E19-0574 2nd Review

Puyallup School District
Kessler Center

Stormwater Site Plan

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Revised: March 2020
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S&H Job Number 18,328

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1.0 PROJECT OVERVIEW AND CONDITIONS

1.1 Scope

The project proposes to construct the Kessler Center building for the Puyallup School District, which will include classrooms, meeting rooms, and district staff offices. The site is located at 1501 39th Avenue SW, Puyallup, WA 98373. See the Vicinity map included in Figure 1. In addition, the project proposes storm drainage, sanitary sewer, and water utility improvements together with surfacing and restoration that includes paving, curb and sidewalk, and vegetative improvements in support of the building project.

This report addresses the City of Puyallup site development, storm drainage design and stormwater site plan requirements of PMC Chapter 21.10 and the Washington State Department of Ecology Stormwater Management Manual for Western Washington, as Amended in December 2014 (the Manual).

1.2 Existing Conditions Summary

This project proposes improvements to parcel number 0419043117. The parcel is approximately 18.35 acres and has been previously developed for Puyallup School District. The address for this project is at 1501 39th Avenue SW, Puyallup, WA, 98373. According to Pierce County Assessor-Treasurer, there are 5 buildings (four offices and one warehouse) located on this parcel and they are all proposed to remain. The existing warehouse building was built in 1987; the Central Kitchen or Food Services building addition was built in 1997; the Information Technology Center (ITC) office building, the Transportation Center modular office building and a Student Records modular office building were built in 2007. A warehouse addition was constructed in 2019. See Figure 2 for the site plan, which shows existing conditions.

The existing site is gently sloped. The majority of the site has previously been cleared of all forested vegetation and developed in some manner. The site surfacing consists of buildings, impervious pavements and gravels, and vegetative surfaces.

The project site is located within the City of Puyallup's Pothole Drainage Basin, see Figure 10. The stormwater runoff from the site is generally directed to four onsite subbasins, a north, a south and a southwest subbasin as well as the newly created warehouse addition subbasin. The north subbasin includes surface runoff from the existing ITC, Central Kitchen the original Warehouse buildings, and several paved parking lots. The north basin has existing stormwater quality and quantity facilities (StormFilter®, flow control manhole/oil pollution control device, and infiltration pond.) The south subbasin includes surface runoff from the existing gravel driver training area. The south subbasin has existing stormwater quality (biofiltration swale) that is located upstream of the stormwater quantity facilities (infiltration pond). The southwest subbasin includes runoff that is tributary to the existing wetland that is generally located on an adjacent offsite parcel. The existing wetland receives associated run on from both 17th Street SW and 39th Avenue E. The new warehouse addition subbasin discharges to the new infiltration trench constructed as a part of the recent warehouse Addition Project.

The majority of the proposed work will take place with the south subbasin, with small portions of the project being located in the north and southwest subbasins. Please see the subbasin exhibit presented as Figure 3.

Please see Table 1 of this report for a summary of existing and proposed surfacing for this project.

1.3 Critical Areas

1.3.1 Flood Zone

The project site is located within an area of minimal flood hazard (0.2% annual change flood hazard), Zone X. Please see Figure 6. This site is located near 89th Avenue Court East, which has documented flooding problems due to the nature of the Black Swamp Pothole subbasin. Pierce County has determined a "reasonably safe flood elevation" for the adjacent wetland to be El. 351.0 (NAVD88). The reasonably safe flood elevation of 351.0 (NAVD88) is below all proposed improvements and will not impact the project.

1.3.2 Wetlands

An existing Category IV wetland has been identified adjacent to and offsite with portions of it extending onsite and located in the southwest portion of the parcel. Please see wetland documents included in Appendix E outlining the wetland assessment and reconnaissance work. The wetland reconnaissance work performed and document prepared by Grette Associates, dated May 2019, states the Category IV wetland located in the southwest portion of the parcel shall have a buffer zone of 50 ft. All proposed project improvements are located outside of the wetland and buffer zone.

1.3.3 Aquifer Recharge and Wellhead Protection Zone

The project lies within an aquifer recharge area and wellhead protection area, as defined by the City of Puyallup's Aquifer Recharge and Wellhead Protection Areas, see Figure 7. This project does not negatively impact the Aquifer Recharge or Wellhead protection area.

1.3.4 Other Critical Areas

We are not aware of any other critical areas on or near the site.

1.4 Proposed Conditions

The project proposes storm, sanitary sewer, and water utility improvements in support of the Kessler Center Building. The Kessler Center Building will connect into the existing water and proposed new gravity sewer piping. Stormwater runoff from pollution generating impervious surfaces will be collected, conveyed and treated by a bioretention facility and then conveyed to infiltration trenches for disposal. Building roof stormwater runoff will be collected and conveyed directly to infiltration. The proposed project surface coverages are summarized in Table 1 of this report and shown on the surface coverage exhibits in Figures 11 and 12. Please see the proposed site plan Figure 2.

Table 1 – Project Surface Coverages

Existing		
Coverage Description	**Square Feet**	**Acres**
Grass / Landscaping	217,914	5.00
Gravel	34,369	0.79
Building	1,188	0.03
Pavement	23,363	0.54
Total Impervious	**58,920**	**1.36**
Total Project Area	**276,834**	**6.36**

Proposed		
Coverage Description	**Square Feet**	**Acres**
Grass / Landscaping	83,265	1.91
Gravel	66,753	1.53
Building	23,482	0.54
Pavement	103,334	2.38
Total Impervious	193,569	**4.45**
Total Project Area	**276,834**	**6.36**

Some work is proposed in the southwest subbasin, and therefore a wetland hydrologic analysis is required and is included with this report. See Appendix D.

The north subbasin work consists only of installing one new driveway access to 17th Street. The new and replaced impervious area is about 2,400 square feet and those figures are not included in Table 1. Approximately 1,200 square feet of this area will be tributary to the north subbasin, and approximately 1,200 square feet will be tributary to the existing storm system in 17th Street. Since both of these areas are less than 2,000 square feet, no minimum requirements are triggered for the new driveway.

2.0 DISCUSSION OF MINIMUM REQUIREMENTS

According to the Manual, the development threshold minimum requirement flow charts (presented as Figure 8 of this report) necessitate that Minimum Requirements 1-10 apply to the new hard surfaces, converted pervious surfaces and the land disturbed. Below is a summary of the Minimum Requirements applicable to this project.

2.1 Minimum Requirement #1 - Prepare a Stormwater Site Plan

According to the City of Puyallup Land Use & Development Requirements, a Preliminary and Final Stormwater Site Plan shall be provided. A Preliminary Stormwater Site Plan has been provided with the previous Preliminary Site Plan permit package. This report is the final Stormwater Site Plan and is submitted to the City during the Final Site Plan permitting process per City requirements to fully satisfy this requirement.

2.2 Minimum Requirement #2 - Construction Stormwater Pollution Prevention

A Construction Stormwater Pollution Prevention Plan (CSWPPP) has been prepared and is included with this permit submittal package under a separate cover.

2.3 Minimum Requirement #3 - Source Control for Pollution

The Puyallup School district will employ source control BMPs on the project site in accordance with Volume IV of the Manual. Construction BMPs are included in the CSWPPP.

2.4 Minimum Requirement #4 - Preservation of Natural Drainage Systems and Outfalls

The majority of the area within the project boundary will continue to infiltrate as it does in the existing condition. A wetland analysis has been performed to ensure wetland function will not be adversely affected by any change in discharge (see Appendix D).

2.5 Minimum Requirement #5 - On-site Stormwater Management

Stormwater will be managed onsite in accordance with City of Puyallup and DOE requirements. Per the flow chart for LID requirements included in Figure 8 of this report, the project will elect to satisfy the LID performance standard through the use of infiltration trenches. Additionally, lawn and landscape areas will be subject to BMP T5.13: Post-Construction Soil Quality and Depth.

2.6 Minimum Requirement #6 - Runoff Treatment

The project proposes the use of a bioretention facility to treat runoff from project surfaces. Calculations for the proposed facility are provided in Appendix C.

2.7 Minimum Requirement #7 - Flow Control

The project proposes full infiltration of project surfaces through infiltration trenches. Calculations for the proposed facility are provided in Appendix B.

2.8 Minimum Requirement #8 - Wetland Protection
Grette Associates performed a wetland reconnaissance for the subject site. The site investigations identified one Category IV wetland located in the southwest portion of the subject property. All proposed development is outside of the 50-foot buffer zone. Wetland reports are included in Appendix E of this report. A wetland analysis has been performed to ensure discharge to the wetland conforms to the requirements of Appendix I-D of the Manual. This analysis is included in Appendix D.

2.9 Minimum Requirement #9 - Operation and Maintenance
An Operations and Maintenance Plan is included with this permit submittal package under a separate cover. The O&M Manual document will need to be located at specific locations where this report will not need to be. Therefore, it is best to keep these documents separate from each other.

2.10 Optional Guidance #1 – Financial Liability
Financial liability will be waived as a part of the Final Site Plan Review.

2.11 Optional Guidance #2 – Off Site Analysis and Mitigation
This project does not discharge stormwater off-site in either the north or south subbasin. An offsite analysis for the southwest subbasin (tributary to the adjacent wetland) is included in Appendix D.

3.0 OFFSITE ANALYSIS

An offsite analysis is not required for this project for the north and south subbasins as all onsite runoff is retained and infiltrated, with the exception of a small amount of disturbed area that will be tributary to the adjacent wetland. A required offsite analysis for the southwest subbasin (tributary to the existing wetland) is included in Appendix D.

3.1 Offsite Analysis Study Area
The project site was originally developed for Puyallup School District as a warehouse storage facility within a residential zone in Puyallup.

3.2 Review of Available Information on the Study Area
A Vicinity Map (see Figure 1), Urban Growth Area map (Figure 9), a City of Puyallup Basin Map (Figure 10), a FEMA Floodplain Map (Figure 6), and an Aquifer Recharge & Wellhead Protection Areas Map (Figure 7) are included at the end of the Report. Based on the referenced information, the site lies within the Pothole Basin (Black Swamp Pothole Subbasin), is within the “X” Flood Zone per FEMA, and contains a wetland located in the southwestern area of the property, (see Appendix E).

This site retains and infiltrates all stormwater runoff onsite, with the exception of a small amount of disturbed area that will be tributary to the adjacent wetland. The project will not adversely affect existing offsite stormwater systems or facilities. In the event of an emergency overflow, the proposed infiltration trench will overflow into the proposed bioretention facility. There is no overflow path off of the project site.

4.0 PERMANENT STORMWATER CONTROL PLAN

The project proposes collection of stormwater runoff using catch basins and then conveying it to the appropriate locations using piping. Stormwater runoff from pollution generating impervious surfaces (pgis), or other non pgis or pervious surfaces that mix with pgis surfaces are conveyed to a new bioretention facility that will provide treatment prior to discharge into a new infiltration trench. Runoff collected from the roof of the Kessler center will bypass the bioretention and be discharged directly to the infiltration trench since the roof is

not a pollution-generating surface. Design calculations for each element of this stormwater management plan are included with this report. Appendix A includes conveyance calculations. Appendix B includes infiltration trench calculations. Appendix C includes bioretention calculations. Figure 4 of this report shows the areas tributary to each of the proposed catch basins and storm facilities.

The infiltration system design is based upon infiltrating into the deeper underlying advance outwash soils. The infiltration rate is 5 inches per hour as recommended by the geotechnical report. The geotechnical report recommended that we embed the system into the advance outwash soils 2' to assure contact with the infiltrateable soils.

5.0 CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

A Construction Stormwater Pollution Prevention Plan (CSWPPP) has been prepared and is included with this permit submittal package under a separate cover.

6.0 SPECIAL REPORTS AND STUDIES

A Critical Areas Assessment was performed by Habitat Technologies (Appendix E) and it delineated the wetland and wetland buffer (50 feet). A wetland reconnaissance was performed by Grette Associates in order to confirm the wetland location and buffer width and is provided in Appendix E. The Grette reconnaissance confirms the Habitat Technologies report.

A geotechnical investigation of the project area has been completed by Associated Earth Sciences, Inc. (AESI) and summarized in their geotechnical report dated June 17, 2019 (bound separate from this Stormwater Site Plan). However, additional explorations have been completed for the purposes of determining infiltration rates in the vicinity of the proposed infiltration facilities. These explorations are described in the December 18, 2019 Subsurface Exploration, Infiltration Testing and Design Infiltration Rate Determination Report from AESI (also bound separately).

