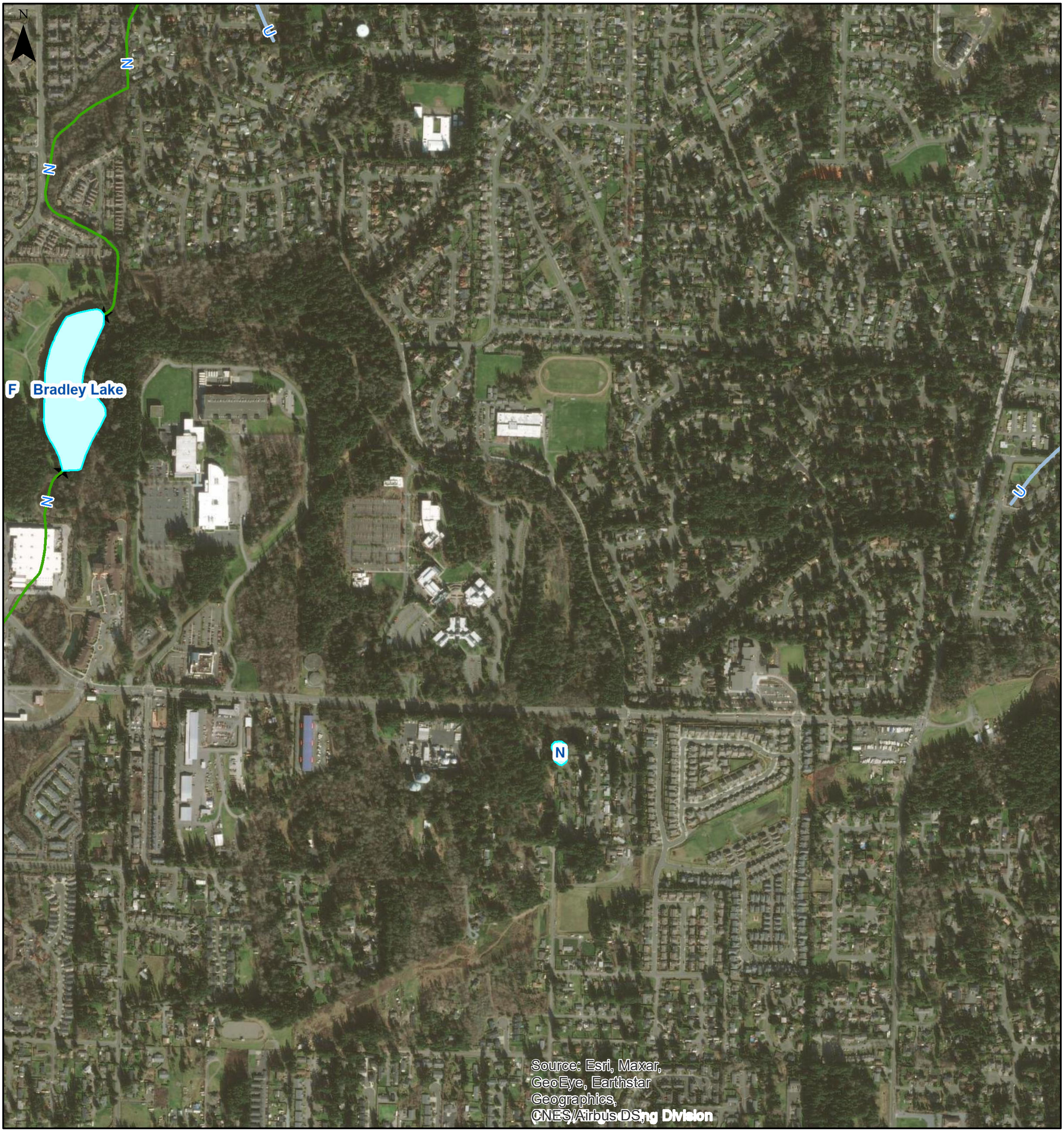
0 0.07 0.15 0.3 km

Maxar

Washington Natural Heritage Program

Washington State Department of Natural Resources | Washington Natural Heritage Program http://www.dnr.wa.gov/natural-heritage-program | Maxar |

Forest Practices Activity Map - Application #_____________



Map Symbols	Additional Information	Legal Description
Harvest Boundary; Road Construction; Stream; RMZ / WMZ Buffers; Rock Pit; Landing; Waste Area; Clumped WRTS/GRTS; Existing Structure		S10 T19.0N R04.0E, S03 T19.0N R04.0E S02 T19.0N R04.0E, S11 T19.0N R04.0E

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES

0 0.25 Miles

Date: 1/26/2022 Time: 3:16:27 PM


122° 16' 38" W
122° 16' 1" W
47° 9' 45" N
47° 9' 12" N
554800
554900
555000
555100
555200
555300
555400
555500
5223500
5223400
5223300
5223200
5223100
5223000
5222900
5222800
5222700
5222600
5222500
17th Street Pl Se
Wildwood Park Dr
39th Ave Se
39th
19C
19E
19B
13B
Soil Map may not be valid at this scale.
Map Scale: 1:4,980 if printed on A portrait (8.5" x 11") sheet.
N
0
50
100
200
300
Meters
0
200
400
800
1200
Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 17, Aug 31, 2021

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

Date(s) aerial images were photographed: Jul 18, 2020—Aug 2, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
13B	Everett very gravelly sandy loam, 0 to 8 percent slopes	12.7	15.3%
19B	Kapowsin gravelly ashy loam, 0 to 6 percent slopes	5.6	6.8%
19C	Kapowsin gravelly ashy loam, 6 to 15 percent slopes	43.6	52.7%
19E	Kapowsin gravelly ashy loam, 30 to 65 percent slopes	20.8	25.1%
Totals for Area of Interest		**82.7**	**100.0%**

GeoEngineers
1101 South Fawcett Avenue, Suite 200
Tacoma, Washington 98402
253.383.4940

October 31, 2022

Washington State Department of Enterprise Services
Division of Engineering & Architectural Services
206 General Administration Building
Olympia, Washington 98504-1012

Attention: Dennis Flynn

Subject: Supplemental Groundwater Information Addendum #1
Pierce College Puyallup – Northwest Parking Lot Additions
Puyallup, Washington
File No. 21342-003-00

INTRODUCTION

This addendum presents additional groundwater monitoring information collected for the Pierce College Puyallup – Parking Lot Additions project in Puyallup, Washington, and is intended to supplement our Geotechnical Engineering Services Report for the same project, dated January 31, 2022 (Geotechnical Report). Our services have been provided in general accordance with our Additional Service Agreement #1 for this project dated December 22, 2021 and our Signed Agreement No. 2020-546 C dated March 16, 2022. Reference to this study should include review and full inclusion of our January 31, 2022 Geotechnical Report. This addendum and our report should be provided and reviewed together for all our geotechnical information, conclusions, and recommendations presented by us on this project.

The City of Puyallup (City) requested, and in general accordance with the Washington State Department of Ecology's 2014 Stormwater Management Manual for Western Washington (SWMMWW), that groundwater monitoring data be collected during the wet season (defined by City as December 21 through April 1) in the vicinity of the former proposed detention pond to be located near the future northwest parking lot. We facilitated drilling and installation of a groundwater monitoring well (MW-1) at the site on January 3, 2022. MW-1 was placed in the vicinity of the former proposed stormwater detention system. The location of the well is shown on the Site Plan, Figure 1. We understand that due to site constraints and other factors, the northwest stormwater facility design was changed to an underground detention pipe system. The underground system will be located beneath the western portion of the proposed northwest parking lot. The bottom of the facility is planned to be between about Elevation 506.5 and 507 feet. As part of the system change, the parking lot layout was elongated toward the west to northwest.

In the following sections, we discuss the subsurface conditions encountered during drilling, present the groundwater monitoring data collected, and provide additional conclusions and recommendations for design of the northwest stormwater facility.

SUBSURFACE CONDITIONS

During drilling for MW-1, we advanced through about 12 inches of forest duff and/or organic-rich soil at the surface. Underlying the forest duff, we encountered what we interpret to be glacial till. The upper approximate 4½ feet was weathered and generally consisted of medium dense silty sand. Beneath the weathered zone, soil generally consisted of dense to very dense silty sand with gravel, very dense gravel with silt and sand, and very stiff to hard silt with varying sand content. A more detailed description of our interpretation of geologic and subsurface conditions at the project site and additional exploration logs are provided in our Geotechnical Report. Our exploration and laboratory testing program and summary exploration log for this study is included in Appendix A.

We encountered groundwater at about 21 feet below ground surface (bgs) during drilling. After constructing the monitoring well, we measured groundwater at about 9¾ feet bgs. Based on subsurface soil conditions (soil lithology and soil moisture conditions), followed by the subsequent rise in groundwater level (approximate 11-foot rise after well construction), it is our opinion that artesian groundwater conditions are present in the vicinity of MW-1. It should be noted that our other geotechnical studies in the project vicinity on campus have documented near surface perched groundwater seepage, but it was not interpreted to be a regional groundwater table at the depths noted or an artesian condition.

GROUNDWATER MONITORING

We installed a pressure transducer data logger within MW-1 to record groundwater levels at regular time intervals. The data logger was programmed to collect a groundwater reading once a day at 12:00 between January 4 and May 18, 2022. Groundwater data collected was compiled and correlated to an elevation versus date presented in the Groundwater Hydrograph, Figure 2.

The maximum and average groundwater elevations are presented in Table 1 below.

TABLE 1. GROUNDWATER ELEVATION SUMMARY

Date and Time of Maximum Elevation	Approx. Maximum Elevation (feet, NAVD88[1])	Approx. Average Elevation (feet, NAVD88[1])
1/17/22 12:00	506.0	504.5

Notes:

[1] The North American Vertical Datum 1988.

CONCLUSIONS AND RECOMMENDATION

Design Considerations

- We recommend that Elevation 506 feet be considered the limiting elevation for the bottom of the stormwater system for storage considerations.
- Buoyancy effects should be considered as a part of the detention system design. As such, we suggest that an initial and assumed groundwater elevation of 508 feet (NAVD88) be considered as a target groundwater elevation for buoyancy calculation checks. This is somewhat conservative. If

it is found that buoyancy effects at this groundwater elevation is a concern, we should be contacted and provided an opportunity to review and assist with the design.

- Total soil unit weight (above groundwater) may be considered to be 125 pounds per cubic foot (pcf).
- Effective soil unit weight (below groundwater) may be considered to be 62.6 pcf.
- Follow detention pipe system manufacturer recommendations for mitigating buoyancy effects.

Construction Considerations

Based on proposed design elevations, expect to encounter water below about Elevation 506 feet during excavation and construction. This will occur from either near surface seepage and/or artesian conditions, as described above. Artesian conditions may temporarily cause the base of the excavation to “float” and/or become unstable and/or disturbed. We expect that artesian conditions should subside shortly after excavation and just be wet. If the excavation takes place in mid- to late-summer, we expect the upward artesian seepage to be less prominent and the basal soils could potentially be dryer and less difficult to manage.

Subgrade stabilization below the bottom of the stormwater system may be necessary during construction. As such, we recommend budgeting and planning for at least 12 inches of subgrade over-excavation and replacement with quarry spalls (Washington State Department of Transportation [WSDOT] Standard Specification 9-13.1(5)), aside from any design base materials already in the project plans and specifications. Ultimately, base and subgrade conditions will have to be observed during excavation to determine if this, or other means of stabilization, are necessary.

LIMITATIONS

We have prepared this letter for the exclusive use of the Washington State Department of Enterprise Services (DES) and their authorized agents for the Pierce College Puyallup – Parking Lot Additions project located in Puyallup, Washington.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices for geotechnical engineering in this area at the time this letter was prepared. The conclusions, recommendations, and opinions presented in this letter are based on our professional knowledge, judgment, and experience. No warranty, express or implied, applies to the services or this letter.

Except for described and modified herein, the conclusions and recommendations and limitations presented in our January 31, 2022 Geotechnical Report remain unchanged and still apply to this project. Please refer to Appendix A titled “Report Limitations and Guidelines for Use” in our Geotechnical Report for additional information pertaining to use of this letter.

We trust that this letter meets your needs. If you have any questions regarding this letter, please contact us.

Sincerely,
GeoEngineers, Inc.

10/31/22

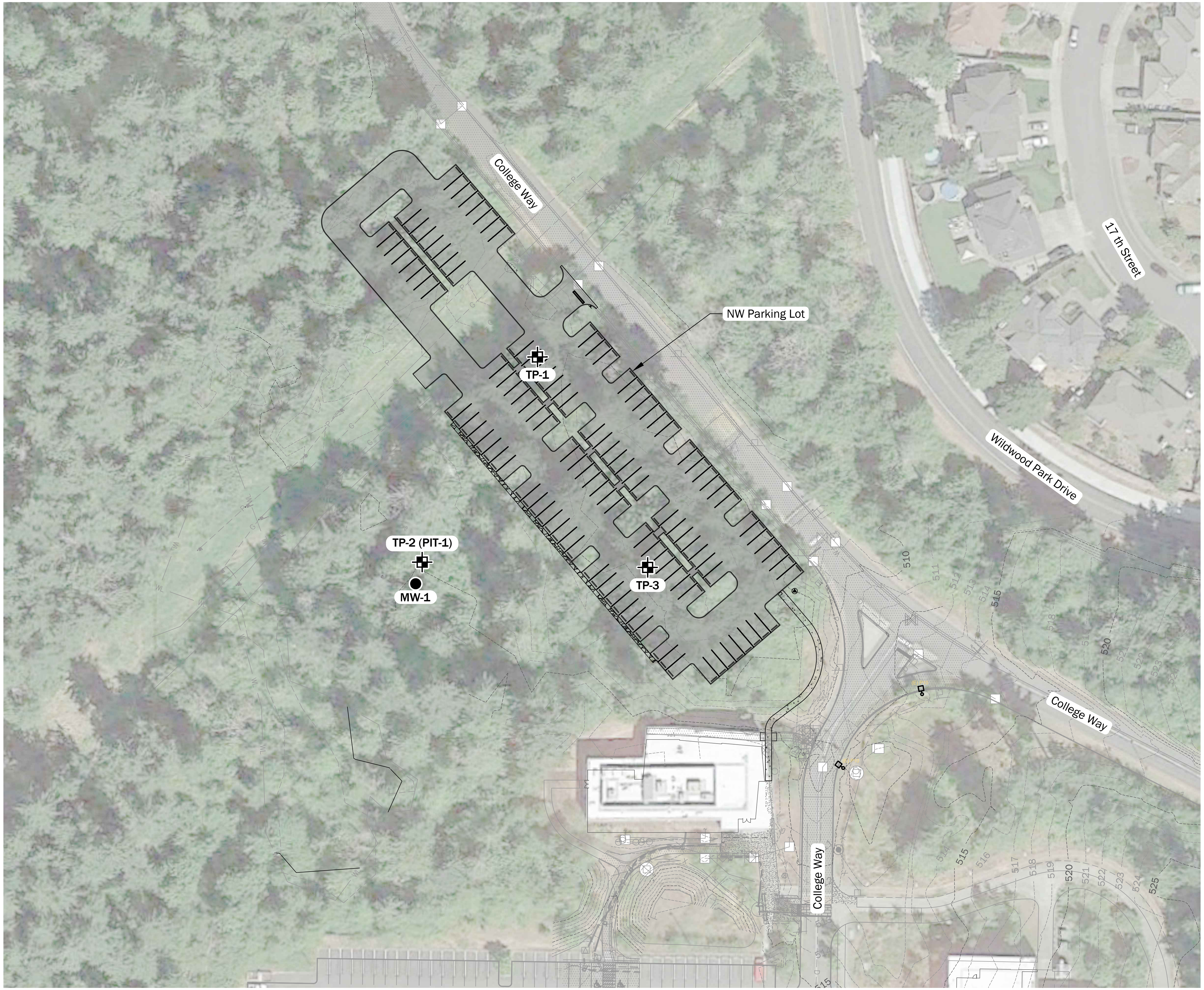
Christopher R. Newton, PE
Geotechnical Engineer

Dennis (D.J.) Thompson, PE
Associate Geotechnical Engineer

CRN:DJT:leh

Attachments:
Figure 1. Site Plan
Figure 2. Groundwater Hydrograph
Appendix A. Subsurface Explorations and Laboratory Testing
  Figure A-1 – Key to Exploration Logs
  Figure A-2 – Log of Monitoring Well
  Figures A-3 and A-4 – Sieve Analysis Results

1 copy submitted electronically



Legend

MW-1 ● Monitoring Well by GeoEngineers, Inc., 2022

TP-1 Test Pit by GeoEngineers, Inc., 2021

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Background from AHBL, Inc., received on 10/06/2022.
Aerial from Google Earth Pro dated 08/14/2020.

Projection: Washington State Plane, South Zone, NAD83, US Foot

N W E S

80 0 80
Feet

Site Plan

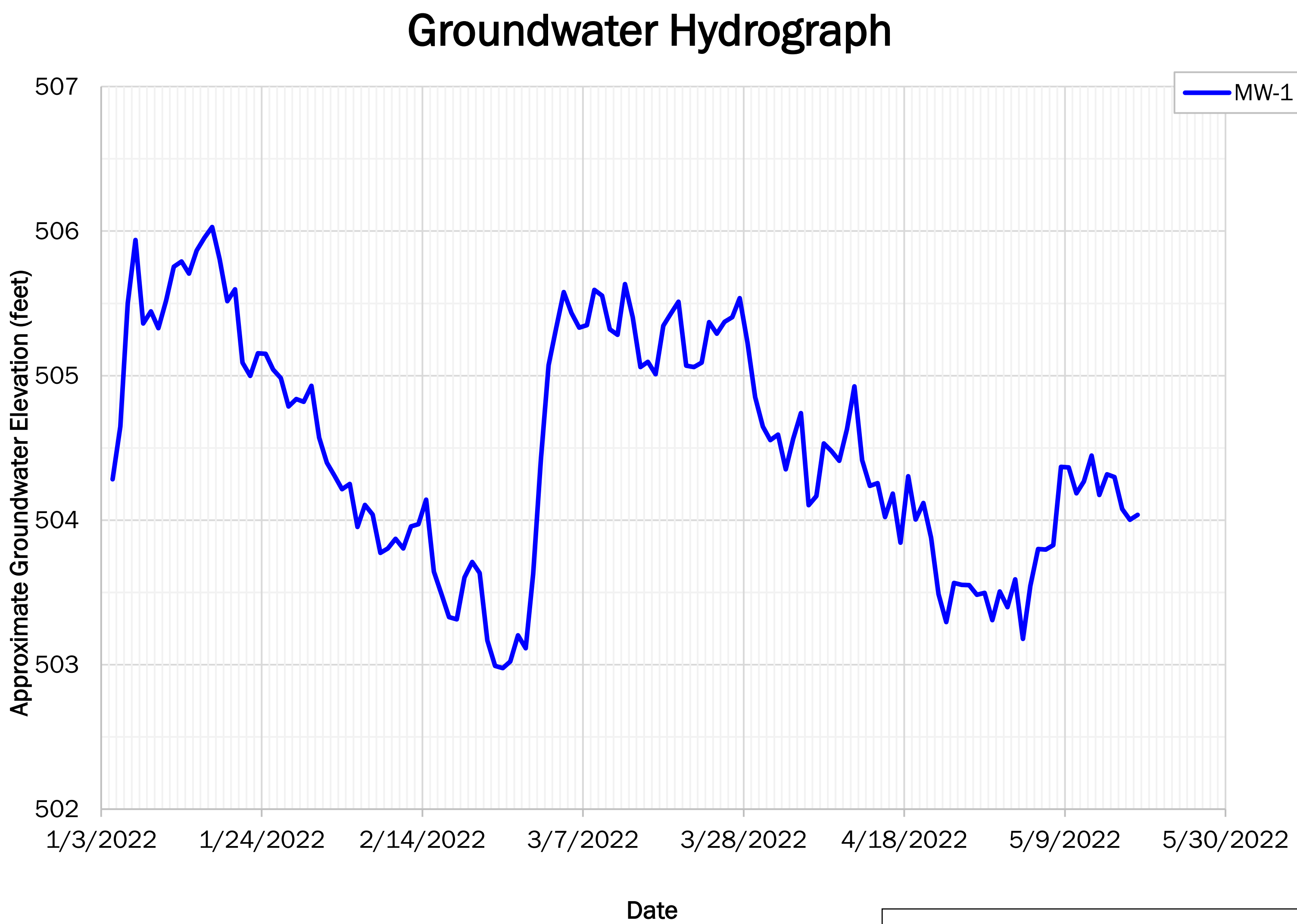
Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

GEOENGINEERS

Figure 1

P:\21\21342003\CAD\00\Addendum Report\2134200300_F01_Site Plan.dwg TAB:F01 Date Exported: 11/01/22 - 16:29 by mfadhl

21342-003-00 Date Exported 07/21/22



Note:
1. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Groundwater Hydrograph
Pierce College Puyallup - Parking Lot Additions Puyallup, Washington
GEOENGINEERS — **Figure 2**

APPENDIX A
Subsurface Explorations and Laboratory Testing

APPENDIX A
SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

Subsurface Explorations

Subsurface conditions were explored by advancing one hollow-stem auger boring on January 3, 2022. Subsurface exploratory services were provided by Holocene Drilling, Inc. under subcontract to GeoEngineers, Inc. The boring was advanced to a nominal depth of about 25¼ feet below surrounding site grade. A groundwater monitoring well was installed with a pressure transducer at this boring.

The boring was located in the field using an electronic tablet equipped with a global positioning system (GPS) software application. The exploration coordinates were approximated using publicly available aerial imagery and coordinate software. The exploration location is included on the Site Plan, Figure 1. The location and elevation of the exploration should be considered approximate.

Our field representative collected samples, classified the soils, maintained a detailed log of the exploration, and observed groundwater conditions. The samples were obtained with a standard split spoon sampler in general accordance with ASTM International (ASTM) D 1586. Field blow counts are presented on the logs. The soils were classified visually in general accordance with the system described in Figure A-1, which includes a key to the exploration logs. A summary log of the exploration is included as Figure A-2.

Laboratory Testing

Soil samples obtained from the boring were transported to GeoEngineers laboratory. Representative soil samples were selected for laboratory tests to evaluate the pertinent geotechnical engineering characteristics of the site soils and to confirm our field classification.

Our testing program consisted of the following:

- Five – Particle-size distribution analyses (sieve analyses (SA))
- One – Moisture content determination (MC)

Tests were performed in general accordance with test methods of ASTM or other applicable procedures. The following sections provide a general description of the tests performed.

Sieve Analysis

Particle-size analyses were completed on selected samples in general accordance with ASTM Test Method C 136. This test method determines quantitatively the distribution of particle sizes in soils. Typically, the distribution of particle sizes larger than 75 micrometers (μm) is determined by sieving. The results of the tests were used to verify field soil classifications and determine pertinent engineering characteristics. Figures A-3 and A-4 present the results of our sieve analyses.

Moisture Content

The moisture content of a selected sample was determined in general accordance with ASTM Test Method D 2216. The test results are used to aid in soil classification and correlation with other pertinent engineering soil properties. The test results are shown on the exploration log at the respective sample depth.

SOIL CLASSIFICATION CHART

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

NOTE: Multiple symbols are used to indicate borderline or dual soil classifications

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel / Dames & Moore (D&M)
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

Blowcount is recorded for driven samplers as the number of blows required to advance sampler 12 inches (or distance noted). See exploration log for hammer weight and drop.

"P" indicates sampler pushed using the weight of the drill rig.

"WOH" indicates sampler pushed using the weight of the hammer.

ADDITIONAL MATERIAL SYMBOLS

SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
	AC	Asphalt Concrete
	CC	Cement Concrete
	CR	Crushed Rock/ Quarry Spalls
	SOD	Sod/Forest Duff
	TS	Topsoil

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

NOTE: The reader must refer to the discussion in the report text and the logs of explorations for a proper understanding of subsurface conditions. Descriptions on the logs apply only at the specific exploration locations and at the time the explorations were made; they are not warranted to be representative of subsurface conditions at other locations or times.

Key to Exploration Logs

GeoEngineers

Figure A-1

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	1/3/2022	1/3/2022	25.25	OA	CRN	Holocene Drilling, Inc.	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D-50 Turbo (track-mounted)
Surface Elevation (ft) Vertical Datum	514.55 NAVD88	Top of Casing Elevation (ft)	518.29
Easting (X) Northing (Y)	1198829 671013	Horizontal Datum	WA State Plane South NAD83 (feet)

DOE Well I.D.: BNP-056
A 2-in well was installed on 1/3/2022 to a depth of 25 ft.

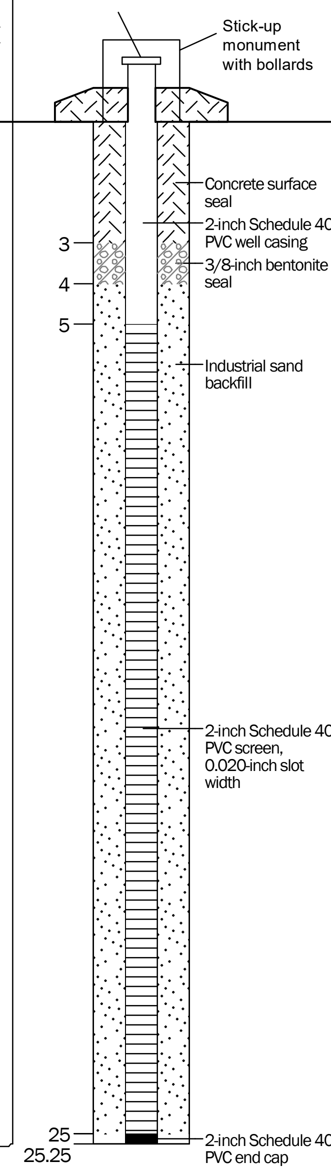
Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1/3/2022	9.75	504.80

Notes: Groundwater observed at approximately 21 feet below ground surface during drilling

Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
0				Duff	Forest duff		
				SM	Gray with moderate oxidation staining silty fine to medium sand with occasional gravel (medium dense, moist) (weathered glacial till)		
	16	26	1 MC			20	
				SM	Gray silty fine sand with gravel (dense, moist) (glacial till)		
5	10	42	2				
	8	78/9"	3 SA		Grades to very dense, includes approximate 1-inch thick layer of wet, fine to medium sand	12	43
				ML	Gray silt with sand (hard, moist)		
10	17	85/11"	4 SA			17	71
				ML	Gray sandy silt and includes approximate 1-inch-thick layer of wet, fine to medium sand (very stiff, near wet)		
15	12	22	5 SA			19	51
				SM	Gray silty fine sand with gravel (very dense, wet)		
20	6	50/6"	6 SA			15	34
				GW-GM	Gray fine to coarse gravel with silt and sand (very dense, wet)		
25	3	50/3"	7 SA			8	8