7.0 OTHER PERMITS

This project also requires a SEPA permit. This project proposes to disturb more than 1 acre of land, which means a Construction Stormwater General Permit from Washington State Department of Ecology is required. A building permit is required.

8.0 OPERATION AND MAINTENANCE MANUAL

An Operations and Maintenance Plan is included with this permit submittal package under a separate cover. The O&M Manual document will need to be located at specific locations where this report will not need to be. Therefore, it is best to keep these documents separate from each other.

9.0 DECLARATION OF COVENANT FOR PRIVATELY MAINTAINED FLOW CONTROL AND TREATMENT FACILITIES

The project will provide a declaration of covenant for privately maintained flow control and treatment facilities.

10.0 DECLARATION OF COVENANT FOR PRIVATELY MAINTAINED ON-SITE STORMWATER MANAGEMENT BMPS

The project will provide a declaration of covenant for privately maintained on-site stormwater management BMPs.

FIGURES

Figure 1 – Vicinity Map

Figure 2 –Site Plan

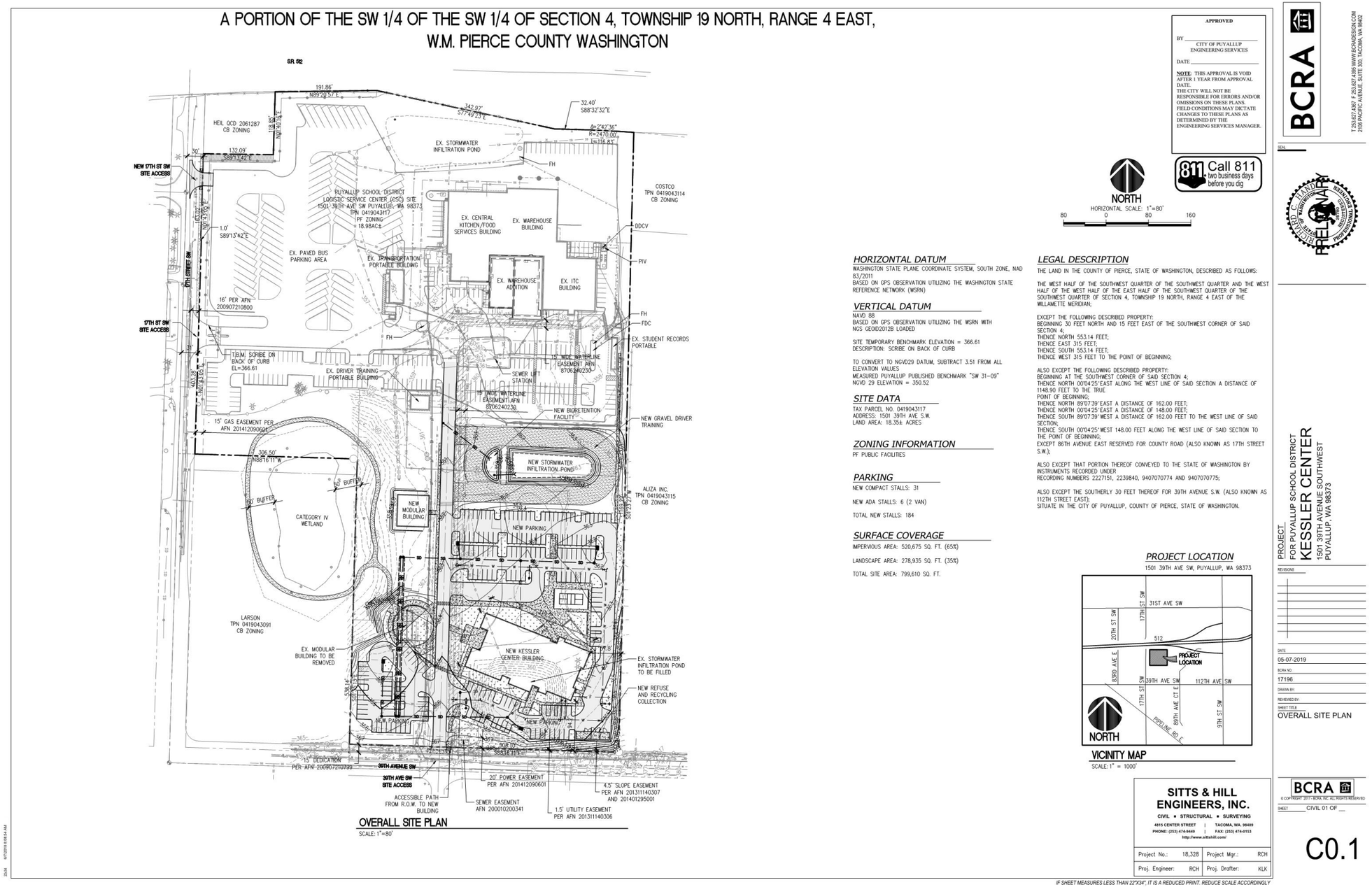


Figure 3 – Existing Subbasin Exhibit

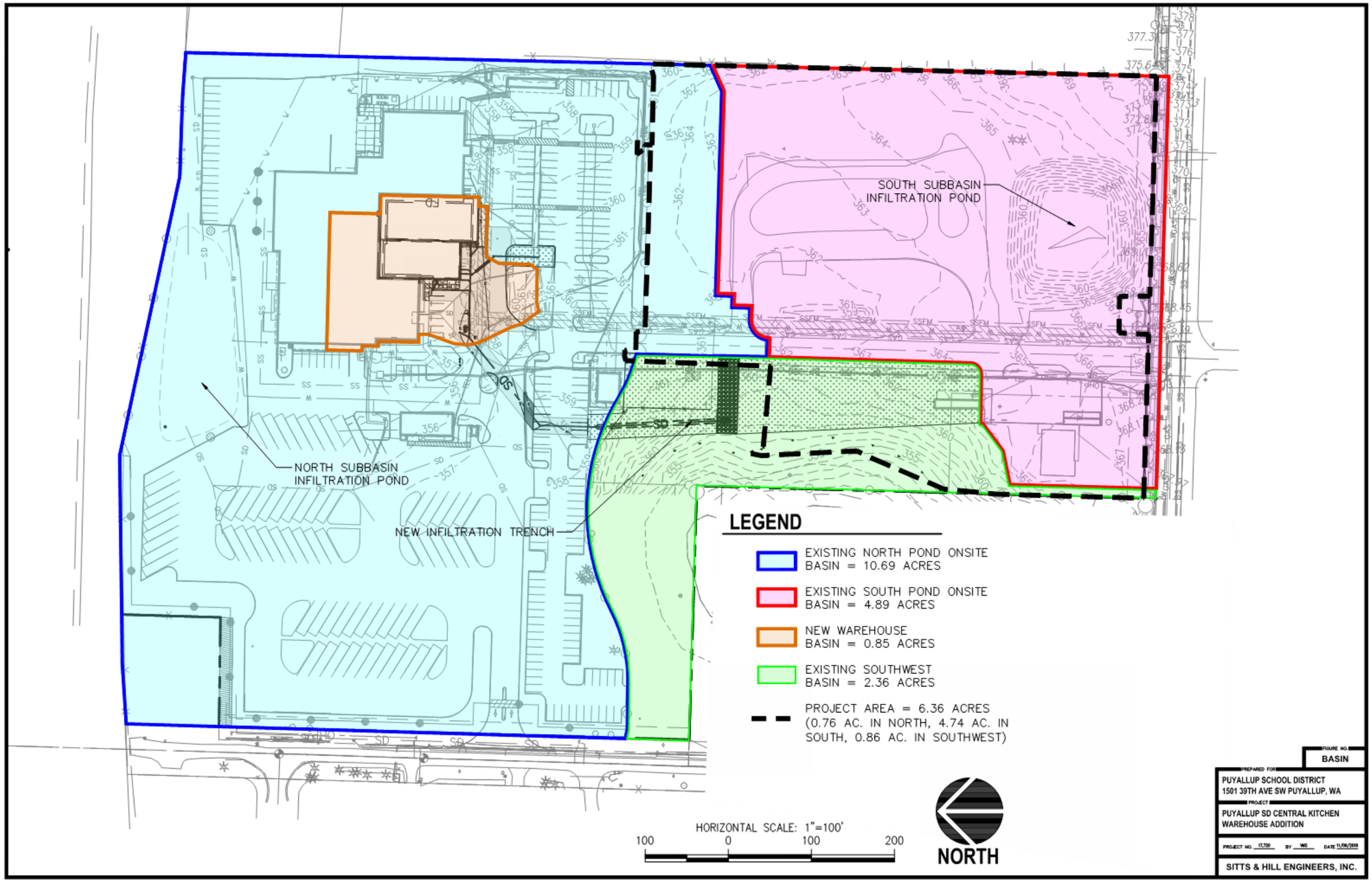


Figure 4 –Basin Areas

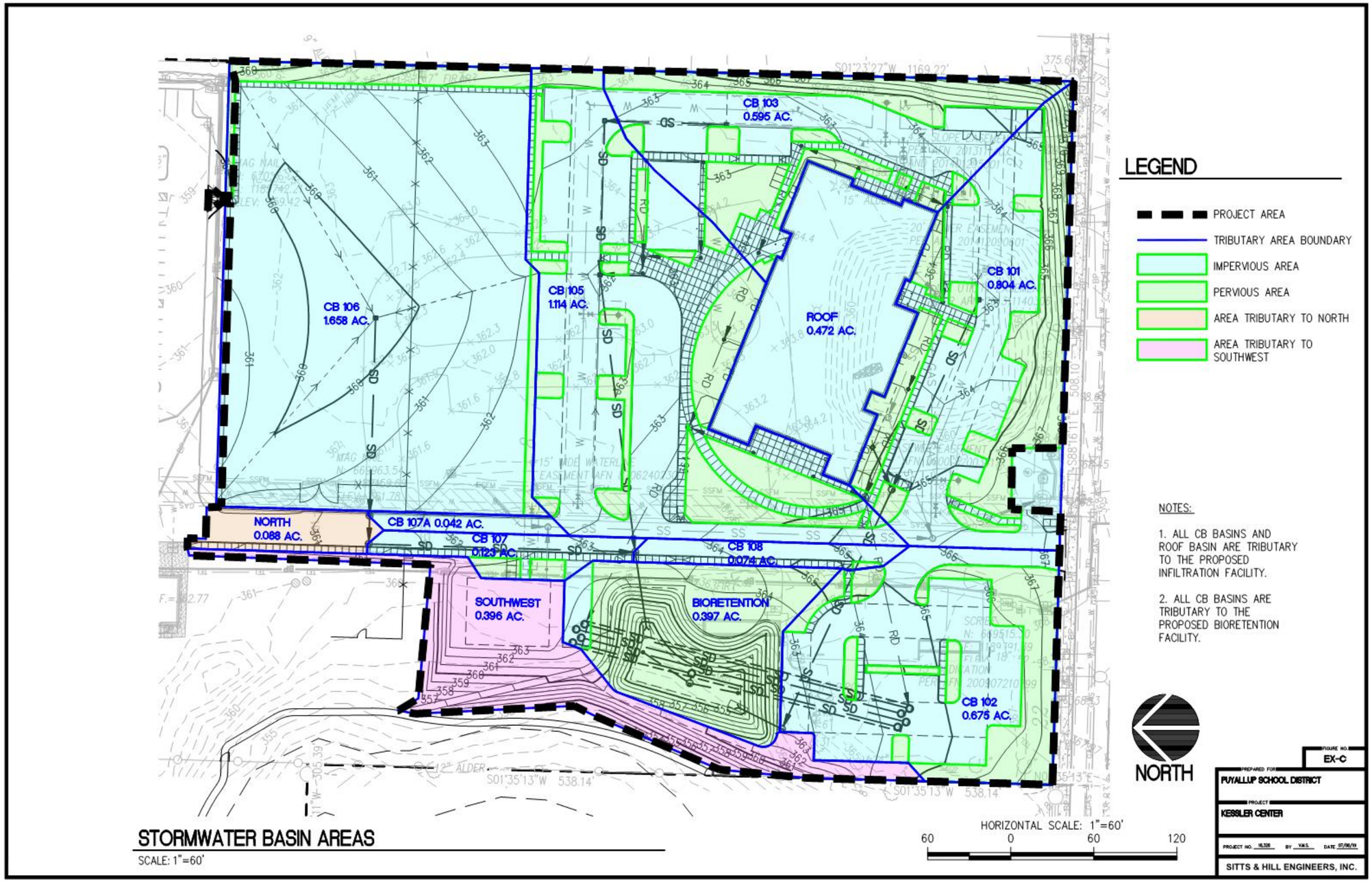


Figure 5 – Wetland Basin Area

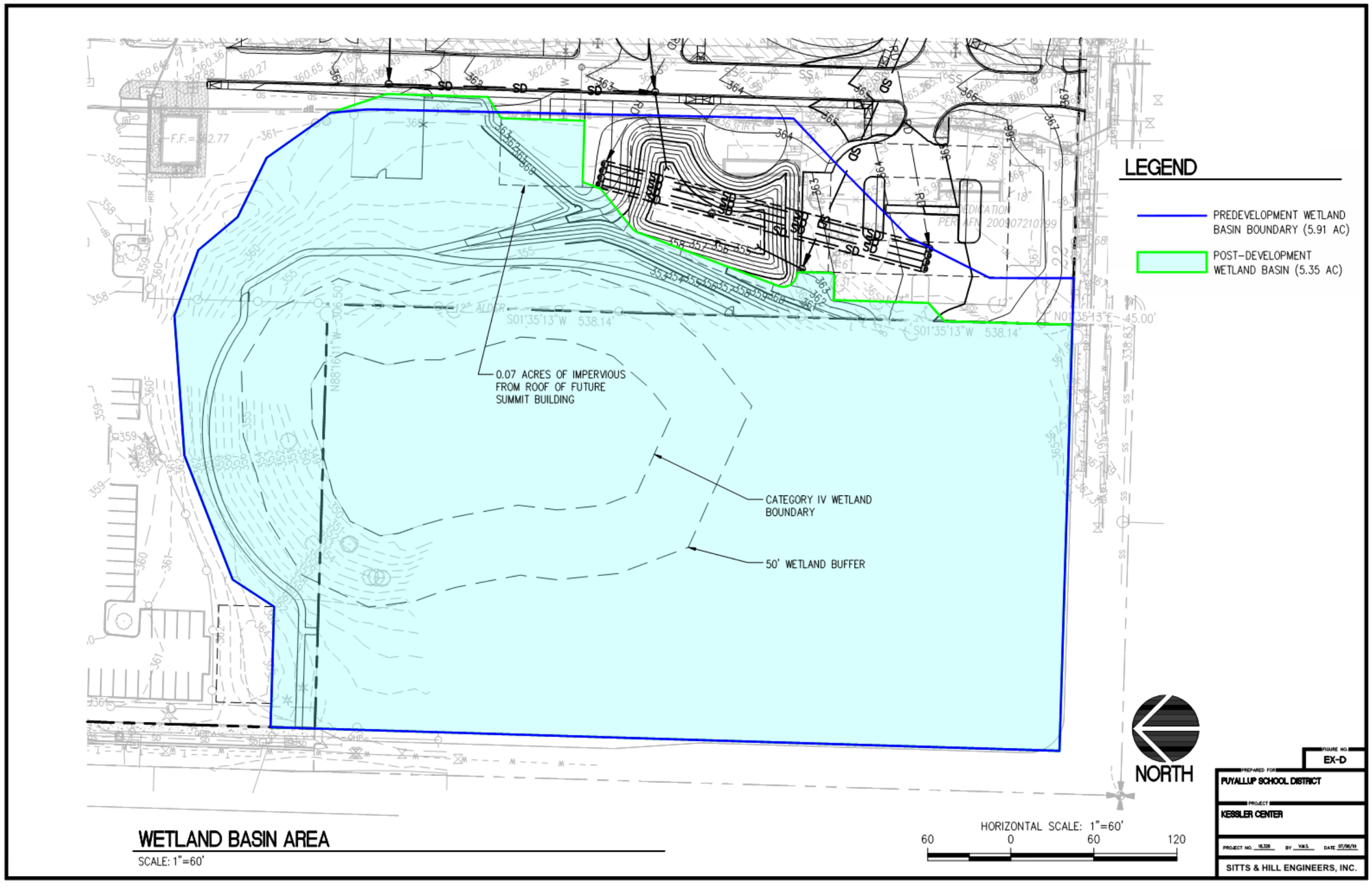


Figure 6 – FEMA Map

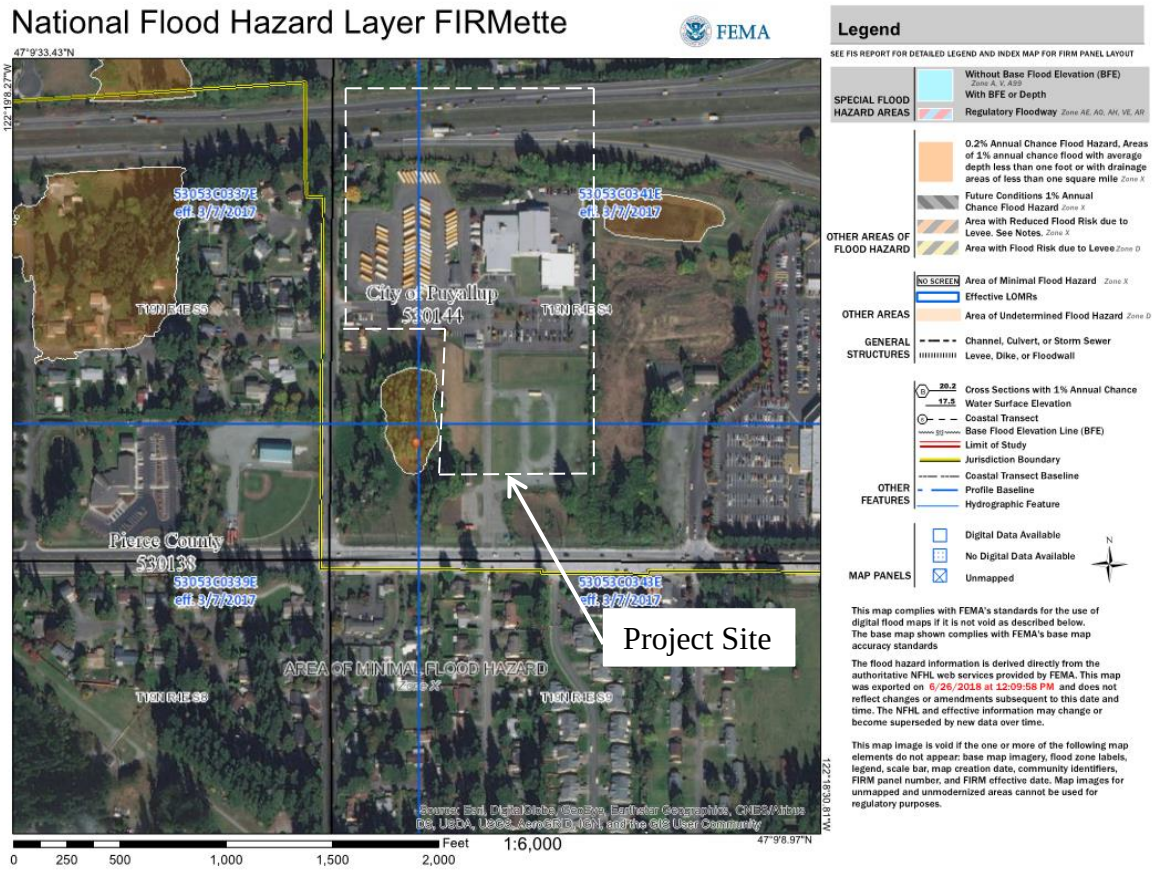


Figure 7 – Aquifer Recharge & Wellhead Protection Map

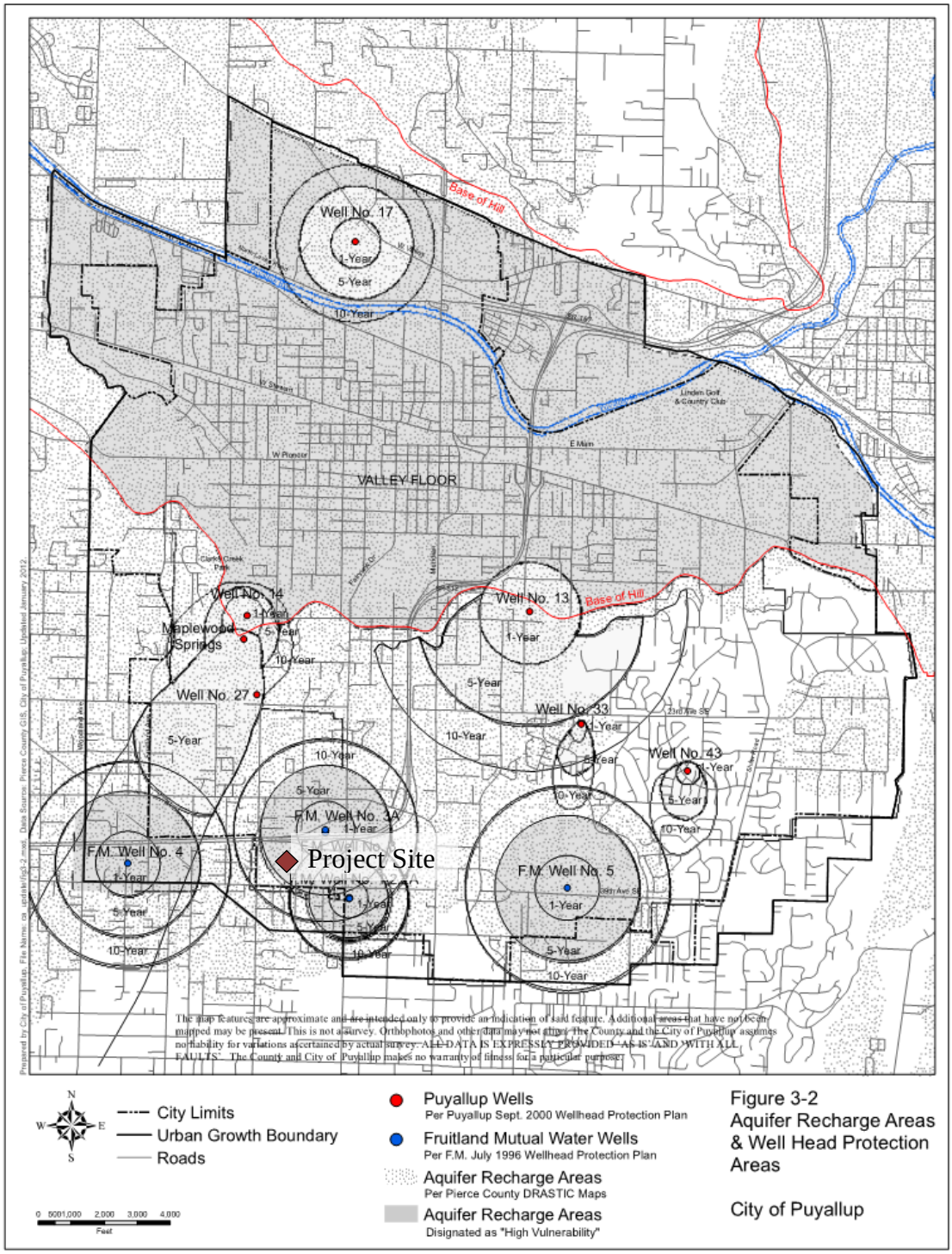


Figure 8 – Flow Charts for Determining Minimum Requirements

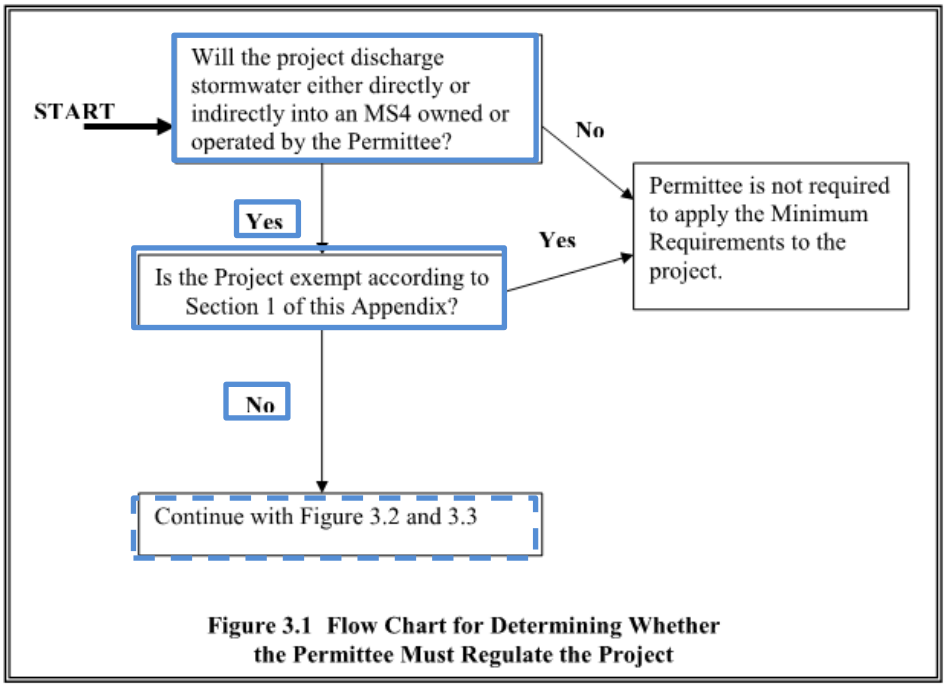


Figure 3.1 Flow Chart for Determining Whether the Permittee Must Regulate the Project