Elevation (feet): 510, 505, 500, 495, 490

WELL LOG



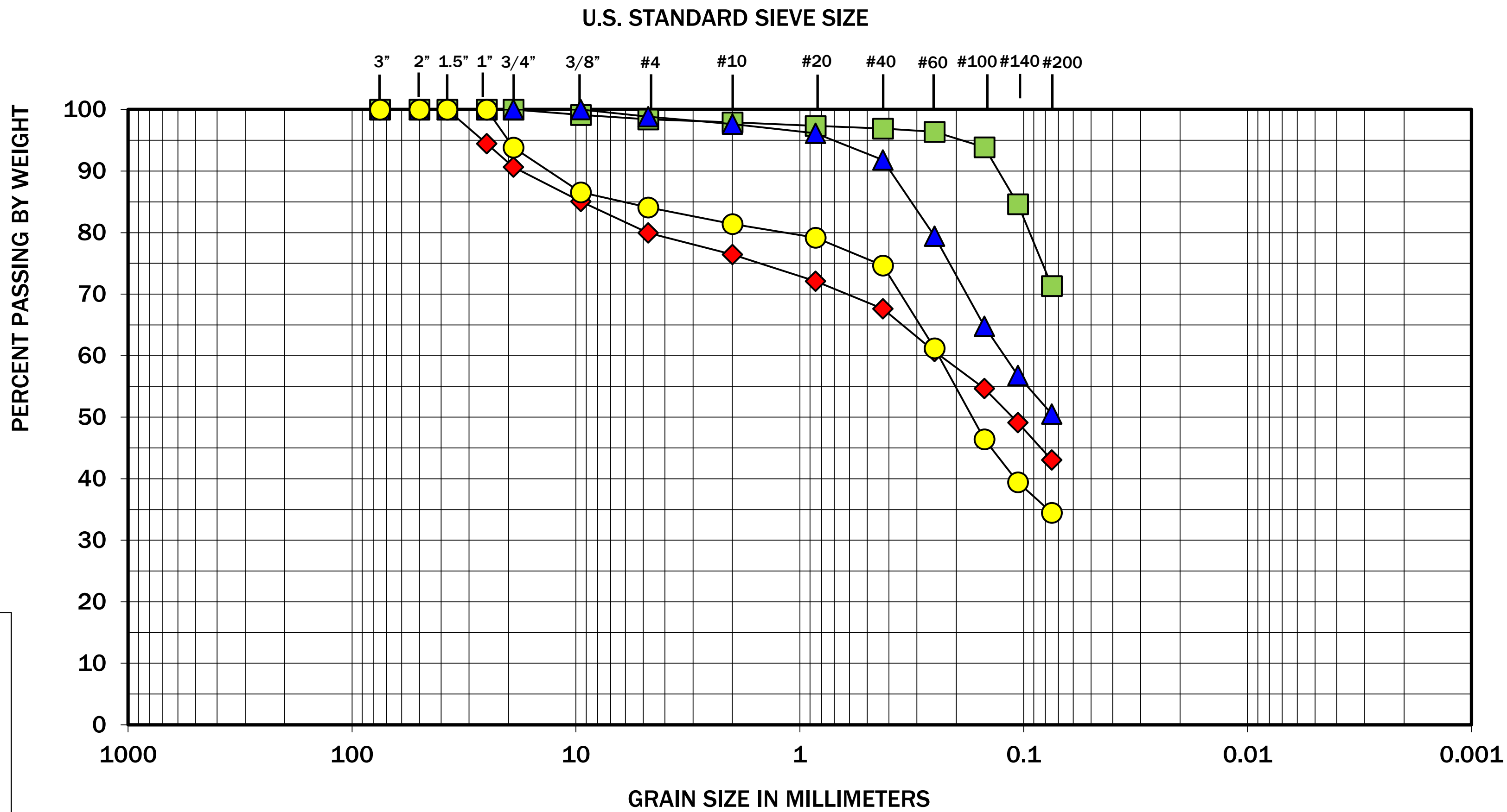
Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Monitoring Well MW-1

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00

21342-003-00 Date Exported: 1/14/22



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	MW-1	7.5	12	Silty sand with gravel (SM)
■	MW-1	10	17	Silt with sand (ML)
▲	MW-1	15	19	Sandy silt (ML)
●	MW-1	20	15	Silty sand with gravel (SM)

AASHTO ACCREDITED

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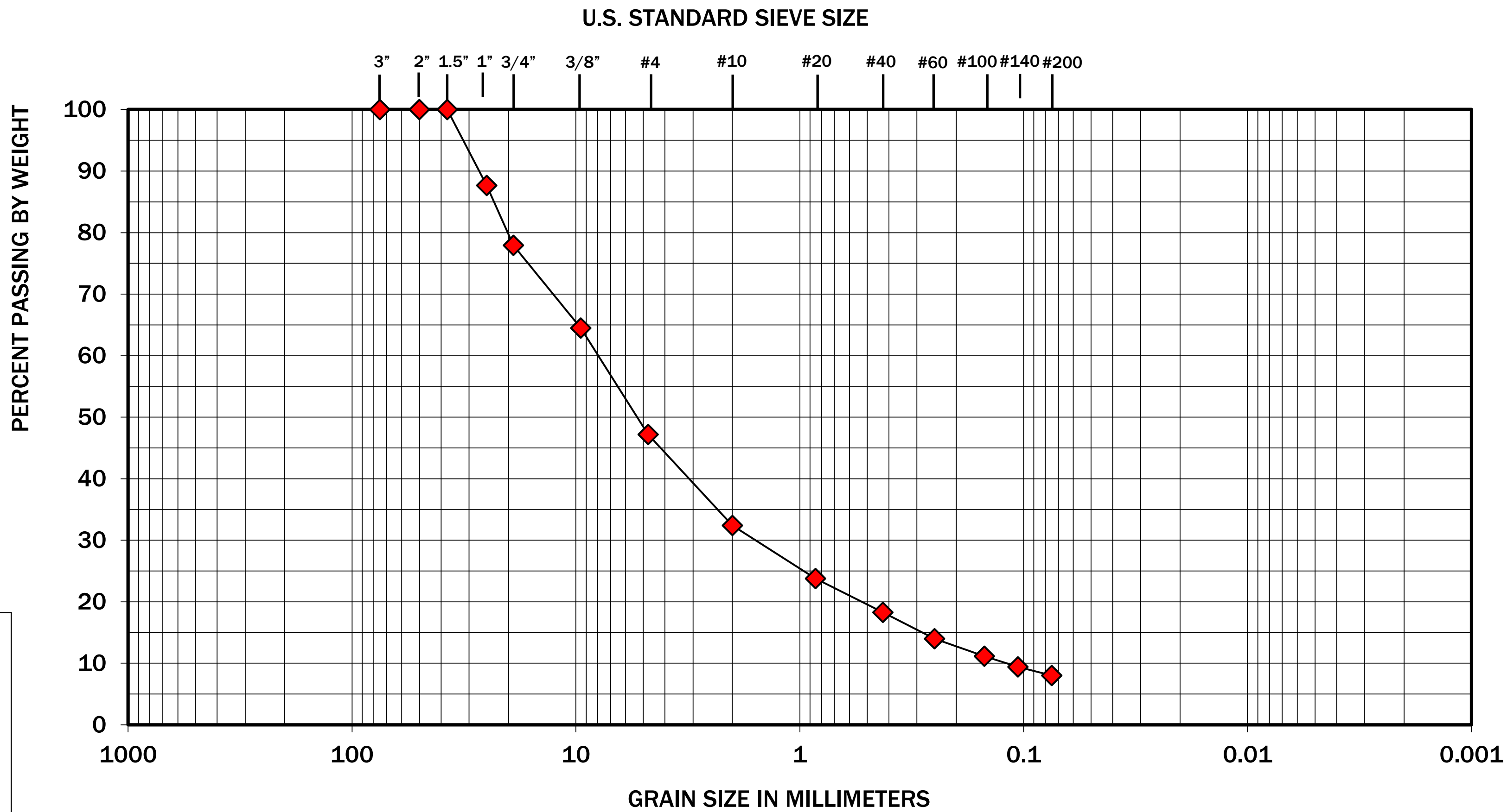
The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

GEOENGINEERS

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

Sieve Analysis Results

Figure A-3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	MW-1	25	8	Well-graded gravel with silt and sand (GW-GM)

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GEOENGINEERS

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

Sieve Analysis Results

Figure A-4

TECHNICAL MEMORANDUM

Prepared for: Andy Hartung, AIA
McGranahan Architects
2111Pacific Avenue, Suite 100
Tacoma, WA 98402

February 28, 2024

File No.: 3359-001/3032.001

Prepared by: Grette Associates, *a division of Farallon Consulting L.L.C.*
2709 Jahn Ave. NW, Ste. H5
Gig Harbor, WA 98335-7999

Re: Stormwater Manual: Minimum Requirement 8 - Wetland Assessment and Rating

1 INTRODUCTION

Grette Associates, a division of Farallon Consulting, L.L.C., is under contract with McGranahan Architects to assist with stormwater design support associated with Pierce College's Puyallup campus parking lot expansion project. The purpose of this memorandum is to summarize the wetland assessment of the known wetland (Wetland OS-1) situated immediately east of the intersection of 27th Avenue Southeast and 7th Street Southeast (Pierce County parcel 0419032101; Figure 1).

Figure 1. Map

The City of Puyallup has requested an assessment be performed for the offsite wetland in response to stormwater design parameters outlined in the State's stormwater manual, specifically Minimum Requirement 8 (MR-8) for wetland protection.

2 METHODS

Wetland OS-1 was visually assessment to document the general characteristics of the wetland.

MR-8 requires any wetland identified to receive water from a project needs to be rated using the Washington State Department of Ecology's (Ecology) *Washington State Wetland Rating System for Western WA – 2014 Update: Version 2* (Hruby and Yahnke 2023). As such, Wetland OS-1 was rated using the current version of Ecology's wetland rating system.

This assessment did not include a wetland delineation or preparation of critical areas report or similar document.

3 RESULTS

According to wetland rating system, Wetland OS-1 is classified as a Category III wetland that provides low habitat function (score of 5 habitat points). While this feature exhibits moderate water quality and hydrology functions, this wetland provides low habitat function largely due to its location within the landscape and being situated within a dense urban environment (Table 1; Attachment 1). As such, Wetland OS-1 likely provides limited wildlife habitat because it does not connect to undeveloped upland habitats compared to those wetland features in the vicinity of the project area (Figure 1).

Wetland OS-1 also appears to be one of several wetland features that appear to support Wildwood Creek. According to queried databases, Wildwood Creek originates just south of 37th Avenue Southeast and flows north through the Bradley Park wetland complex and through Wetland OS-1 before continuing west to Clarks Creek. During the assessment, Grette Associates did not observe a defined channel associated with Wildwood Creek.

During Grette Associates' assessment, as well as queried databases, did not result in the identification of any habitats that would support any rare, endangered, threatened, or sensitive species.

Table 1. Wetland rating and categorization summary

Feature	Cowardin Class	HGM Class	Water Quality	Hydrology	Habitat	Total	Category[1]
Wetland A	PAB/SS/FO	Depressional	7	6	5	18	III

[1] Per Chapter 21.06 of Puyallup Municipal Code.

Per Puyallup Municipal Code (PMC) 21.06.930, assuming high land use, Category III wetlands that provide low habitat function (5 points or less) are subject to an 80-foot buffer.

If you have any questions on this assessment, please contact me at (253) 573-9300, or by email at chadw@gretteassociates.com.

Regards,

Chad Wallin, PWS
Biologist
GRETTE ASSOCIATES, *a division of Farallon Consulting L.L.C.*

References:

Hruby, T. & Yahnke, A. 2023. Washington State Wetland Rating System for Western Washington: 2014 Update (Version 2). Publication #23-06-009. Washington Department of Ecology.

ATTACHMENT 1

WETLAND RATING FORM

Wetland name or number Offsite Wetland 1

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Offsite Wetland 1 Date of site visit: 02/20/2024

Rated by Rachel Quindlen Trained by Ecology? X Yes ___No Date of training 04/2021

HGM Class used for rating Depressional Wetland has multiple HGM classes? X Y ___N

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

Source of base aerial photo/map Google Earth Pro

OVERALL WETLAND CATEGORY III (based on functions X 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	H	M	L	H	M	L	H	M	L	
Landscape Potential	H	M	L	H	M	L	H	M	L	
Value	H	M	L	H	M	L	H	M	L	**TOTAL**
Score Based on Ratings	7			6			5			18

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	

Wetland name or number Offsite Wetland 1

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 total 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 total 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 total 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 total 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	

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 sheet flow, 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).

Wetland name or number Offsite Wetland 1

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.

   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 Offsite Wetland 1

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	2
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	3
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	4
Total for D 1 Add the points in the boxes above	9

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	1
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	1
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	0
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	2

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 in development or in effect 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*

Wetland name or number Offsite Wetland 1

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/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	2
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	5
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 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	3
Total for D 4 Add the points in the boxes above	10

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 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	1
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	1
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	3

Rating of Landscape Potential If score is: X 3 = H __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. Is the unit 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 downgradient 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 downgradient of unit. points = 2 • Surface flooding problems are in a sub-basin farther downgradient. 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	0
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	0

Rating of Value If score is: __2-4 = H __1 = M X 0 = L *Record the rating on the first page*

Wetland name or number Offsite Wetland 1

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 if the unit is at least 2.5 ac, or more than 10% of the unit if it is smaller than 2.5 ac.

X Aquatic bed	4 structures or more: points = 4
___ Emergent	3 structures: points = 2
X Scrub-shrub (areas where shrubs have > 30% cover)	2 structures: points = 1
X Forested (areas where trees have > 30% cover)	1 structure: points = 0

If the unit has a Forested class, check if:

X The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/groundcover) that each cover 20% within the Forested polygon

4

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 if the unit is < 2.5 ac, or ¼ ac if the unit is at least 2.5 ac to count (see text for descriptions of hydroperiods).

X Permanently flooded or inundated	4 or more types present: points = 3
X Seasonally flooded or inundated	3 types present: points = 2
___ Occasionally flooded or inundated	2 types present: points = 1
X Saturated only	1 type present: points = 0
___ Permanently flowing stream or river in, or adjacent to, the wetland	
___ Intermittently or seasonally flowing stream in, or adjacent to, the wetland	
___ **Lake Fringe wetland**	**2 points**
___ **Freshwater tidal wetland**	**2 points**

2

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, Canada thistle**

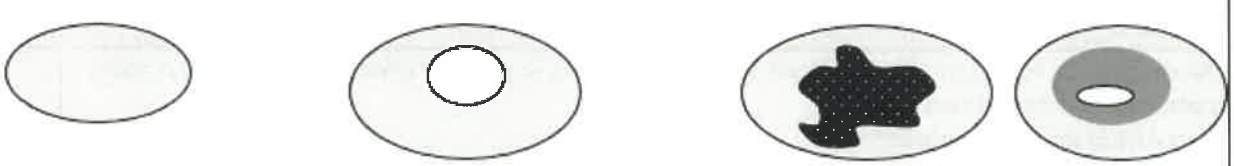
If you counted: > 19 species	points = 2
5 - 19 species	points = 1
< 5 species	points = 0

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.

3



None = 0 points **Low = 1 point** **Moderate = 2 points**

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

Wetland name or number Offsite Wetland 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. _X_ Large, downed, woody debris within the wetland (> 4 in. diameter and 6 ft long). _X_ Standing snags (dbh > 4 in.) within the wetland ____ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extend at least 3.3 ft (1 m) over open water or 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) _X_ 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 above for the list of strata and H 1.5 in the manual for the list of aggressive plant species)	3
Total for H 1 Add the points in the boxes above	13

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 polygons accessible from the wetland. *Calculate:* % relatively undisturbed habitat _0_ + [(% moderate and low intensity land uses)/2] _0_ = _0_ % Total accessible habitat is: * all available habitat polygons are separated from the wetland unit by dense residential housing, paved residential roads, or busy 2-4 lane streets. > 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. Total habitat in 1 km Polygon around the wetland. *Calculate:* % relatively undisturbed habitat _28_ + [(% moderate and low intensity land uses)/2] _4_ = _32_ % Total habitat > 50% of Polygon points = 3 Total habitat 10-50% and in 1-3 patches points = 2 Total habitat 10-50% and > 3 patches points = 1 Total habitat < 10% of 1 km Polygon points = 0	1
H 2.3. Land use intensity in 1 km Polygon: > 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 data — 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*

WDFW Priority Habitats

See complete descriptions of Priority Habitats listed by WDFW, and the counties in which they can be found, in: Washington Department of Fish and Wildlife. 2008 (current year, as revised). Priority Habitat and Species List.[133] This list was updated for consistency with guidance from WDFW.

This question is independent of the land use between the wetland unit and the Priority Habitat. All vegetated wetlands are by definition a Priority Habitat but are not included in this list because they are addressed by this rating system.

Count how many of the following Priority Habitats are within 330 ft (100 m) of the wetland unit:

— **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. This habitat automatically counts if mapped on the PHS online map within 100m of the wetland. If not mapped, a determination can be made in the field.

— **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.

— **Fresh Deepwater:** Lands permanently flooded with freshwater, including environments where surface water is permanent and often deep, so that water, rather than air, is the principal medium within which the dominant organisms live. Substrate does not support emergent vegetation. Do not select if Instream habitat is also present, or if the entire Deepwater feature is included in the wetland unit being rated (such as a pond with a vegetated fringe).

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

— **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. Do not select if Fresh Deepwater habitat is also present.

— **Nearshore:** Relatively undisturbed nearshore habitats. These include Coastal Nearshore, Open Coast Nearshore, and Puget Sound Nearshore.

— **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) diameter at breast height (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.

[133] http://wdfw.wa.gov/publications/00165/wdfw00165.pdf

Wetland name or number Offsite Wetland 1

— **Oregon White Oak:** Woodland stands of pure oak or oak/conifer associations where canopy coverage of the oak component is important. For single oaks or oak stands <0.4 ha in urban areas, WDFW's Management Recommendations for Oregon White Oak[134] provides more detail for determining if they are Priority Habitats

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

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.

— **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.

— **Westside Prairies:** Herbaceous, non-forested plant communities that can either take the form of a dry prairie or a wet prairie.

[134] https://wdfw.wa.gov/publications/00030/wdfw00030.pdf

Wetland name or number Offsite Wetland 1

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

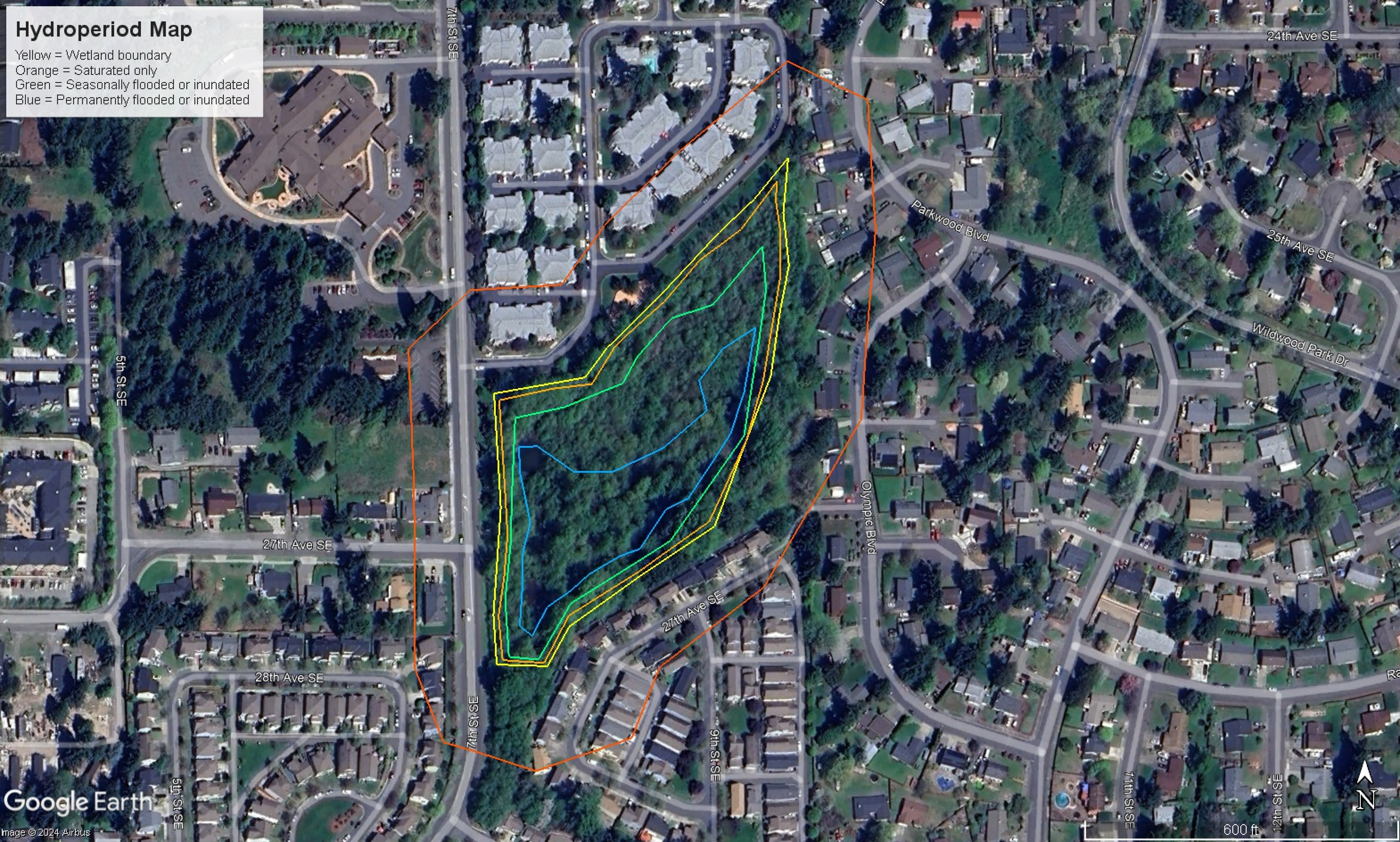
Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	**Category**
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity 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**	**Cat. I**
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 chapter 4.8 in the manual. — 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**	**Cat. I** **Cat. II**
SC 2.0. Wetlands of High Conservation Value (WHCV) SC 2.1. Does the wetland overlap with any known or historical rare plant or rare & high-quality ecosystem polygons on the WNHP Data Explorer?[135] Yes = **Category I** No – Go to **SC 2.2** SC 2.2. Does the wetland have a rare plant species, rare ecosystem (e.g., plant community), or high-quality common ecosystem that may qualify the site as a WHCV? Contact WNHP for resources to help determine the presence of these elements. Yes – Submit data to WA Natural Heritage Program for determination,[136] Go to **SC 2.3** No = **Not a WHCV** SC 2.3. Did WNHP review the site within 30 days and determine that it has a rare plant or ecosystem that meets their criteria? Yes = **Category I** No = **Not a WHCV**	**Cat. I**
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 = **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 = **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 = **Category I bog** No = **Not a bog**	**Cat. I**

[135] https://www.dnr.wa.gov/NHPdata
[136] https://www.dnr.wa.gov/Publications/amp_nh_sighting_form.pdf

Wetland name or number Offsite Wetland 1

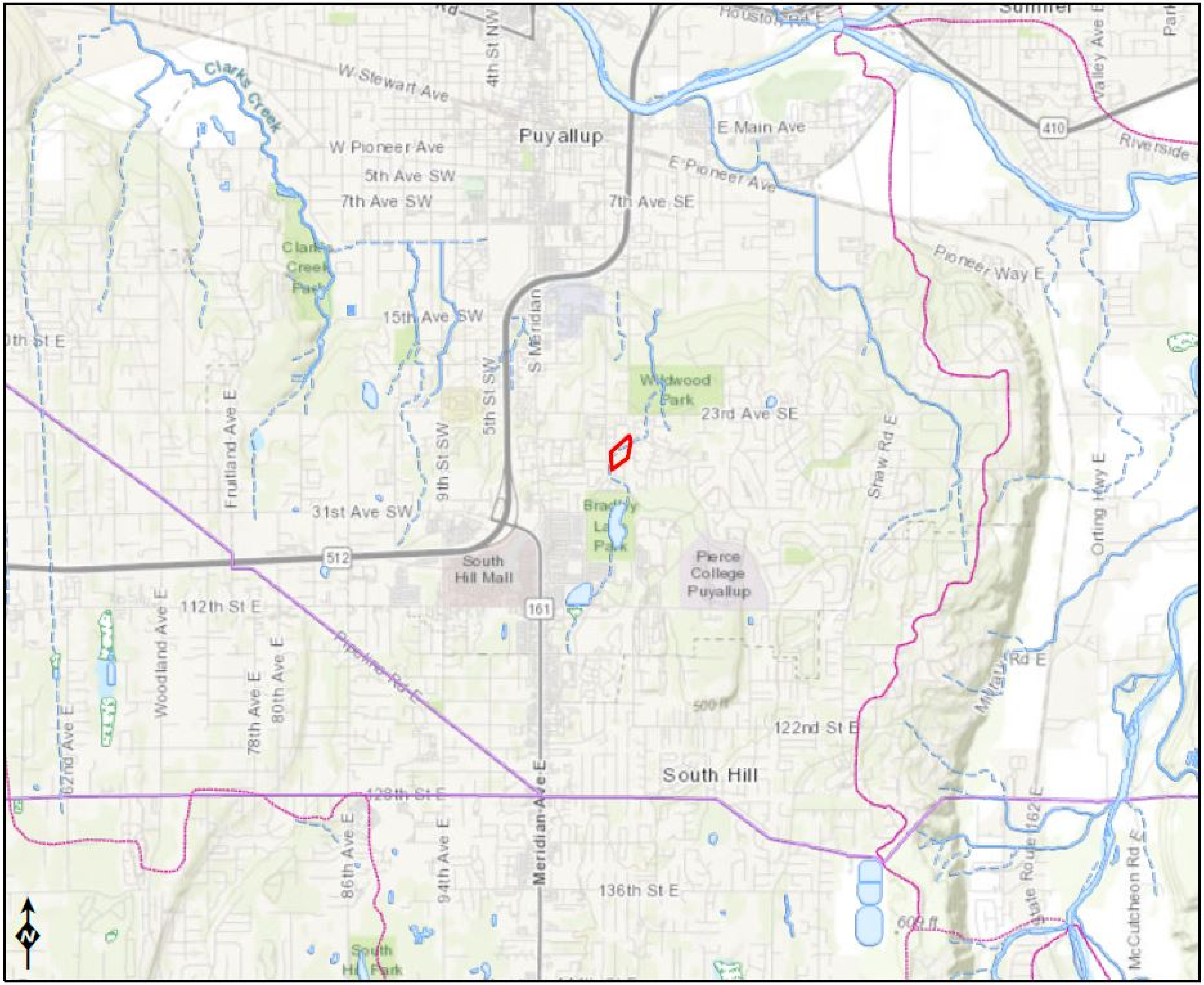
SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as Priority Habitats? ***If you answer YES, you will still need to rate the wetland based on its functions.*** — **Old-growth forests** (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**	**Cat. I**
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)* — The lagoon retains some of its surface water at low tide during spring tides 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 in H 1.5 in the manual). — 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**	**Cat. I** **Cat. 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 and Ocean Shores Blvd SW, including lands west of E. Oceans Shores Blvd SW. 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**	**Cat I** **Cat. II** **Cat. III** **Cat. IV**
Category of wetland based on Special Characteristics If you answered No for all types, enter "Not Applicable" on Summary Form	


Cowardin Map
Yellow = Wetland boundary
Light Brown = Forested (3 strata)
Green = Shrub/scrub
Blue = Aquatic Bed
Parkwood Blvd
25th Ave SE
Wildwood Park Dr
5th St SE
27th Ave SE
Olympic Blvd
27th Ave SE
28th Ave SE
7th St SE
9th St SE
6th St SE
11th St SE
12th St SE
29th Ave
600 ft
N
Google Earth
Image © 2024 Airbus


Hydroperiod Map
Yellow = Wetland boundary
Orange = Saturated only
Green = Seasonally flooded or inundated
Blue = Permanently flooded or inundated
7th St SE
24th Ave SE
Parkwood Blvd
25th Ave SE
Wildwood Park Dr
5th St SE
27th Ave SE
Olympic Blvd
27th Ave SE
28th Ave SE
7th St SE
9th St SE
5th St SE
11th St SE
12th St SE
600 ft
N
Google Earth
Image © 2024 Airbus

February 20, 2024

Contributing Basin Map



National Hydrography Dataset

NHD Watercourses
Stream/river (perennial)
Stream (intermittent)