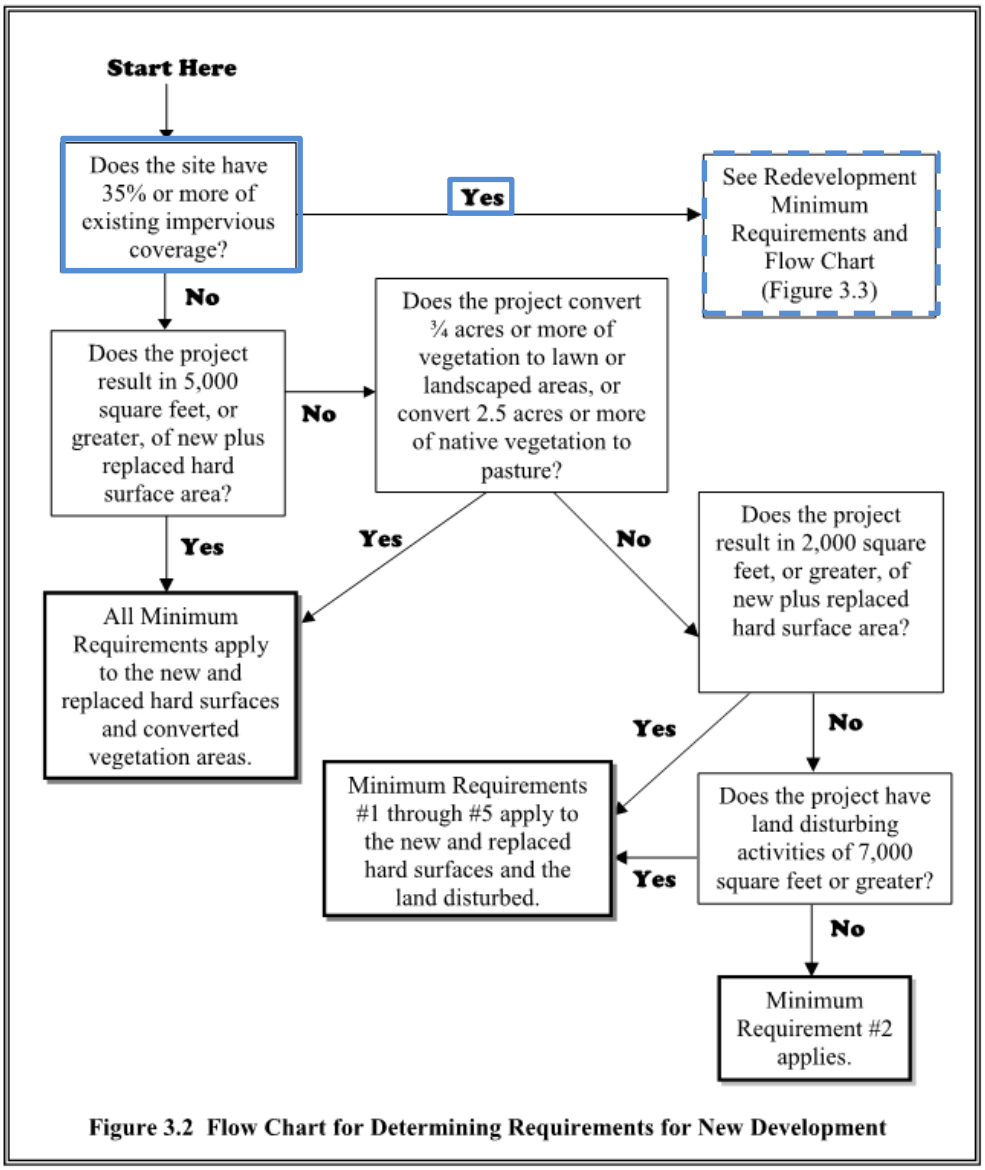


Figure 3.2 Flow Chart for Determining Requirements for New Development

Western Washington Phase II Municipal Stormwater Permit

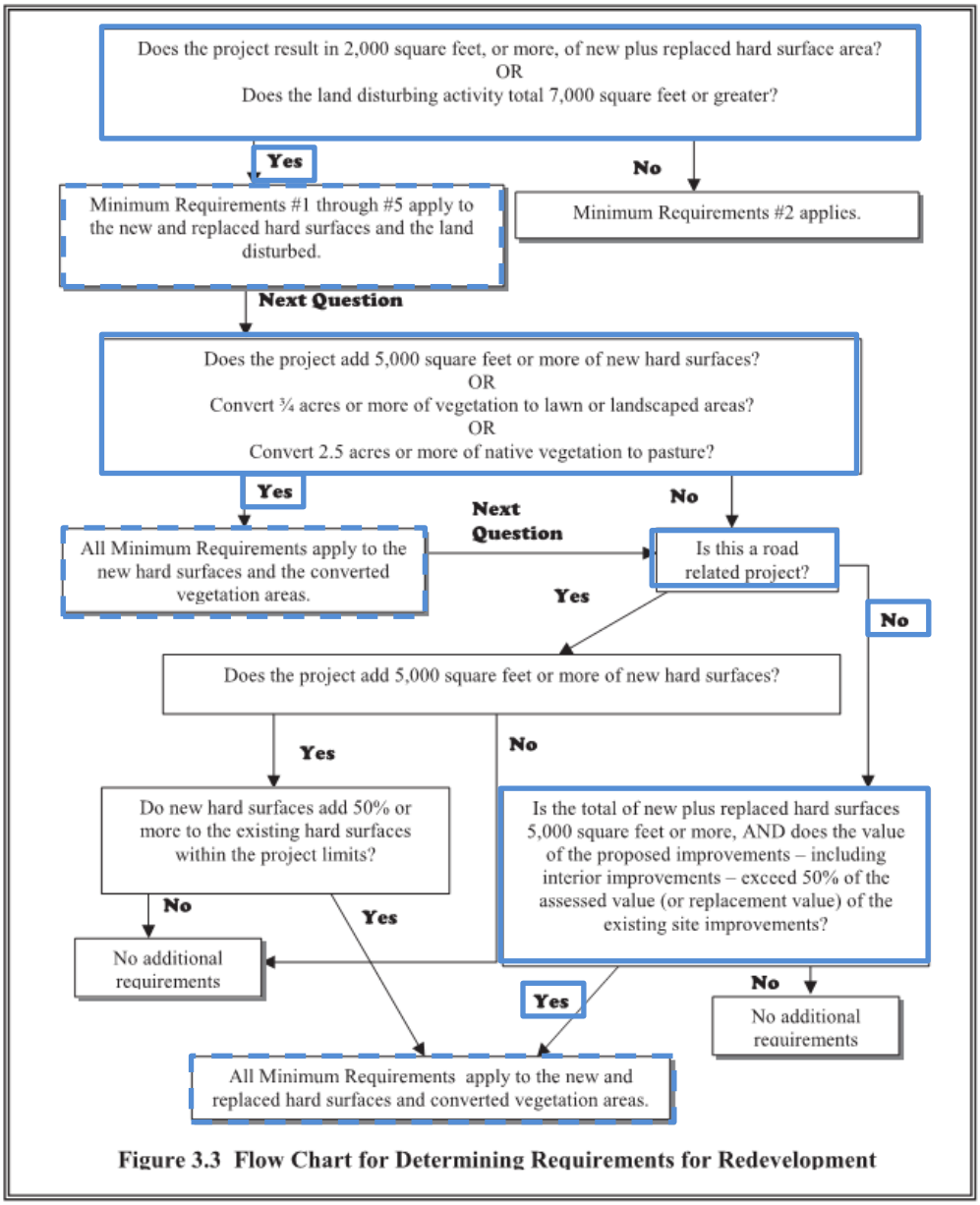


Figure 3.3 Flow Chart for Determining Requirements for Redevelopment

Figure I-2.5.1 Flow Chart for Determining LID MR #5 Requirements