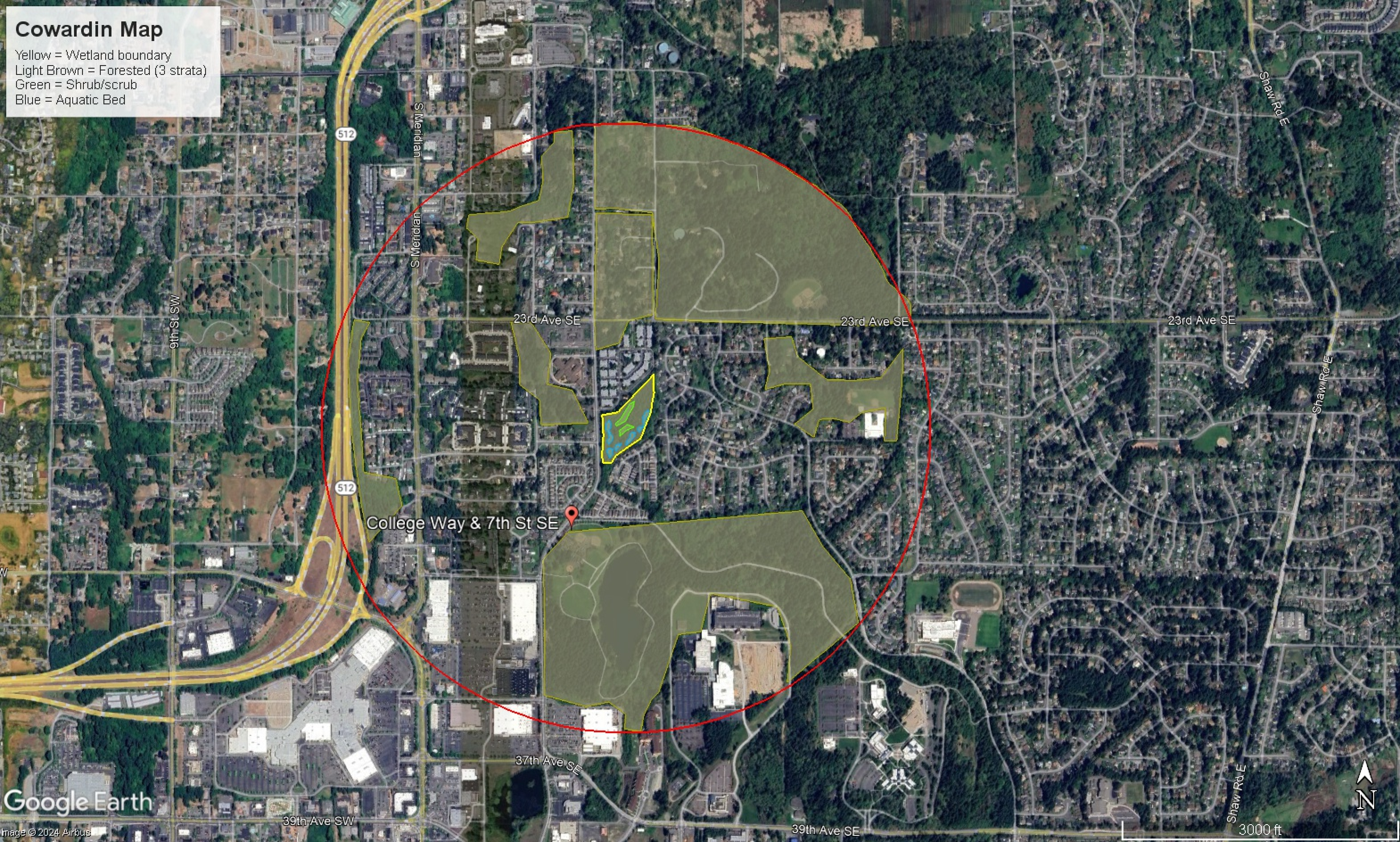
NHD Waterbodies
Lake/pond/reservoir
Swamp/marsh
Canal/ditch
Ice mass

NHD Areas
Large river
Rapids
Foreshore
Canal/ditch

Subbasins (12 digit HUCs)
HUC boundary

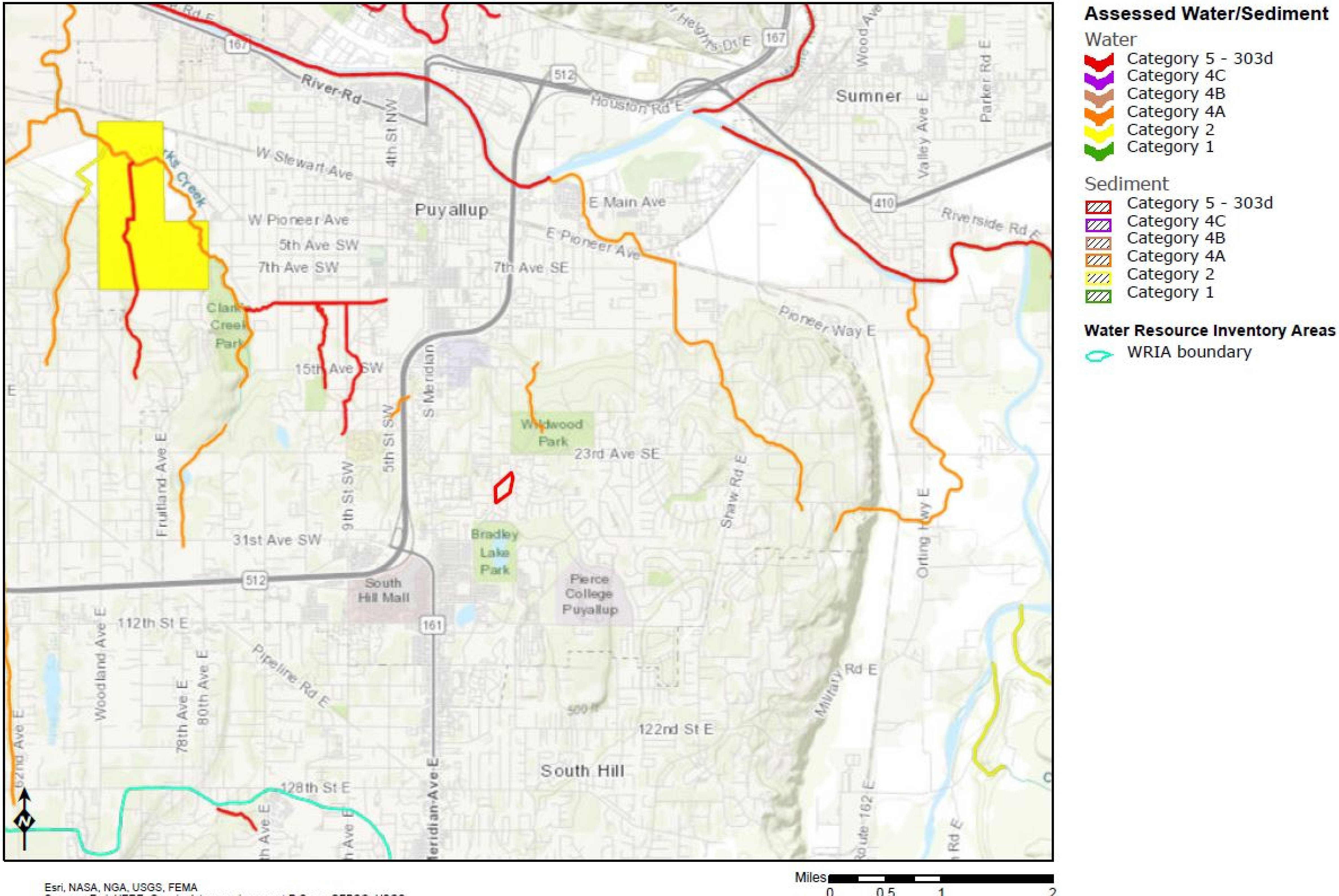
Miles
0 0.5 1 2

Esri, NASA, NGA, USGS, FEMA
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri


Cowardin Map
Yellow = Wetland boundary
Light Brown = Forested (3 strata)
Green = Shrub/scrub
Blue = Aquatic Bed
S Meridian
512
9th St SW
23rd Ave SE
23rd Ave SE
23rd Ave SE
Shaw Rd E
College Way & 7th St SE
37th Ave SE
39th Ave SW
39th Ave SE
3000 ft
N
Google Earth
Image © 2024 Airbus

February 20, 2024

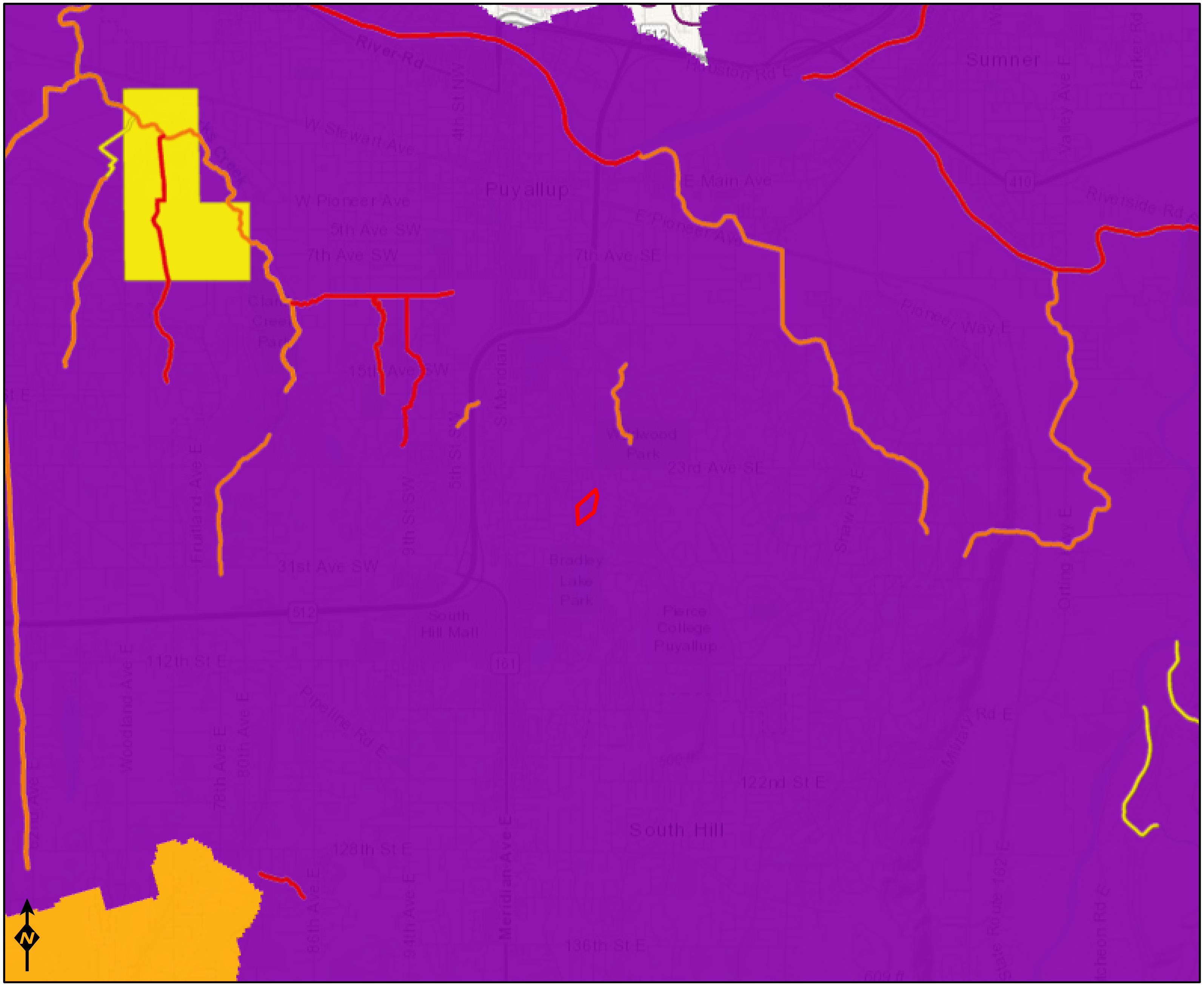
303d Map



Esri, NASA, NGA, USGS, FEMA
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri

February 20, 2024

TMDL Map



Assessed Water/Sediment

Water
- Category 5 - 303d
- Category 4C
- Category 4B
- Category 4A
- Category 2
- Category 1

Sediment
- Category 5 - 303d
- Category 4C
- Category 4B
- Category 4A
- Category 2
- Category 1

WQ Improvement Projects
- Approved
- In Development

Water Quality Standards
- All Standards

Water Resource Inventory Areas
- WRIA boundary

Subbasins (8 digit HUCs)
- HUC boundary

Miles 0 0.5 1 2

Esri, NASA, NGA, USGS, FEMA
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri

Appendix D

Operation and Maintenance Manual

Private Stormwater Facilities Operation & Maintenance Manual

PREPARED FOR:

McGranahan Architects
Contact: Mr. Andy Hartung
2111 Pacific Avenue, Suite 100
Tacoma, WA 98402

PROJECT:

Pierce College Puyallup
Campus Parking Expansion – Lot A
Puyallup, WA
2200718.13

PREPARED BY:

Claire Hovde, PE
Project Engineer

REVIEWED BY:

William J. Fierst, PE
Principal

DATE

September 2023
Revised January 2024

01/17/2024

I hereby state that this Private Stormwater Facilities Operation & Maintenance Manual for the Pierce College - Puyallup Campus Parking Expansion project has been prepared by me or under my supervision and meets the standard of care and expertise that is usual and customary in this community for professional engineers. I understand that City of Puyallup does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

Private Stormwater Facilities Operation & Maintenance Manual

PREPARED FOR:

McGranahan Architects
Contact: Mr. Andy Hartung
2111 Pacific Avenue, Suite 100
Tacoma, WA 98402

PROJECT:

Pierce College Puyallup
Campus Parking Expansion – Lot A
Puyallup, WA
2200718.13

PREPARED BY:

Claire Hovde, PE
Project Engineer

REVIEWED BY:

William J. Fierst, PE
Principal

DATE

September 2023
Revised January 2024

Table of Contents

Appendices

Maintenance Checklists

Annual Inspection Report

1.0 Introduction

The Pierce College Puyallup Campus maintenance staff shall be responsible for maintaining properly functioning stormwater control facilities. This report presents a maintenance program that meets City of Puyallup maintenance requirements. The private stormwater facilities for this project include a system of catch basins and pipes to collect surface runoff and route it through a bioretention facility for stormwater treatment prior to routing to a detention pond.

It is vitally important that the proponent/owner maintain these facilities in a timely and conscientious manner to ensure the facilities function as designed. Siltation, debris, or lack of maintenance can reduce the capabilities of the conveyance system which can lead to localized flooding. If bioretention facilities are not maintained in accordance with the attached maintenance checklist, onsite stormwater can contribute to negative water quality to downstream waterbodies of the state.

2.0 Responsibility

The private stormwater facilities will be owned and maintained by Pierce College Puyallup Campus maintenance personnel.

Property Owner:

Pierce College Puyallup
1601 39th Avenue SE
Puyallup, WA 98374
(253) 840-8400

3.0 Schedule

Maintenance of the stormwater facilities shall follow the schedule as specified in the attached maintenance checklists. Additional maintenance may be required to respond to unusual storm events or reduced performance of the treatment system. A copy of the City of Puyallup-recommended maintenance schedule is attached and may be photocopied and used as inspection records. An annual inspection report must be submitted to the City of Puyallup in accordance with the Maintenance Agreement.

4.0 Cost

The following is an estimate of the average annual cost of maintenance for the stormwater control facilities within the scope of this project.

Vactor truck @ $200/hour x 12 hours	$2,400
Personnel @ $25/hour x 12 hours	$300
Dumping Fees @ $50/ton x 12 tons	$600
Sweep Parking Lot Once Yearly	$1,500
Total Estimated Annual Cost	**$4,800**

5.0 Vegetation Management Plan

The attached maintenance schedule provides guidance on vegetation control and management. Irrigation and other maintenance as necessary shall be provided to ensure that vegetation remains viable and that a hardy root structure forms in the first year. Vegetation planting shall be provided, as described in the construction documents.

6.0 Instructions for Person Maintaining Stormwater System

The attached Maintenance Checklists specify maintenance schedules for stormwater facilities onsite. Plan to complete a checklist for all system components per the following schedule:

1. Monthly from November through April.
2. Once in late summer (preferably September).
3. After major storm events.

Using photocopies of the attached pages, check off the problems that are noted each time the item is inspected. Document comments on problems found and the corrective action taken. The Inspection Checklist sheets should be kept on file for the City to inspect at all reasonable times and used to prepare the annual report required by City of Puyallup, due no later than January 30 for the preceding year's report.

7.0 Conclusion

This Operation and Maintenance Manual is developed for the operation of the Pierce College Puyallup Campus Parking Expansion – Lot A private stormwater systems. This Maintenance document has been prepared within the guidelines of City of Puyallup Construction Standards. If this plan is implemented, the owner can expect the stormwater system to function as designed.

AHBL, Inc.

Claire Hovde, PE
Project Engineer

CFH/jms/lsk

September 2023
Revised January 2024

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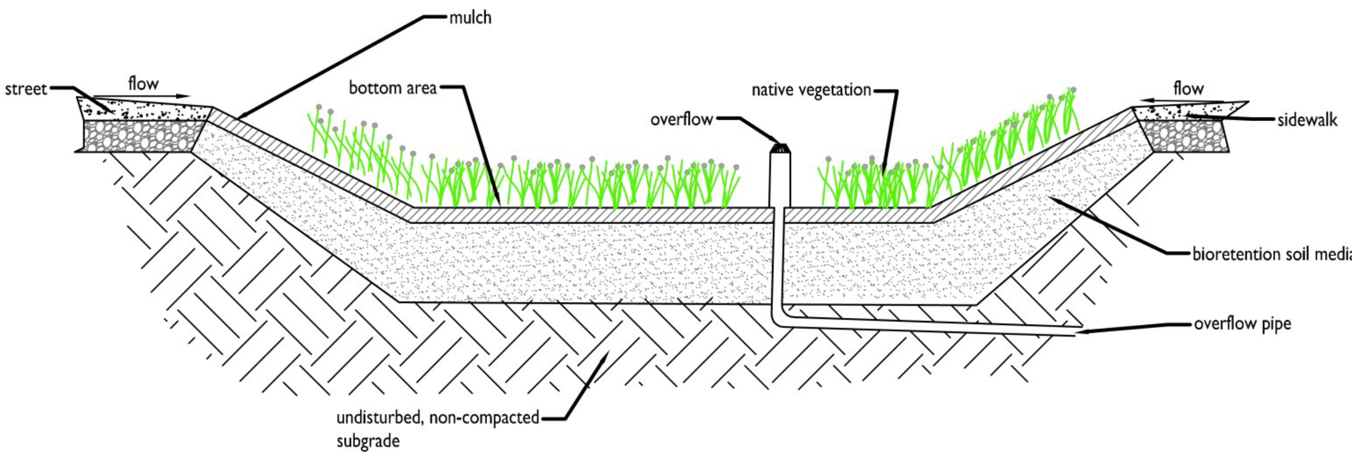
Maintenance Checklists

Bioretention System

Bioretention facilities are engineered facilities that store and treat stormwater by filtering it through a specified soil profile. Water that enters the facility ponds in an earthen depression or other basin (e.g., concrete planter) before it infiltrates into the underlying bioretention soil. Stormwater that exceeds the surface storage capacity overflows to an adjacent drainage system. Treated water is either infiltrated into the underlying native soil or collected by an underdrain and discharged. An underdrain system can be comprised of perforated or slotted pipe, wrapped in an aggregate blanket.

Facility objects that are often associated with a bioretention unit include:

- Inlet
- Overflow
- Underdrains (optional)
- Signage
- Catch Basin
- Drywell



Key Operations and Maintenance Considerations

- Protect the facility from external loads (e.g. trucks, riding mowers, other heavy equipment) to preserve the proper function of bioretention soils. Because the risk of compaction is higher when soils are saturated, any type of loading in the bioretention facility (including foot traffic) should be avoided during wet conditions. All maintenance activities must be performed in a manner to prevent compaction of the bioretention soil.
- Erosion control measures must be maintained in areas of concentrated flows (e.g., pipes inlets or narrow curb cuts). Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly

designed facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems occur, the following should be reassessed:

- (1) flow volumes from contributing areas and bioretention cell sizing; (2) flow velocities and gradients within the cell; and (3) flow dissipation and erosion protection strategies in the pretreatment area and flow entrance. If sediment is deposited in the bioretention area, immediately determine the source within the contributing area, stabilize, and remove excess surface deposits.
- Establish and follow a maintenance schedule for visual inspection and remove sediment if the volume of the ponding area has been compromised.
- Corrective maintenance for excessive drawdown times may include clearing underdrain obstructions or tilling the bioretention soil media. Partial or complete replacement of bioretention soil media may be necessary.
- Regular maintenance of vegetation includes weeding and pruning. Plants require irrigation during the first 2 to 3 years of establishment and during extended dry periods. Replace all dead plants and, if specific plants have a high mortality rate, assess the cause and replace with appropriate species.
- The soil mix and plants are selected for optimum fertility, plant establishment, and growth. Nutrient and pesticide inputs should not be required and may degrade the pollutant processing capability of the bioretention area, as well as contribute pollutant loads to receiving waters. If in question, have soil analyzed for fertility.
- Replace mulch annually in bioretention facilities where heavy metal deposition is high (e.g., contributing areas that include gas stations, ports and roads with high traffic loads). In residential settings or other areas where metals or other pollutant loads are not anticipated to be high, replace or add mulch as needed (likely 3 to 5 years) to maintain a 2 to 3-inch depth.
- Soil mixes for bioretention facilities are designed to maintain long-term fertility and pollutant processing capability. Estimates from metal attenuation research suggest that metal accumulation should not present an environmental concern for at least 20 years in bioretention systems, but this will vary according to pollutant load. Replacing mulch media in bioretention facilities where heavy metal deposition is likely provides an additional level of protection for prolonged performance. If in question, have soil analyzed for fertility and pollutant levels.
- Presence of pests such as geese or rodents can generally be corrected by ensuring that drawdown time matches facility design function and plants are spaced at proper densities.
- If an underdrain is present, remove trash, debris, and sediment from the inlet orifice biannually.

- Irrigate or hand-water vegetation as needed to help plants establish in the first few years after installation and as needed after plants are established. The following schedule is recommended:
    - Provide watering weekly for two summers. On average, plants require 1-inch of water weekly to establish. Additional water may be necessary during excessive heat.
    - Provide summer watering every two to four weeks during the summer or as needed during prolonged dry periods.
    - Provided summer watering as needed after plants are established.

Refer to City of Puyallup Engineering and Construction Standards Section 600 for grass specifications and planting requirements.

Bioretention System			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
General	Pests	Signs of pest infestations (IPM protocol threshold(s) are exceeded), including rodent holes or mounds that disturb dispersion flow paths.	Pests are not present or engaged in activities that present a significant public health risk or compromise to the intended design function of the facility. Pests that have exceeded acceptable thresholds have been addressed using appropriate IPM measures. Standing water that may allow mosquito breeding has been removed and cause of standing water has been addressed (see "Ponded Water"). Pest-damaged vegetation has been removed.
Facility Area	Trash and Debris	Trash and debris present in facility area.	Facility area is free of trash and debris.
	Pet Waste	Large volumes of feces from domestic pets are present.	Pet waste removed. Pet waste station or additional signage installed, if appropriate.
	Mulch	Mulch depth is less than 2 inches or the facility has bare spots without mulch cover.	Mulch has been restored to a depth of 2 to 3 inches and is appropriate to the location within the facility (e.g. compost mulch in the bottom and wood chips on side slopes).
Facility Bottom Area	Sediment	Sediment accumulated to extent that infiltration rate is reduced, water can be seen to be ponding, or surface storage capacity is significantly impacted.	Source of sediment has been identified and controlled. Excess sediment has been removed, and damaged vegetation and mulch has been replaced.
	Leaves	After fall leaf drop, leaves have accumulated in the facility in a manner to pose a risk of impeding water flow or clogging the outlet.	Leaves have been removed.
	Ponded Water	Water overflows during storms smaller than the design event, or ponded water remains in the basin more than 48 hours after the end of a storm.	Cause of excessive ponding has been identified by investigating: 1) potential that debris build-up is impeding infiltration; 2) condition of underdrain (if present); 3) potential that other water inputs are present (e.g. groundwater, illicit connections); 4) facility size is appropriate to contributing area; and 5) condition of bioretention soil media.

Bioretention System			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
			Cause of excessive ponding has been corrected. Engineer has been consulted where necessary.
Earthen Side Slopes and Berms	Erosion at Inlets/ Outlets	Erosion (gullies/ rills) greater than 2 inches deep around inlets, outlet, and alongside slopes.	For channels or cuts over 3 inches deep, temporary erosion control measures have been put into place until permanent repairs are made. Source of erosion has been addressed/ eliminated and eroded areas repaired per design specifications, with additional stabilizing material (cobbles, vegetation, etc.) added as necessary.
	Erosion of Side Slopes	Erosion of sides causes slope to become a hazard.	Source of erosion has been addressed and side slopes repaired to design specifications. Slopes have stabilizing material where necessary.
	Settlement	Settlement greater than 3 inches (relative to undisturbed sections of berm).	Slopes and berm have been restored to design elevations/ heights.
	Berm Leaking	Downstream face of berm wet; seeps or leaks evident.	Any seeps or leaks have been plugged and berm material and compaction are per design specifications. Engineer has been consulted where necessary.
	Rodents in Berm	Any evidence of rodent holes or water piping in berm.	Rodents have been eradicated (see "Pests in Facility"). Holes have been filled and berm compacted (see "Berm Leaking").
Amended Soil	Soil Nutrients	Soil not providing plant nutrients.	Soil providing plant nutrients.
	Bare Spots	Bare spots on soil in bioretention area.	No bare spots. Bioretention area covered with vegetation or mulch mixed into the underlying soil.
	Compaction	Poor infiltration due to soil compaction in the bioretention area.	No soil compaction in the bioretention area.
Low Permeability Check Dams and Weirs	Sediment or Other Debris Blocking	Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice.	No blockage present of check dam, flow control weir, or orifice. Any likely immediate sources of additional debris or sediment (e.g. additional dead plant material, erosion issue, etc. upstream) addressed or removed.
	Erosion or Undercutting	Erosion and/or undercutting present.	Eroded and/or undercut areas have been repaired and sources of issue addressed to prevent further erosion/undercutting at weir.
	Grade Board Not Level	Grade board or top of weir damaged or not level.	Grade board is undamaged (repaired or replaced) and level.

Bioretention System			
Drainage System Feature	**Potential Defect**	**Conditions When Maintenance Is Needed**	**Minimum Performance Standard**
			Note: table spans multiple pages.
Inlet	Erosion at Inlet	Concentrated flows are causing erosion at inlet.	A cover of rock or cobbles or other erosion protection measure (e.g., matting) is in place to protect the ground where concentrated water enters the facility (e.g., a pipe, curb cut or swale).
Splash Block Inlet	Water Misdirected from Inlet	Water is not being directed properly to the facility and away from the inlet structure.	Splash block(s) reconfigured/ repaired to direct water to facility and away from structure.
Curb Inlet/Outlet	Leaf Accumulation at Curb Cut	Accumulated leaves or other debris at curb cuts (inlets and outlets) can block water flow and proper function of the facility. Maintenance is particularly important in the fall.	Curb cuts and adjacent gutters are free of leaves and debris, and water can flow freely into (and out of) the facility.
Pipe Inlet/Outlet	Pipe is Damaged	Pipe is damaged.	Pipe repaired or replaced to design specifications.
	Pipe is Clogged	Pipe is clogged, completely or partially. Problem material may include leaves, debris, trash, roots, sediment, or other material.	Pipe is unclogged and free of any obstructions. Pipe functioning at design capacity.
	Access is Blocked	Vegetation is blocking access for inspection.	Area within 1 foot of inlets/outlets is clear of vegetation, and access pathways are clear and maintained where necessary.
Trash Rack	Trash and Debris	Trash or other debris is present on trash rack. Capacity may be reduced by buildup of trash or debris.	Trash rack is free of trash, leaves, debris, or other foreign material.
	Bar Screen Damage	Bar screen on trash rack is damaged or missing.	Bar screen has been repaired/ replaced to design specifications.
Overflow	Overflow Blocked	Overflow capacity is reduced by sediment or debris.	Overflow area is free of sediment and debris and capacity functions per design standards.
Underdrain Pipe	Reduced Capacity	Plant roots, sediment, or debris may reduce the capacity of the underdrain. Symptoms may include ponded water in facility bottom area.	Underdrain pipe is free or plant roots, sediment, and debris. Infiltration and pipe capacity functioning per design function.
Vegetation (continues on next page)	Plant Health	Plants not thriving across at least 80% of the entire design vegetated area within the BMP; overly dense vegetation requiring pruning.	Healthy water tolerant plants in bioretention area, plants thriving across at least 80% of the entire design vegetated area within the facility.