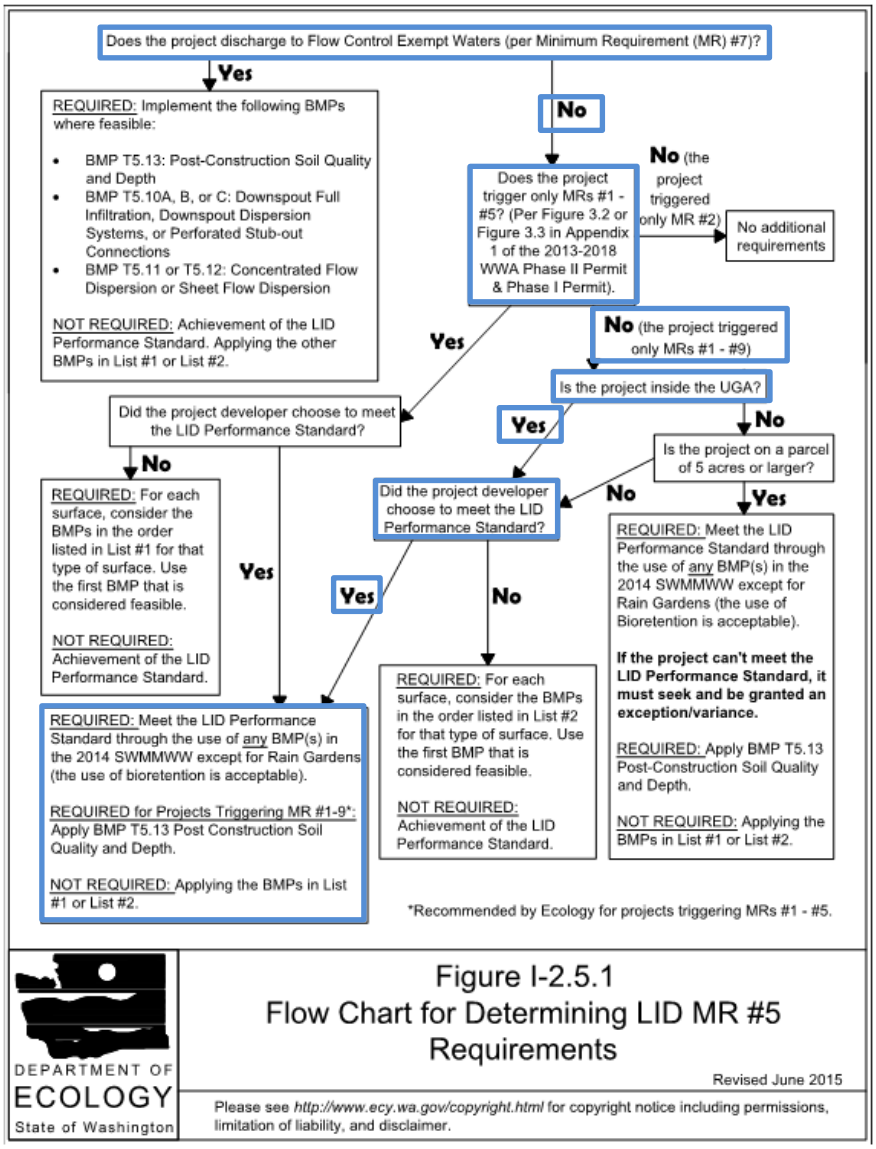


Figure 9 – City of Puyallup Urban Growth Area

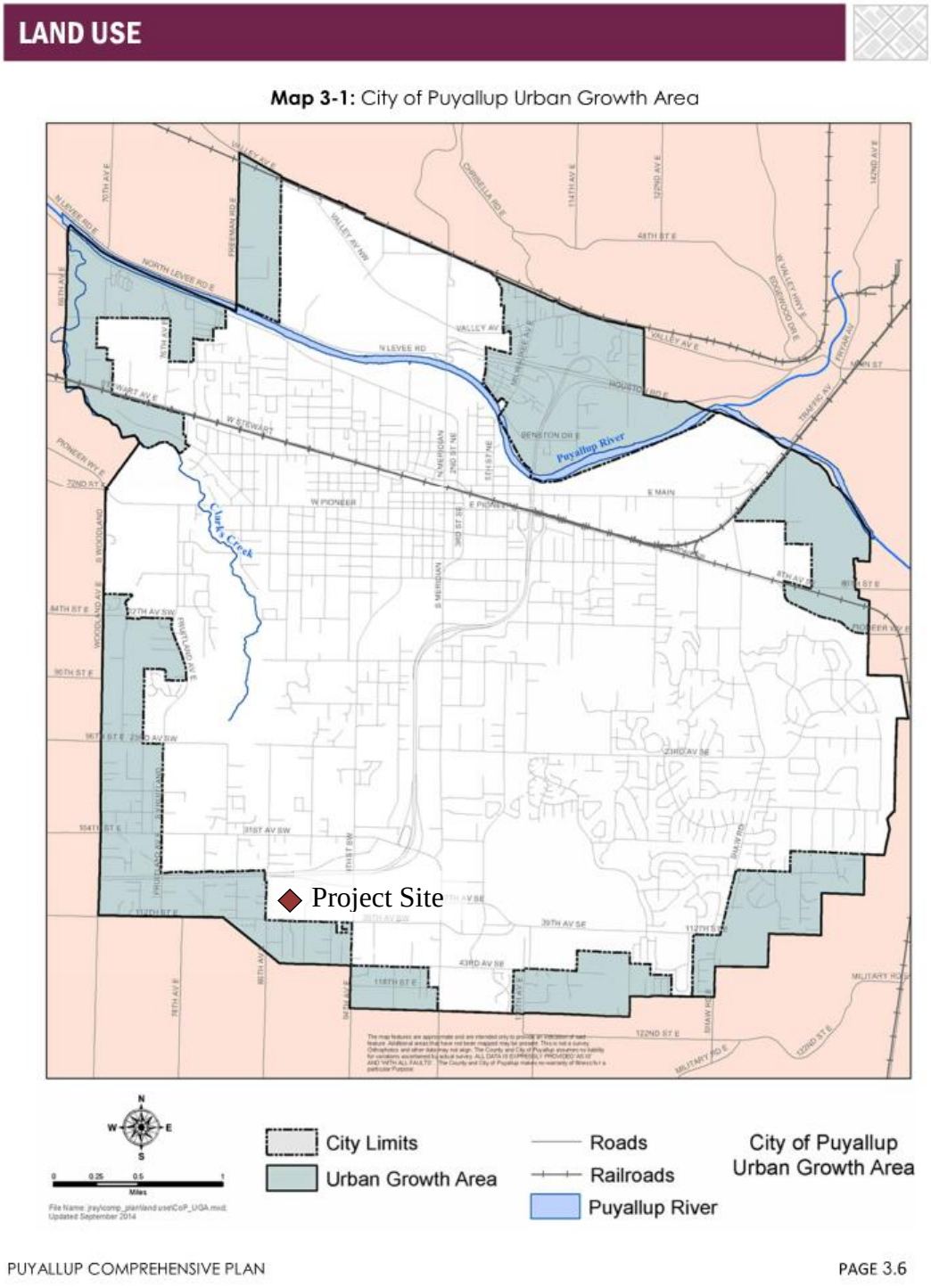


Figure 10 – City of Puyallup Drainage Basins

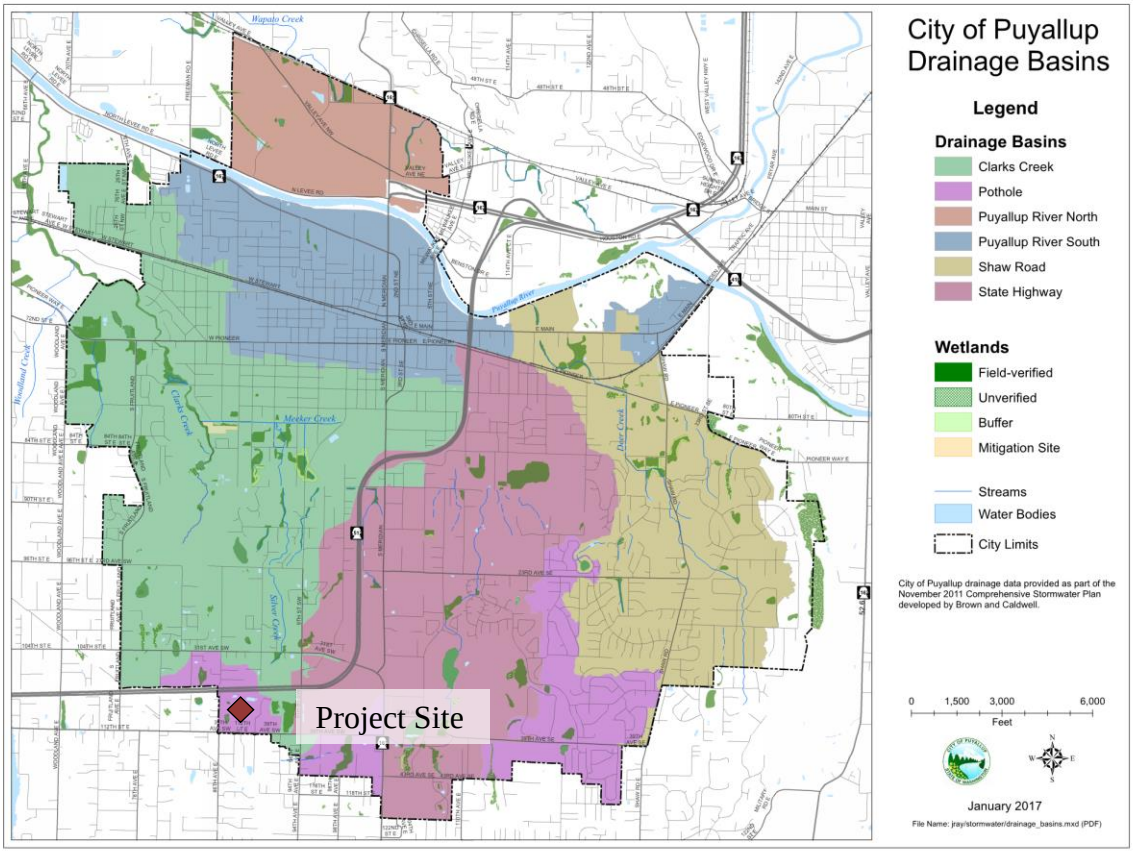


Figure 11 – Existing Surface Coverage

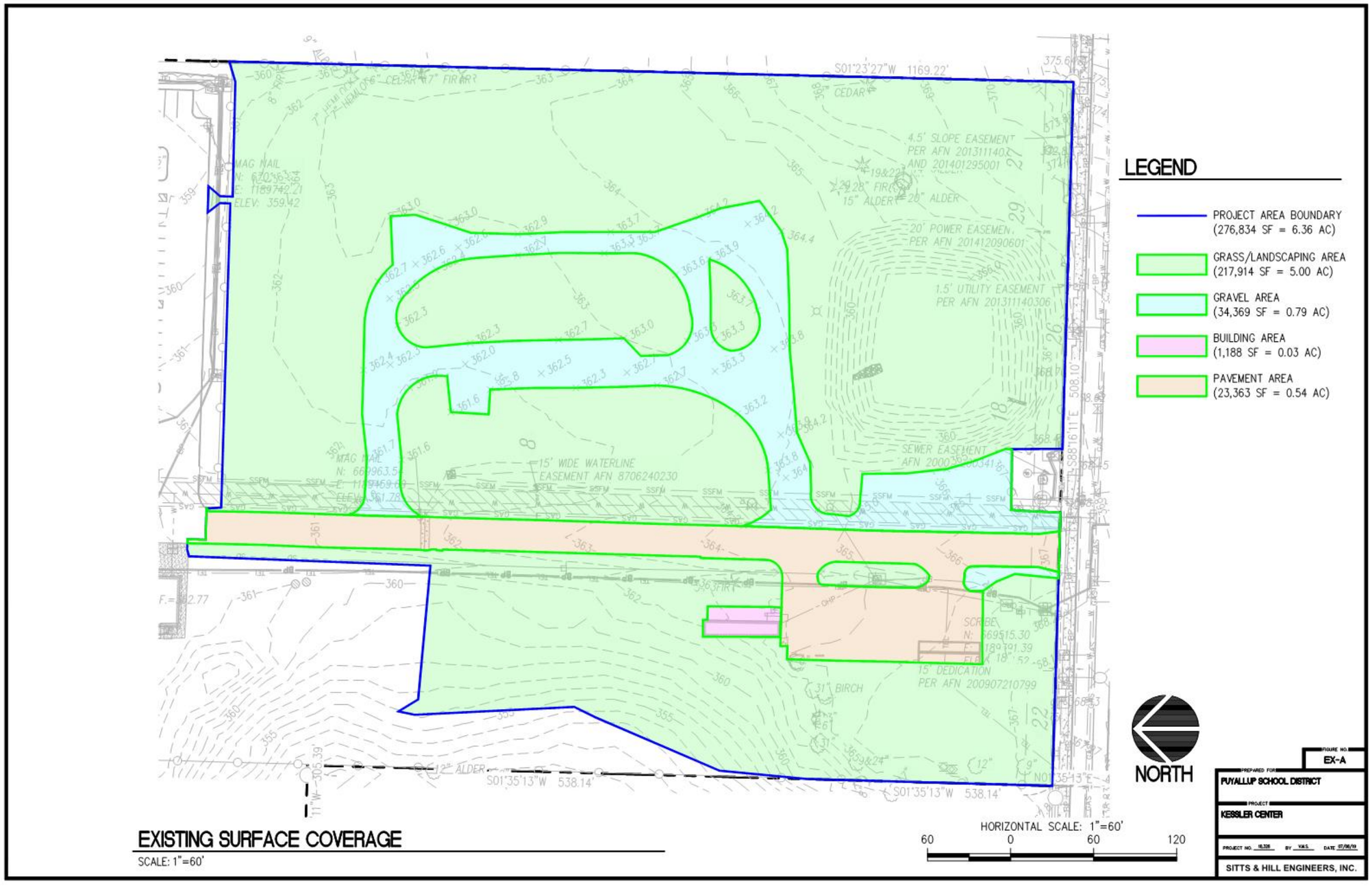
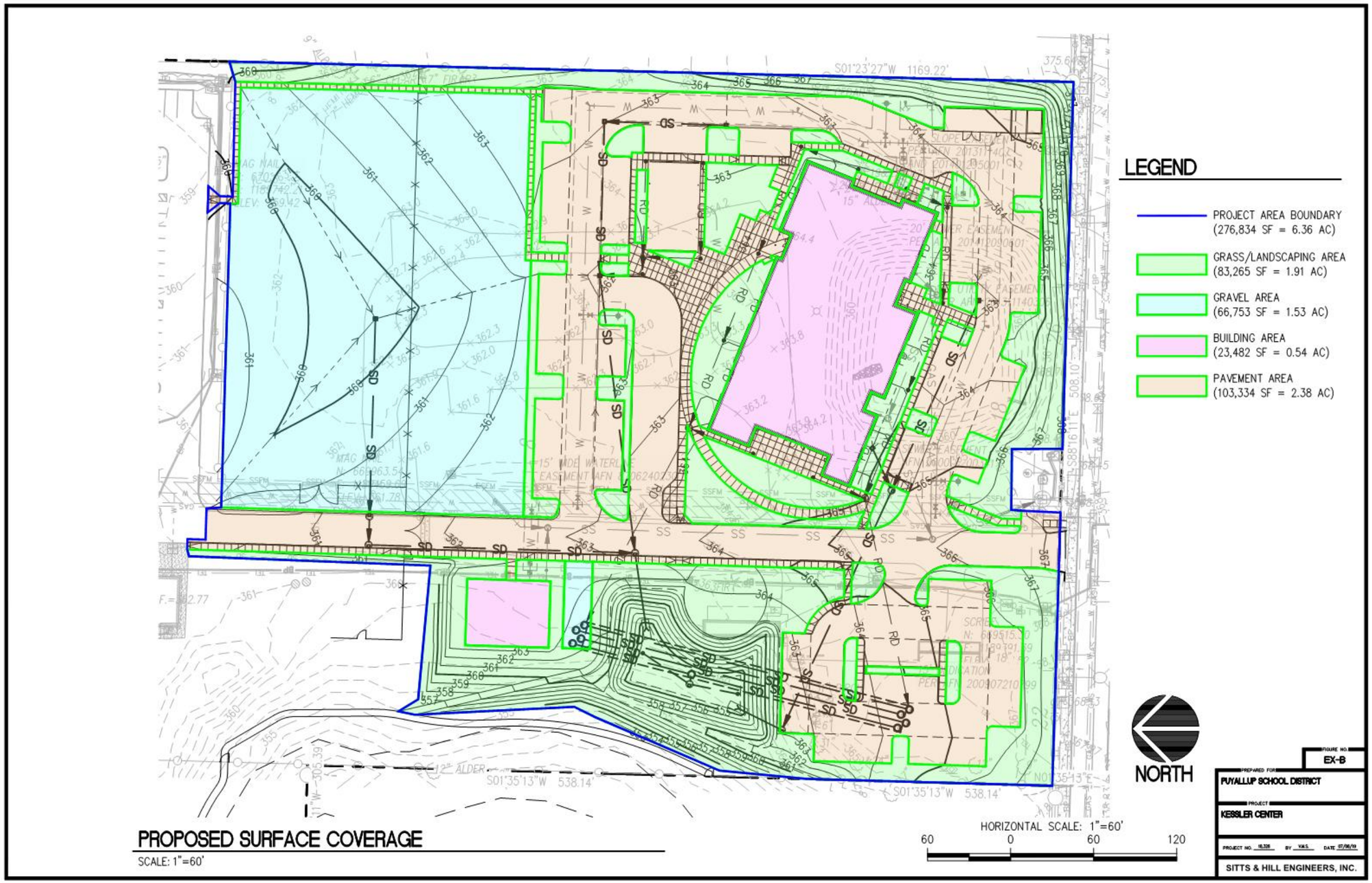


Figure 12 – Proposed Surface Coverage



APPENDIX A – Conveyance Calculations

See Figure 4 for a map of the basin areas used for conveyance calculations. Due to the depth of the proposed infiltration trench, free discharge is assumed. See Appendix B for trench calculations that show no backwater condition will be created in the proposed conveyance system.

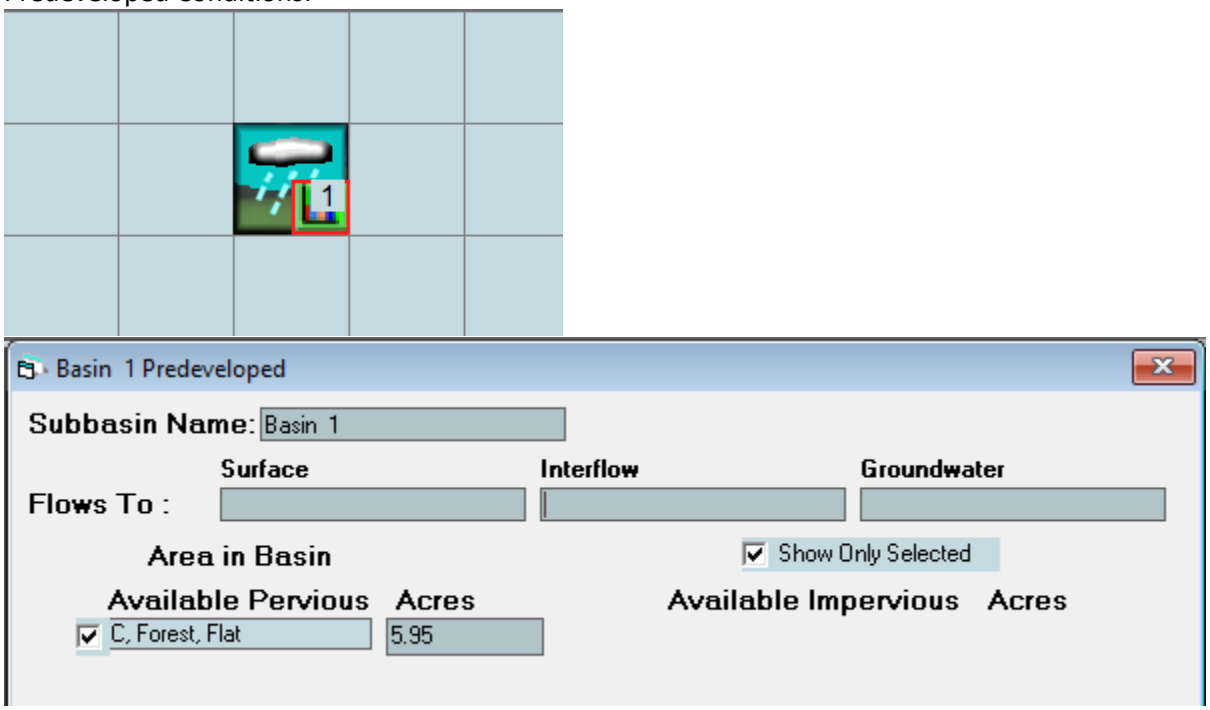
PUYALLUP SCHOOL DISTRICT - KESSLER CENTER
CONVEYANCE CALCULATIONS, 25-YEAR 24-HOUR

LOCATION		GROUND	AREA	∑AREA	CN	Tc	$Q_{25yr,\,24hr}$	Pipe Size	Pipe Length	"n"	SLOPE	Hydraulic Area	Hydraulic Radius	Wetted Chord Angle	Water Depth	%Full	Manning's Q	Manning's Velocity	Full Pipe Q	Full Pipe Velocity
FROM	TO	COVER	(AC.)	(AC.)		(MIN.)	(CFS)	in	LF		(FT/FT)	SF	FT	Radians	FT		CFS	(FT/SEC)	CFS	(FT/SEC)
CB 101		PERV.	0.334	0.334	86															
	CB 102	IMPERV.	0.470	0.470	98	6.00	0.59	12	341	0.014	0.0075	0.205	0.174	2.351	0.307	31%	0.59	2.88	2.87	1.00
CB 102		PERV.	0.216	0.550	86															
	BIO	IMPERV.	0.459	0.929	98	6.00	1.12	12	35	0.014	0.0100	0.294	0.214	2.740	0.400	40%	1.12	3.81	3.32	0.87
CB 103		PERV.	0.248	0.248	86															
	CB 104	IMPERV.	0.347	0.347	98	6.00	0.44	12	88	0.014	0.0100	0.150	0.145	2.076	0.246	25%	0.44	2.93	3.32	1.13
CB 104		PERV.	0.000	0.248	86															
	CB 105	IMPERV.	0.000	0.347	98	6.00	0.44	12	111	0.014	0.0100	0.150	0.145	2.076	0.246	25%	0.44	2.93	3.32	1.13
CB 105		PERV.	0.301	0.550	86															
	CB 108	IMPERV.	0.813	1.160	98	6.00	1.32	12	202	0.014	0.0100	0.331	0.229	2.895	0.439	44%	1.32	3.98	3.32	0.83
CB 106		PERV.	0.108	0.108	86															
	CB 107A	IMPERV.	1.550	1.550	98	6.00	1.42	12	143	0.014	0.0050	0.454	0.268	3.388	0.561	56%	1.42	3.13	2.35	0.75
CB 107A		PERV.	0.000	0.108	86															
	CB 107	IMPERV.	0.042	1.592	98	6.00	1.46	12	21	0.014	0.0050	0.464	0.271	3.428	0.571	57%	1.46	3.15	2.35	0.75
CB 107		PERV.	0.020	0.129	86															
	CB 108	IMPERV.	0.103	1.695	98	6.00	1.56	12	192	0.014	0.0050	0.488	0.277	3.528	0.596	60%	1.56	3.20	2.35	0.73
CB 108		PERV.	0.002	0.680	86															
	BIO	IMPERV.	0.072	2.928	98	6.00	2.94	18	55	0.014	0.0050	0.783	0.352	2.962	0.683	46%	2.94	3.75	6.92	1.84
ROOF		PERV.	0.000	0.000	86															
	CB 204	IMPERV.	0.236	0.236	98	6.00	0.21	6	419	0.013	0.0100	0.079	0.112	2.834	0.212	42%	0.21	2.66	0.56	0.21
ROOF		PERV.	0.000	0.000	86															
	CB 208	IMPERV.	0.236	0.236	98	6.00	0.21	6	388	0.013	0.0100	0.079	0.112	2.834	0.212	42%	0.21	2.66	0.56	0.21

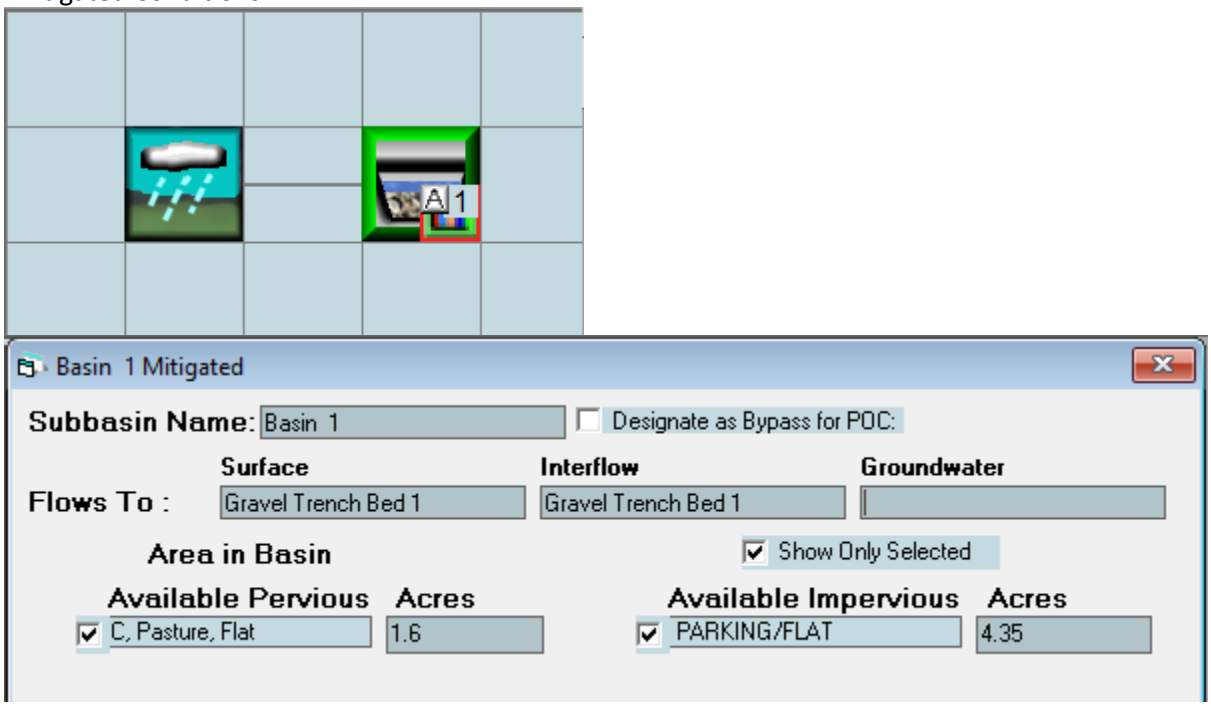
APPENDIX B – Infiltration Trench Calculations

The modeled infiltration trench is designed with a 5-foot width by 10-foot height and includes two 30-inch perforated pipes (stacked vertically). This over-sized trench section is used due to the large depth to the infiltrative layer. Flow control basin areas can be seen in Figure 4.