Bioretention System			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
	Diseased Plant Material	Diseased plants or plant material is present in the facility.	Diseased plants and plant parts have been removed and disposed of in an approved location (off-site). Potential sources of and conditions exacerbating disease have been addressed (see Pacific Northwest Plant Disease Management Handbook). Vegetated areas replanted as necessary to maintain vegetative coverage per design.
	Vegetation Needs Pruning	Trees and shrubs need regular maintenance and/or corrective pruning.	Trees and shrubs pruned per routine maintenance schedule, appropriate to individual species and age of plants. All pruning of mature trees done under direct supervision of ISA certified arborist.
	Large Trees and Shrubs Interfering	Large trees and shrubs interfere with operation of the facility or access for maintenance.	Trees and shrubs have been pruned using most current ANSI A300 standards and ISA BMPs. Trees and shrubs removed if necessary for operation of facility per design function.
	Dead Vegetation	Standing dead vegetation is present (particularly in fall and spring).	Standing dead vegetation has been removed from site; gaps in vegetation have been replaced with new plantings where necessary, or appropriate erosion control measures put in place until vegetation replacement is feasible.
	Maintenance Needed Around Mature Trees	If conditions warrant maintenance work or planting of new vegetation around mature trees (within the dripline), appropriate care must be taken to avoid adverse impacts to the mature tree(s).	The most current ANSI A300 standards and ISA BMPs have been followed to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil) when working around and under mature trees. New plantings under mature trees include mainly plants that come as bulbs, bare root or in 4-inch pots; new plants in no larger than 1-gallon containers.
	Stakes or Guys Present	Stakes or guys present in plantings installed for over 1 year.	Stakes or guys have been removed from new vegetation after 1 year since installation. Holes have been backfilled where necessary.
	Vehicular Sight Lines Impaired by Vegetation	Vegetation causes some visibility (line of sight) or driver safety issues.	Vegetation has been pruned to appropriate height and spread to maintain sight clearances. If continued (regular) pruning of a given plant have been necessary, plant(s) have been relocated to a more appropriate location and replaced with plant(s) of appropriate mature size.
	Emergent Vegetation Compromises Conveyance	Emergent vegetation compromises conveyance (may become too dense).	Emergent vegetation has been thinned and does not impede conveyance.

Bioretention System			
Drainage System Feature	Potential Defect	Conditions When Maintenance Is Needed	Minimum Performance Standard
			Note: table spans multiple pages.
	Noxious Weeds Present	Noxious weeds are present among the site vegetation. Remove, bag, and dispose of Class A & B noxious weeds immediately per WA law. Make reasonable attempts to remove and dispose of Class C noxious weeds. See http://www.nwcb.wa.gov/. Follow Integrated Pest Management (IPM) protocols.	Noxious weeds are not present on site above thresholds established by WA law.

Catch Basin

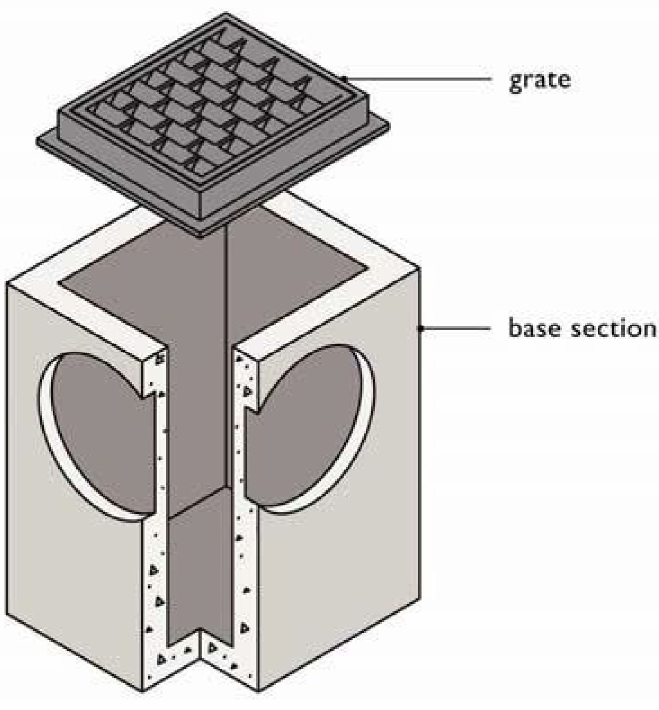
A catch basin is an underground concrete structure typically fitted with a slotted grate to collect stormwater runoff and route it through underground pipes. Catch basins can also be used as a junction in a pipe system and may have a solid lid. There are two types.

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.



Type 1

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.

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.

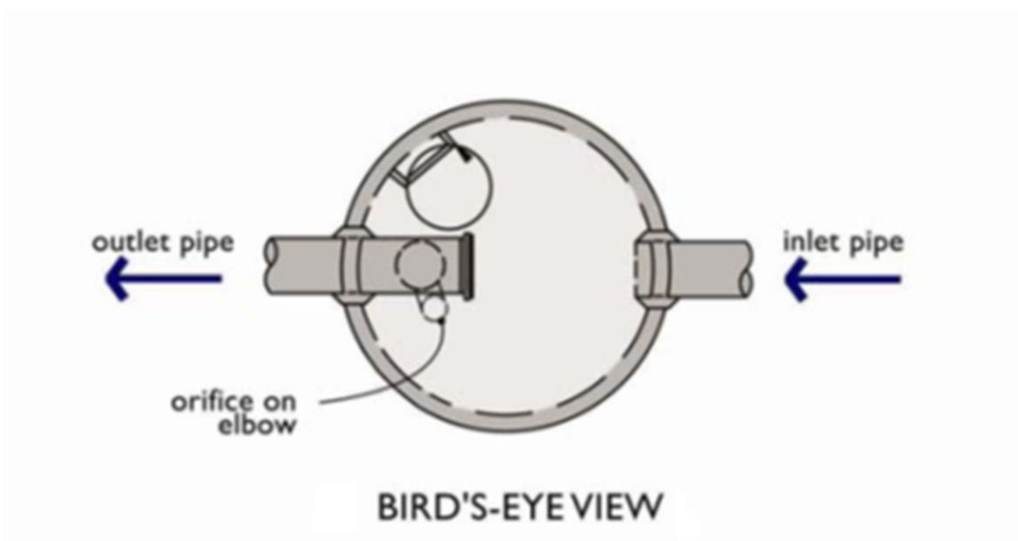
Control Structure/Flow Restrictor

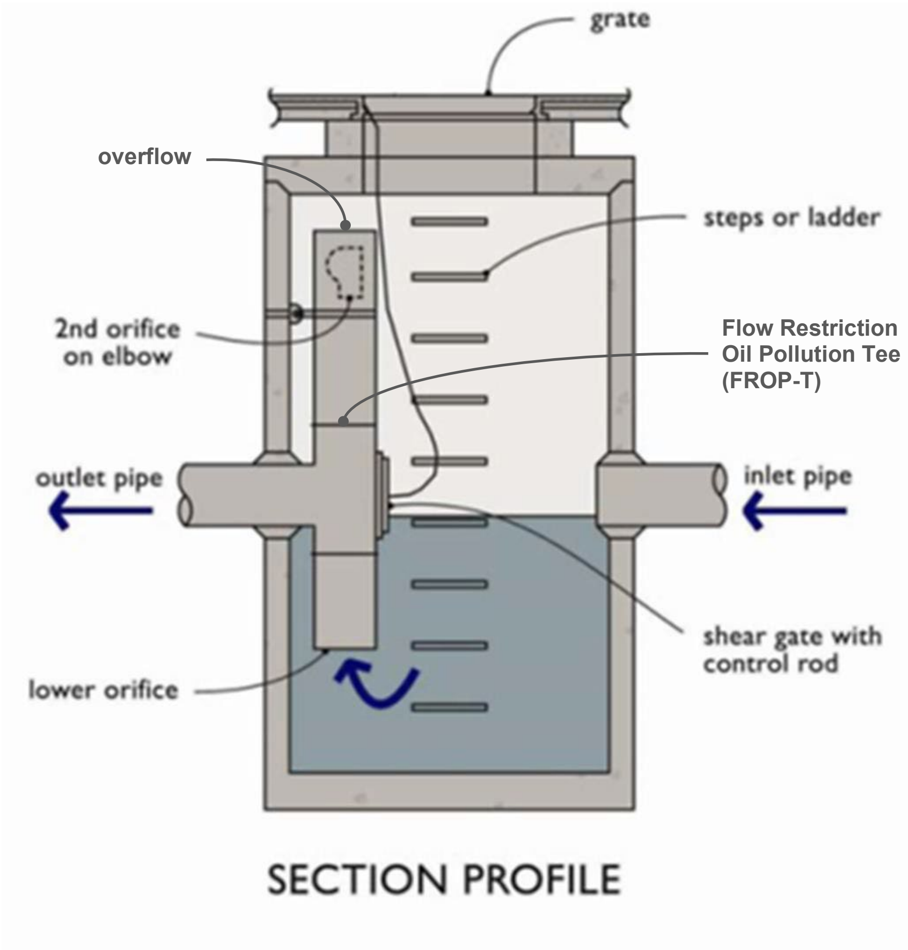
Flow control structures and flow restrictors direct or restrict flow in or out of facility components. Outflow controls on detention facilities are a common example where flow control structures slowly release stormwater at a specific rate. The flow is regulated by a combination of orifices (holes with 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

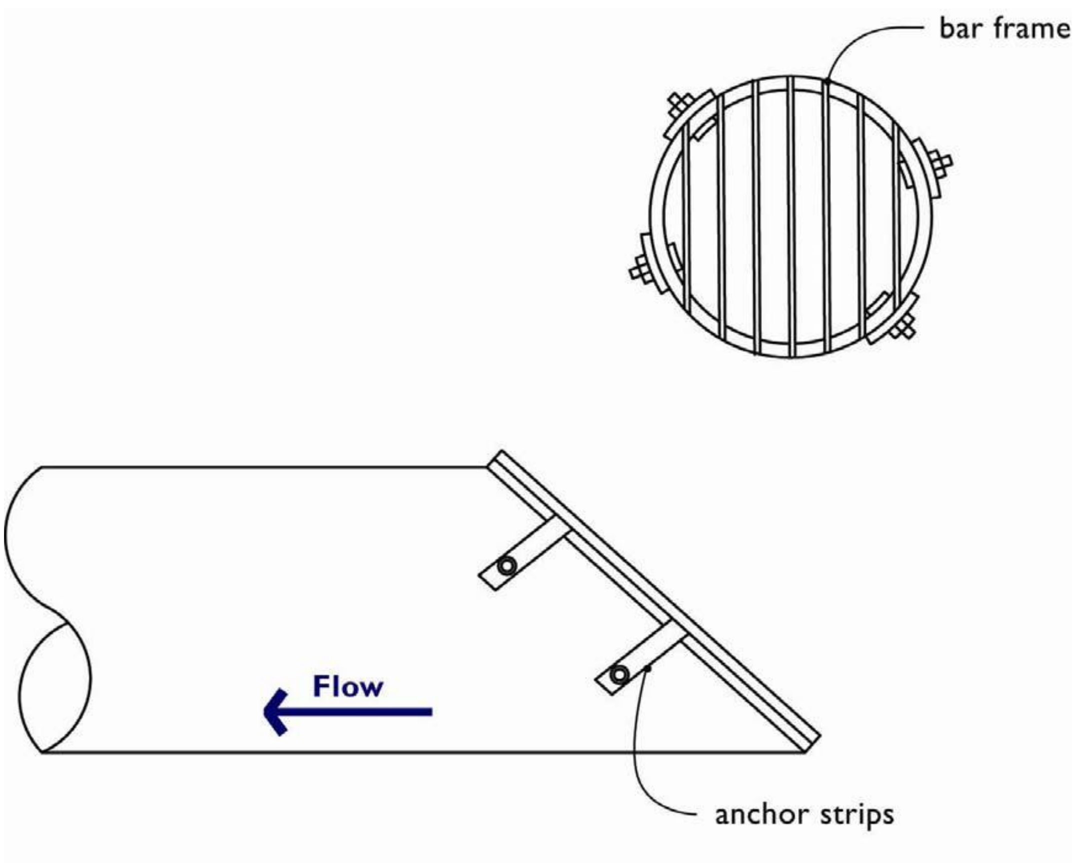
- The most common tool for cleaning stormwater conveyance pipes is a truck with a tank, vacuum hose, and a jet hose (Vactor® truck) to flush sediment and debris from the pipes.

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.

Debris Barrier & Access Barrier (e.g. Trash Rack)

A debris barrier is a bar grate over the open end of a culvert or stormwater conveyance pipe. The intent of a debris barrier is to prevent large materials from entering a closed pipe system. Debris barriers are typically located on the outlet pipe from a detention pond to the control structure. If a debris barrier is not located on an outlet pipe of 18-inch diameter or greater, one should be installed to prevent plugging of the control structure and possible flooding.

An access barrier is installed on a pipe end that is large enough to allow entry. Their function is to prevent debris and unauthorized access into the storm conveyance pipe. Only qualified personnel should attempt to maintain or remove debris from the barrier when water is flowing through the conveyance pipe.



Key Operations and Maintenance Considerations

- The most common tool for cleaning debris and access barriers are hand tools such as a rake to remove collected debris.

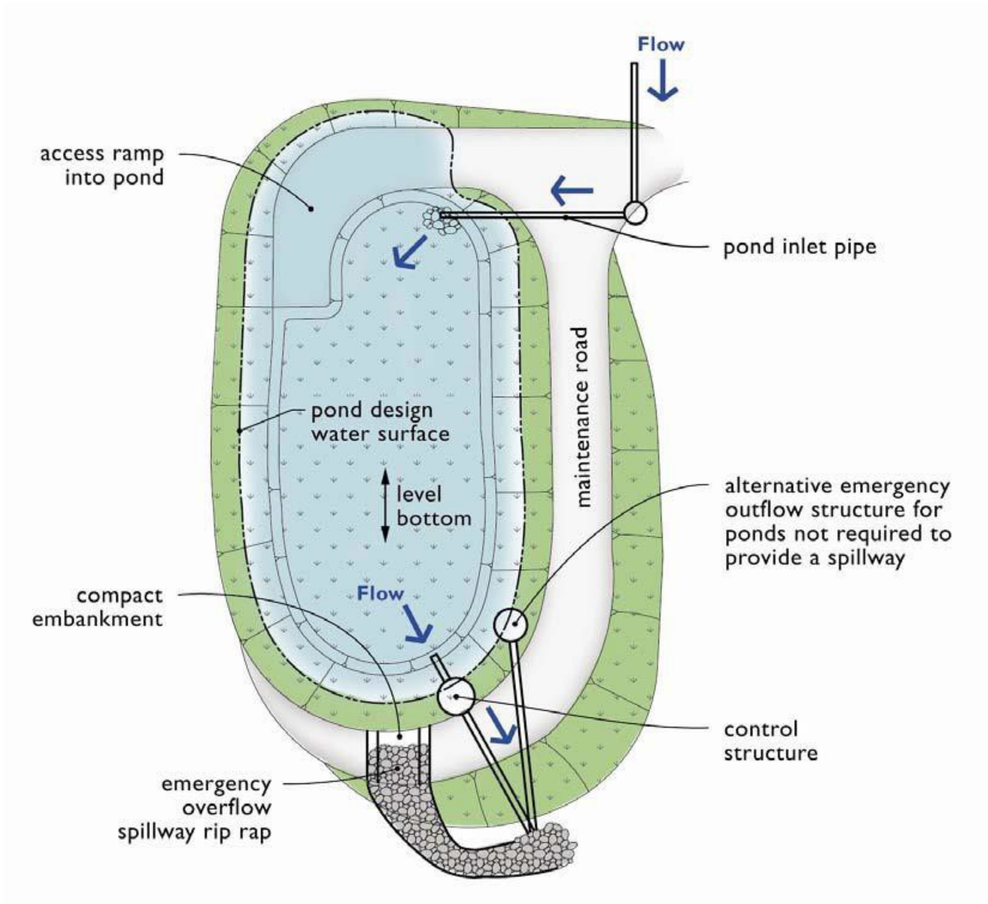
Debris Barrier			
Drainage System Feature	**Potential Defect**	**Conditions When Maintenance Is Needed**	**Minimum Performance Standard**
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
	Damaged/ Missing Bars	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design specifications.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design specifications.
	Missing or Damaged Debris Barrier	Debris barrier missing or not attached to inlet/ outlet pipe.	Barrier is in place and firmly attached to pipe.

Detention Pond

A stormwater detention pond is an open basin built by excavating below existing ground or by constructing above-ground berms (embankments). The detention pond temporarily stores stormwater runoff during rain events and slowly releases it through an outlet (control structure). Detention ponds are typically designed to completely drain within 24 hours after the completion of a storm event.

Facility objects that are typically associated with a detention pond include:

- access road or easement
- fence, gate, and water quality sign
- typical bioswale
- wet bioswale
- media filter cartridge
- control structure/flow restrictor
- energy dissipaters
- conveyance stormwater pipe



Example of a Manicured Detention Pond

Key Operations and Maintenance Considerations

- Maintenance is of primary importance if detention ponds are to continue to function well.
- Sediment should be removed when the standards in the defect table are exceeded. Sediments must be disposed in accordance with current local health department requirements and the Minimum Functional Standards for Solid Waste Handling.
- Handle sediments removed during the maintenance operation in a manner consistent with the City's recommended street waste procedures.
- Maintenance of sediment forebays and attention to sediment accumulation within the pond is extremely important. Continually monitor sediment deposition in the basin. Owners, operators, and maintenance authorities should be aware that significant concentrations of metals (e.g., lead, zinc, and cadmium) as well as some organics such as pesticides, may be expected to accumulate at the bottom of these types of facilities. Regularly conduct testing sediment, especially near points of inflow, to determine the leaching potential and level of accumulation of potentially hazardous material before disposal.
- Slope areas that have become bare should be revegetated and eroded areas should be regraded prior to being revegetated.
- A common tool for cleaning detention ponds is a small bulldozer or excavator to remove built-up sediment and debris from the bottom of the pond during the dry season.

Refer to City of Puyallup Engineering and Construction Standards Section 600 for grass specifications and planting requirements.

Detention Pond			
Drainage System Feature	**Potential Defect**	**Conditions When Maintenance Is Needed**	**Minimum Performance Standard**
			Note: table spans multiple pages.
General	Trash and Debris	Any trash and debris which exceed 1 cubic foot per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Site is free of trash and debris.
	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.
	Vegetation Growth and Hazard Trees	Vegetation 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. Dead, diseased, or dying trees are identified. (Use a certified Arborist to determine health of tree or removal requirements.)	Vegetation does not hinder maintenance activities. Harvested vegetation should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard trees.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants. (Coordinate removal/cleanup with local water quality response agency.)	No contaminants or pollutants present.
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired.
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies.)
	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.

Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes have been stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed civil engineer should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% (typically 6” to 12”) of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (If Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Pond Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation. If settlement is apparent, measure berm to determine amount of settlement. Settling can be an indication of more severe problems with the berm or outlet works. A licensed civil engineer should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernible water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
	Tree Growth	Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	Trees removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes have been stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed civil engineer should be consulted to resolve source of erosion.

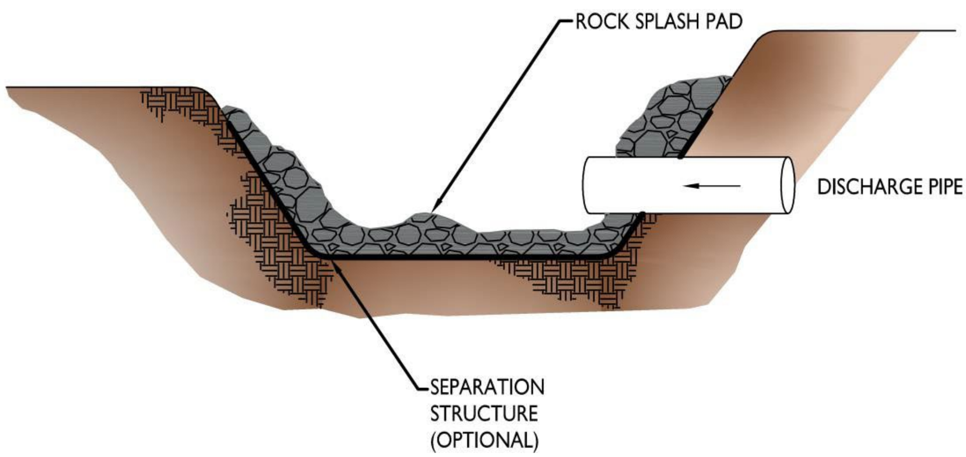
Emergency Overflow/ Spillway	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.	Trees removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed civil engineer should be consulted for proper berm/spillway restoration.
	Rock Missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of flow path of spillway.	Rocks and pad depth are restored to design standards.

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.

Facility Discharge Points (Outfall)

Stormwater facility discharge points may convey stormwater from the stormwater facility into open channels, ditches, ponds, streams, and wetlands. Stormwater facility discharge points need to be assessed to make sure stormwater is not causing any negative impacts to these drainage areas.

Key Operations and Maintenance Considerations

- The most common tools are hand tools to remove debris or to redistribute outfall protection rock.

(Source: USDA - Natural Resources Conservation Service - Illinois)

Facility Discharge Point (Outfall)			
Drainage System Feature	**Potential Defect**	**Conditions When Maintenance Is Needed**	**Minimum Performance Standard**
Monitoring	Contaminants in Discharge Water	Any evidence of oil, gasoline, contaminants, or other pollutants. Sheen, obvious oil, or other contaminants present. • Identify and remove source.	Effluent discharge from facility is clear.
	Receiving Area Saturated	Water in receiving area is causing substrate to become saturated and unstable.	Receiving area is sound and not saturated.
	Ditch or Stream Banks Eroding (via Off Site Assessment)	Erosion, scouring, or headcuts in ditch or stream banks downstream of facility discharge point due to flow channelization or higher flows.	Ditch or stream banks are stable.
	Access	Vegetation is overgrown and there is no access to the outfall.	Vegetation is removed and/or path is cleared to access the outfall.
	Stains or Deposits	Stains or deposits present within the discharge area that are not natural occurring.	No stains or deposits exist and the source has been eliminated, unless the source is determined to be natural occurring.
	Stormwater Flow	Flow exists during the summer dry months when no flows should be present.	Source of the flows has been eliminated or source has been determined to be groundwater interflow.
General	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 replaced to design function.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design function.
	Obstructions, Including Roots	Roots or debris enters pipe 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.
	Pipe Rusted or Deteriorated	Any part of the pipe that is broken, crushed, or deformed more than 20% or any other failure to the piping.	Pipe repaired or 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.

Vegetation

Many stormwater facilities use vegetation as part of the functional design. Vegetation must be maintained to contribute to the function of the facility and to prevent damage to structural elements of the facility (e.g. earthen berms). Another reason to maintain vegetation is aesthetics.

Vegetation maintenance can include trimming, plant replacement, weeding, and pest control. Vegetation maintenance in native vegetation retention areas carries specific requirements.

Objectives for vegetation management in stormwater facilities:

- Maintain healthy plant communities
- Reduce or eliminate sources of pollution related to vegetation care
- Cover bare soil areas with plants
- Control Class A and Class B noxious weeds; control unlisted invasive plants where needed to achieve management objectives
- Tolerance for natural appearance and weeds that do not interfere with facility functions

Key Operations and Maintenance Considerations

- The vegetation management focus is establishing and maintaining healthy low-maintenance native plantings and sustaining the design function of vegetated filters such as biofiltration swales. This includes controlling invasive plants where appropriate, and planting cover on bare soils.
- Use plants appropriate to the facility type, as listed in the City of Puyallup's Engineering and Construction Standards Section 600.
- Consider the use of soil amendments such as compost before using fertilizer.
- Limit mulch use to covering bare soil while establishing plantings.
- When a chemical control method is chosen, carefully follow the manufacturer's label directions for use. When deciding on and using a chemical control, consider stormwater facilities and drainage systems as leading to water bodies and apply chemicals per the label directions for use over or near water.
- Allow a 5-foot buffer from mature established plantings to fence lines and access roads.
- Trees or shrubs that block access roads may be trimmed (or removed if within the access road) when access is required for maintenance by heavy equipment.
- Trees that pose a risk to stormwater structures due to root growth may be removed.

Use Only Appropriate Plants

Use plants that will thrive in the growing conditions of each facility. Growing conditions are affected by moisture, soil conditions, and light. Plants native to western Washington are preferred. Plant lists for biofiltration swales, bioretention systems, rain gardens, and other facility types are given in the City of Puyallup's Engineering and Construction Standards Section 600.

Integrated Pest Management

Landscape management decisions for controlling unwanted vegetation, diseases, and pests in stormwater facilities should follow Integrated Pest Management principles.

An IPM program might consist of the following steps:

Step 1: Correctly identify problem pests and understand their life cycle.

IPM starts with an understanding of the soil, water, natural resources, and human impacts on site. Identify and research the pest species, including basic physiology and best timing for control. Many pests are a problem during certain seasons or can only be treated in specific phases of the life cycle. Local pest identification help can be obtained from WSU Extension Master Gardeners or through online resources such as Washington State Noxious Weed Control Board and Washington Invasive Species Council.

Step 2: Establish tolerance thresholds for pests.

Every landscape has a population of some pest insects, weeds, and diseases. Once the pest has been identified and studied, determine if low levels of the pest are tolerable. Small numbers of certain pests may not be harmful. If this is the case, simply continue to monitor the pest population.

In other cases, the pest may require control. Examples include a pest population that is rapidly increasing in numbers, or an invasive weed that requires control according to state law. Early detection, rapid response (EDRR) plays an important role in the control of pests that are known to be a severe problem in other regions but not yet occurring in ours. In this instance, the tolerance threshold is zero; a quick response to eliminate a future ongoing pest problem is the safest and least expensive control.

Step 3: If pests exceed tolerance thresholds, choose a safe and effective control method.

IPM identifies physical, cultural, biological, and chemical control methods tailored specifically for the pest of concern and the site. Research the available options and choose a control method that is effective. Preferred control methods are economical, low risk to people, and mindful of environmental processes.

Physical control works on a pest directly: digging, hand-pulling, mowing, tilling, trapping, etc.

Cultural control changes the pest's environment: landscape fabric, mulch, soil amendments, altering the irrigation method or duration, crop rotation, crop covers, etc.

Biological control uses natural enemies: beneficial insects, managed grazing, bird boxes and perches, etc.

Chemical control is the use of pesticides: insect bait stations, synthetic and organic foliar herbicides, microbial-based insecticides, oils, soaps, etc.

These control methods should be looked at as tools in a toolbox; IPM selects the right tools for the job at hand. Both short-term control and long-term management is best achieved by using more than one tool. Often, implementing cultural control methods reduces the amount of physical and chemical control needed.

Step 4: Monitor and evaluate.

Observe and record the results of the control treatment. Evaluate the effectiveness. If necessary, modify maintenance practices to support a healthy landscape and prevent recurrence of the pest.

IPM emphasizes that pest control is not a one-time proposition; the pest control process should be viewed as a cycle that rotates through planning, control, and evaluation. As pest issues change over time, the IPM plan adapts.

- Proper planning and management decisions begin the IPM process. All control methods are considered during the information-gathering and planning process. Often a combination of methods is best.
- Cultural methods of vegetation and pest control are preferred.
- Mechanical means of vegetation and pest control are next in line of preference and are utilized where appropriate.
- Biological methods of vegetation and pest control are considered before chemical means, where they are appropriate.
- Botanical and synthetic pesticides are used in an appropriate manner when other control methods are deemed ineffective or not cost-efficient.

Annual Inspection Report

Annual Inspection Report

City of Puyallup – Stormwater BMP Facilities Inspection and Maintenance Log

Return Form to:
Stormwater Engineer/ City of Puyallup
333 South Meridian
Puyallup, WA 98371

Facility Name: ____

Address: ____

Begin Date: ___________________________ End Date: _____________________________

Date	BMP ID#	BMP facility Description	Inspected By	Cause for Inspection	Exceptions Noted	Notes / Actions Taken

Instructions:

Record all inspections and maintenance for all treatment BMP's on this form. Use additional log sheets and/or attach extended comments or documentation as necessary. Submit a copy of the completed log with the Annual Independent Inspector Report to the City, and start a new log at that time. Checklists provided should be used prior to filling out this form. If you have any questions on how to complete your inspection, please contact City staff.

BMP ID #- always use ID# from the Operation and Maintenance Manual.
Inspected by- Note all Inspections and maintenance on this form, including the required independent annual inspection.
Cause for Inspection- Note if the inspection is routine, pre-rainy season, post storm, annual, or in response to a noted problem or complaint.
Exceptions Noted- Note any condition that requires correction or indicates a need for maintenance.
Notes / Actions Taken- Describe any maintenance done and need for follow up.