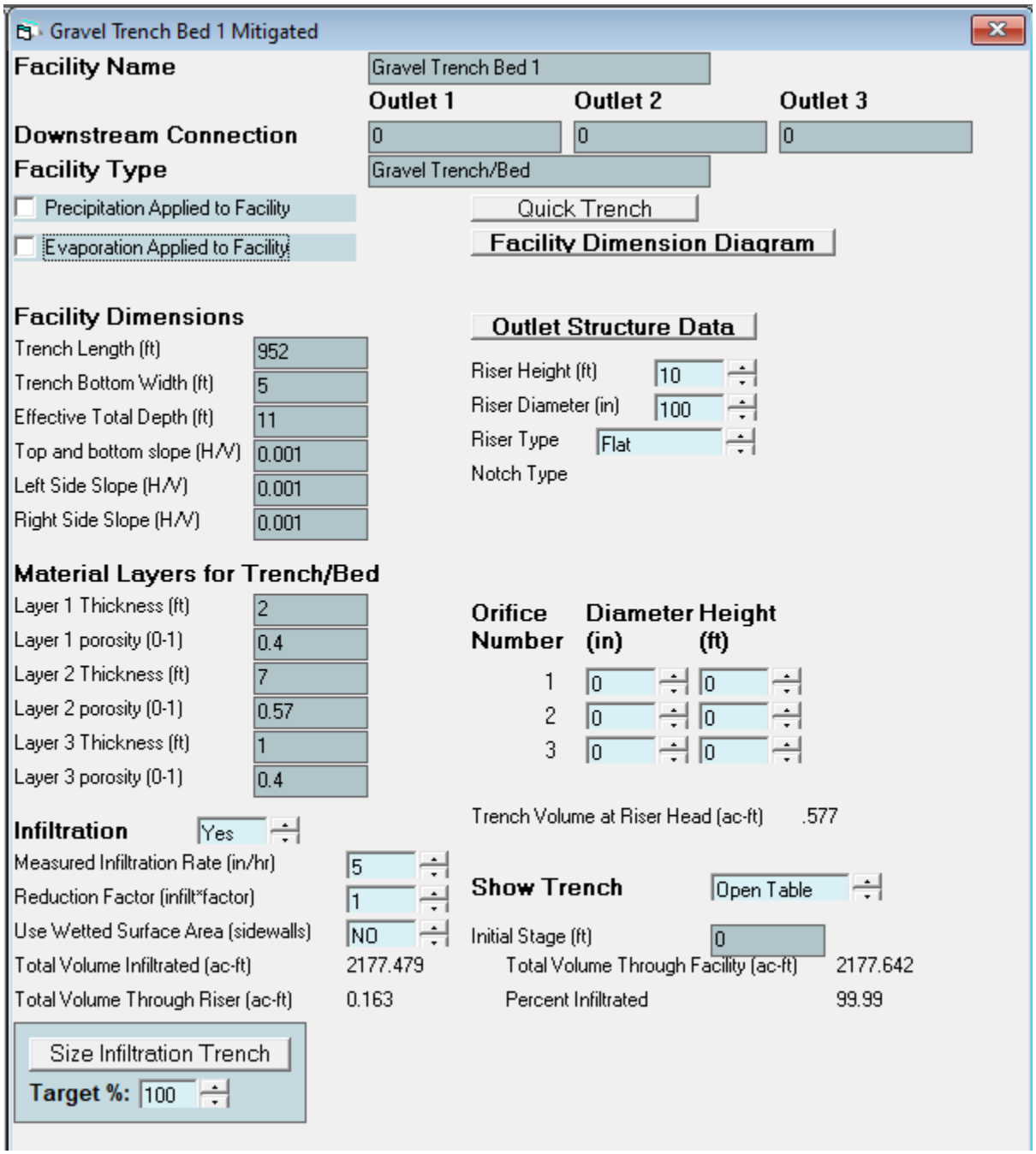
Predeveloped Conditions:



Mitigated Conditions:



Infiltration Trench:



Note that the porosity for layer 2 is determined from the weighted average of a value of 0.4 for the soil material and a value of 1.0 for the pipe space in that layer.

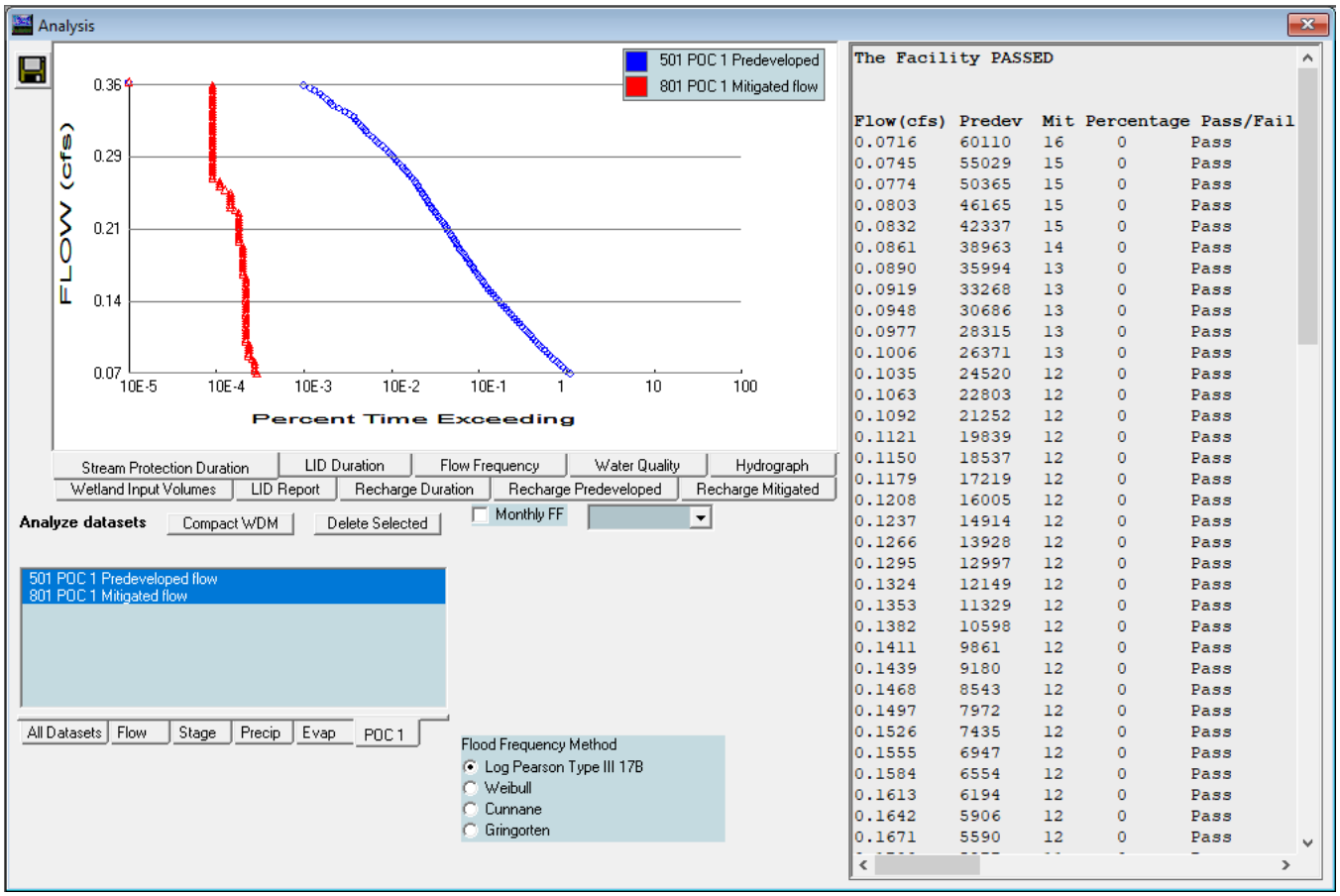
$$Cross\ sectional\ area = 5ft \times 7ft = 35sf$$

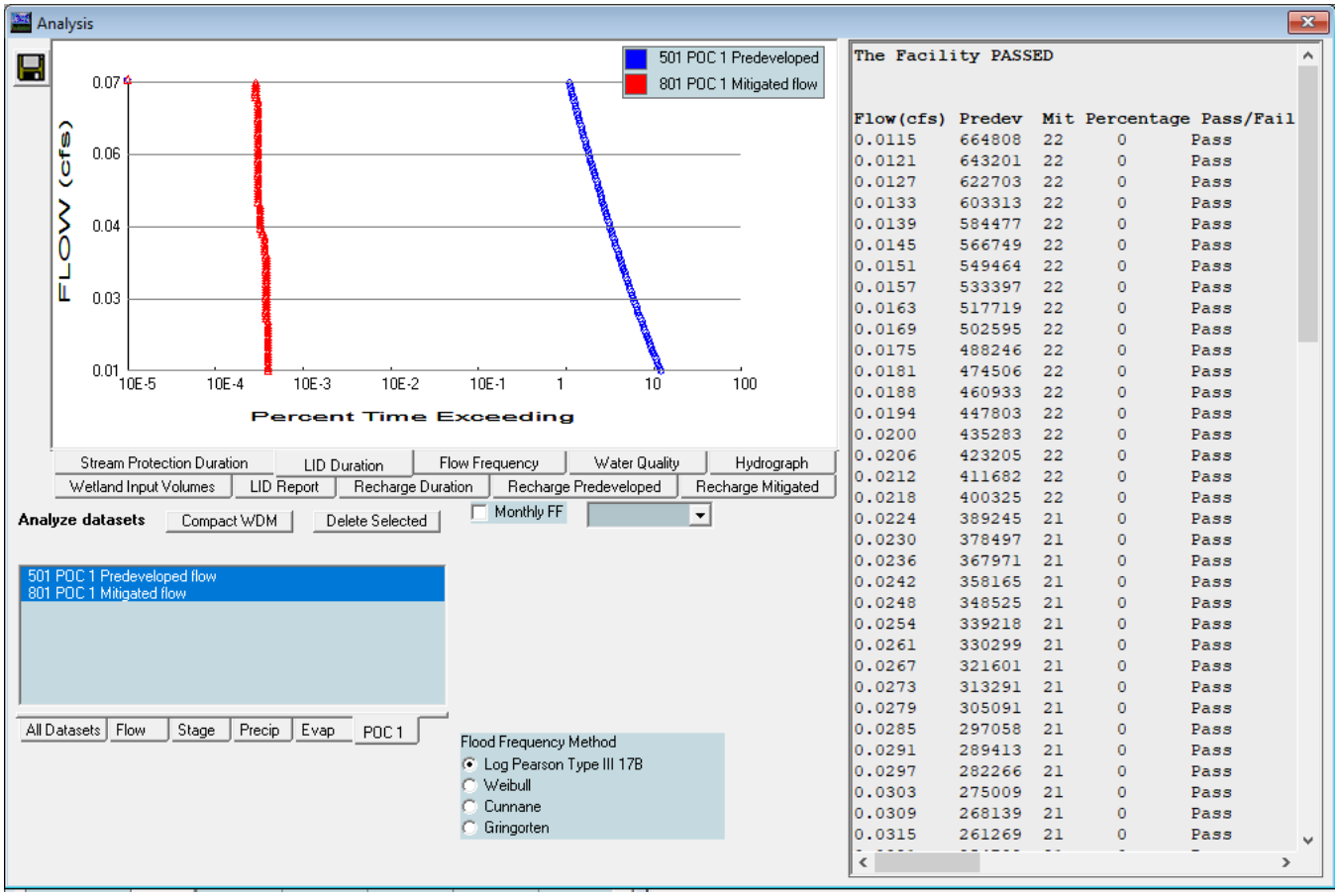
$$Area\ of\ pipe = 2 \times \frac{\pi}{4}(2.5ft)^2 = 9.817sf$$

$$Area\ of\ gravel = 35sf - 9.817sf = 25.183sf$$

$$Porosity = \frac{25.183sf \times 0.4 + 9.817sf \times 1.0}{35sf} = 0.57$$

Results:


Analysis
501 POC 1 Predeveloped
801 POC 1 Mitigated flow
FLOW (cfs)
0.36
0.29
0.21
0.14
0.07
10E-5
10E-4
10E-3
10E-2
10E-1
1
10
100
Percent Time Exceeding
Stream Protection Duration
LID Duration
Flow Frequency
Water Quality
Hydrograph
Wetland Input Volumes
LID Report
Recharge Duration
Recharge Predeveloped
Recharge Mitigated
Analyze datasets
Compact WDM
Delete Selected
Monthly FF
501 POC 1 Predeveloped flow
801 POC 1 Mitigated flow
All Datasets
Flow
Stage
Precip
Evap
POC 1
Flood Frequency Method
Log Pearson Type III 17B
Weibull
Cunnane
Gringorten
The Facility PASSED
Flow(cfs) Predev Mit Percentage Pass/Fail
0.0716 60110 16 0 Pass
0.0745 55029 15 0 Pass
0.0774 50365 15 0 Pass
0.0803 46165 15 0 Pass
0.0832 42337 15 0 Pass
0.0861 38963 14 0 Pass
0.0890 35994 13 0 Pass
0.0919 33268 13 0 Pass
0.0948 30686 13 0 Pass
0.0977 28315 13 0 Pass
0.1006 26371 13 0 Pass
0.1035 24520 12 0 Pass
0.1063 22803 12 0 Pass
0.1092 21252 12 0 Pass
0.1121 19839 12 0 Pass
0.1150 18537 12 0 Pass
0.1179 17219 12 0 Pass
0.1208 16005 12 0 Pass
0.1237 14914 12 0 Pass
0.1266 13928 12 0 Pass
0.1295 12997 12 0 Pass
0.1324 12149 12 0 Pass
0.1353 11329 12 0 Pass
0.1382 10598 12 0 Pass
0.1411 9861 12 0 Pass
0.1439 9180 12 0 Pass
0.1468 8543 12 0 Pass
0.1497 7972 12 0 Pass
0.1526 7435 12 0 Pass
0.1555 6947 12 0 Pass
0.1584 6554 12 0 Pass
0.1613 6194 12 0 Pass
0.1642 5906 12 0 Pass
0.1671 5590 12 0 Pass



WWHM2012
PROJECT REPORT

Project Name: Infiltration Trench
Site Name: PSD Support Campus
Site Address:
City :
Report Date: 3/26/2020
Gage : 42 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2019/09/13
Version : 4.2.17

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	5.95
Pervious Total	5.95

Impervious Land Use	acre
Impervious Total	0
Basin Total	5.95

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	1.6
Pervious Total	1.6

Impervious Land Use	acre
PARKING FLAT	4.35
Impervious Total	4.35
Basin Total	5.95

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Name : Gravel Trench Bed 1
Bottom Length: 952.00 ft.
Bottom Width: 5.00 ft.

Trench bottom slope 1: 0.001 To 1
Trench Left side slope 0: 0.001 To 1
Trench right side slope 2: 0.001 To 1
Material thickness of first layer: 2
Pour Space of material for first layer: 0.4
Material thickness of second layer: 7
Pour Space of material for second layer: 0.57
Material thickness of third layer: 1
Pour Space of material for third layer: 0.4
Infiltration On
Infiltration rate: 5
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 2177.479
Total Volume Through Riser (ac-ft.): 0.163
Total Volume Through Facility (ac-ft.): 2177.642
Percent Infiltrated: 99.99
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 10 ft.
Riser Diameter: 100 in.

Element Flows To:
Outlet 1 **Outlet 2**

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.109	0.000	0.000	0.000
0.1222	0.109	0.005	0.000	0.550
0.2444	0.109	0.010	0.000	0.550
0.3667	0.109	0.016	0.000	0.550
0.4889	0.109	0.021	0.000	0.550
0.6111	0.109	0.026	0.000	0.550
0.7333	0.109	0.032	0.000	0.550
0.8556	0.109	0.037	0.000	0.550
0.9778	0.109	0.042	0.000	0.550
1.1000	0.109	0.048	0.000	0.550
1.2222	0.109	0.053	0.000	0.550
1.3444	0.109	0.058	0.000	0.550
1.4667	0.109	0.064	0.000	0.550
1.5889	0.109	0.069	0.000	0.550
1.7111	0.109	0.074	0.000	0.550
1.8333	0.109	0.080	0.000	0.550
1.9556	0.109	0.085	0.000	0.550
2.0778	0.109	0.093	0.000	0.550
2.2000	0.109	0.100	0.000	0.550
2.3222	0.109	0.108	0.000	0.550
2.4444	0.109	0.116	0.000	0.550
2.5667	0.109	0.123	0.000	0.550
2.6889	0.109	0.131	0.000	0.550
2.8111	0.109	0.138	0.000	0.550
2.9333	0.109	0.146	0.000	0.550

3.0556	0.109	0.154	0.000	0.550
3.1778	0.109	0.161	0.000	0.550
3.3000	0.109	0.169	0.000	0.550
3.4222	0.109	0.177	0.000	0.550
3.5444	0.109	0.184	0.000	0.550
3.6667	0.109	0.192	0.000	0.550
3.7889	0.109	0.199	0.000	0.550
3.9111	0.109	0.207	0.000	0.550
4.0333	0.109	0.215	0.000	0.550
4.1556	0.109	0.222	0.000	0.550
4.2778	0.109	0.230	0.000	0.550
4.4000	0.109	0.238	0.000	0.550
4.5222	0.109	0.245	0.000	0.550
4.6444	0.109	0.253	0.000	0.550
4.7667	0.109	0.260	0.000	0.550
4.8889	0.109	0.268	0.000	0.550
5.0111	0.109	0.276	0.000	0.550
5.1333	0.109	0.283	0.000	0.550
5.2556	0.109	0.291	0.000	0.550
5.3778	0.109	0.299	0.000	0.550
5.5000	0.109	0.306	0.000	0.550
5.6222	0.109	0.314	0.000	0.550
5.7444	0.109	0.321	0.000	0.550
5.8667	0.109	0.329	0.000	0.550
5.9889	0.109	0.337	0.000	0.550
6.1111	0.109	0.344	0.000	0.550
6.2333	0.109	0.352	0.000	0.550
6.3556	0.109	0.360	0.000	0.550
6.4778	0.109	0.367	0.000	0.550
6.6000	0.109	0.375	0.000	0.550
6.7222	0.109	0.382	0.000	0.550
6.8444	0.109	0.390	0.000	0.550
6.9667	0.109	0.398	0.000	0.550
7.0889	0.109	0.405	0.000	0.550
7.2111	0.109	0.413	0.000	0.550
7.3333	0.109	0.421	0.000	0.550
7.4556	0.109	0.428	0.000	0.550
7.5778	0.109	0.436	0.000	0.550
7.7000	0.109	0.444	0.000	0.550
7.8222	0.109	0.451	0.000	0.550
7.9444	0.109	0.459	0.000	0.550
8.0667	0.109	0.466	0.000	0.550
8.1889	0.109	0.474	0.000	0.550
8.3111	0.109	0.482	0.000	0.550
8.4333	0.109	0.489	0.000	0.550
8.5556	0.109	0.497	0.000	0.550
8.6778	0.109	0.505	0.000	0.550
8.8000	0.109	0.512	0.000	0.550
8.9222	0.109	0.520	0.000	0.550
9.0444	0.109	0.525	0.000	0.550
9.1667	0.109	0.531	0.000	0.550
9.2889	0.109	0.536	0.000	0.550
9.4111	0.109	0.541	0.000	0.550
9.5333	0.109	0.547	0.000	0.550
9.6556	0.109	0.552	0.000	0.550
9.7778	0.109	0.557	0.000	0.550

9.9000	0.109	0.563	0.000	0.550
10.022	0.109	0.576	0.293	0.550
10.144	0.109	0.590	4.854	0.550
10.267	0.109	0.603	12.17	0.550
10.389	0.109	0.616	21.42	0.550
10.511	0.109	0.630	32.24	0.550
10.633	0.109	0.643	44.43	0.550
10.756	0.109	0.657	57.80	0.550
10.878	0.109	0.670	72.21	0.550
11.000	0.109	0.684	87.54	0.550

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:5.95
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:1.6
Total Impervious Area:4.35

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.143287
5 year	0.219835
10 year	0.26685
25 year	0.321173
50 year	0.357972
100 year	0.391825

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

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

Year	Predeveloped	Mitigated
1902	0.137	0.000
1903	0.088	0.000
1904	0.162	0.000
1905	0.077	0.000

1906	0.045	0.000
1907	0.224	0.000
1908	0.158	0.000
1909	0.153	0.000
1910	0.218	0.000
1911	0.142	0.000
1912	0.494	0.000
1913	0.221	0.000
1914	0.057	0.000
1915	0.098	0.000
1916	0.143	0.000
1917	0.050	0.000
1918	0.147	0.000
1919	0.124	0.000
1920	0.145	0.000
1921	0.159	0.000
1922	0.155	0.000
1923	0.127	0.000
1924	0.063	0.000
1925	0.083	0.000
1926	0.137	0.000
1927	0.113	0.000
1928	0.108	0.000
1929	0.217	0.000
1930	0.139	0.000
1931	0.136	0.000
1932	0.102	0.000
1933	0.120	0.000
1934	0.285	0.000
1935	0.134	0.000
1936	0.129	0.000
1937	0.194	0.000
1938	0.122	0.000
1939	0.013	0.000
1940	0.134	0.000
1941	0.087	0.000
1942	0.203	0.000
1943	0.096	0.000
1944	0.217	0.000
1945	0.162	0.000
1946	0.091	0.000
1947	0.072	0.000
1948	0.301	0.000
1949	0.268	0.000
1950	0.086	0.000
1951	0.110	0.000
1952	0.385	0.088
1953	0.356	0.000
1954	0.130	0.000
1955	0.113	0.000
1956	0.064	0.000
1957	0.189	0.000
1958	0.375	0.000
1959	0.234	0.000
1960	0.066	0.000
1961	0.237	0.000

1962	0.134	0.000
1963	0.063	0.000
1964	0.075	0.000
1965	0.268	0.000
1966	0.082	0.000
1967	0.121	0.000
1968	0.132	0.000
1969	0.122	0.000
1970	0.187	0.000
1971	0.280	0.000
1972	0.184	0.000
1973	0.240	0.000
1974	0.130	0.000
1975	0.292	0.000
1976	0.160	0.000
1977	0.081	0.000
1978	0.256	0.000
1979	0.079	0.000
1980	0.154	0.000
1981	0.148	0.000
1982	0.080	0.000
1983	0.236	0.000
1984	0.111	0.000
1985	0.177	0.000
1986	0.145	0.000
1987	0.274	0.000
1988	0.170	0.000
1989	0.157	0.000
1990	0.185	0.000
1991	0.146	0.000
1992	0.180	0.000
1993	0.191	0.000
1994	0.279	0.000
1995	0.069	0.000
1996	0.305	0.000
1997	0.137	0.000
1998	0.155	0.000
1999	0.021	0.000
2000	0.118	0.000
2001	0.061	0.000
2002	0.207	0.000
2003	0.179	0.000
2004	0.153	0.000
2005	0.295	0.000
2006	0.093	0.000
2007	0.102	0.000
2008	0.155	0.000
2009	0.106	0.000
2010	0.091	0.000
2011	0.084	0.000
2012	0.142	0.000
2013	0.091	0.000
2014	0.065	0.000
2015	0.126	0.000
2016	0.051	0.000
2017	0.206	0.000

2018	0.378	0.000
2019	0.399	1.575
2020	0.120	0.000
2021	0.195	0.000
2022	0.083	0.000
2023	0.164	0.000
2024	0.442	0.000
2025	0.146	0.000
2026	0.234	0.000
2027	0.093	0.000
2028	0.079	0.000
2029	0.156	0.000
2030	0.287	0.000
2031	0.092	0.000
2032	0.064	0.000
2033	0.087	0.000
2034	0.088	0.000
2035	0.336	0.000
2036	0.173	0.000
2037	0.049	0.000
2038	0.145	0.000
2039	0.024	0.000
2040	0.088	0.000
2041	0.104	0.000
2042	0.339	0.073
2043	0.164	0.000
2044	0.214	0.000
2045	0.141	0.000
2046	0.166	0.000
2047	0.124	0.000
2048	0.164	0.000
2049	0.147	0.000
2050	0.107	0.000
2051	0.170	0.000
2052	0.093	0.000
2053	0.158	0.000
2054	0.192	0.000
2055	0.080	0.000
2056	0.071	0.000
2057	0.109	0.000
2058	0.136	0.000
2059	0.227	0.000

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

Rank	Predeveloped	Mitigated
1	0.4936	1.5750
2	0.4423	0.0880
3	0.3992	0.0733
4	0.3848	0.0000
5	0.3778	0.0000
6	0.3752	0.0000
7	0.3558	0.0000
8	0.3393	0.0000
9	0.3363	0.0000

10	0.3047	0.0000
11	0.3010	0.0000
12	0.2953	0.0000
13	0.2917	0.0000
14	0.2874	0.0000
15	0.2853	0.0000
16	0.2801	0.0000
17	0.2790	0.0000
18	0.2736	0.0000
19	0.2682	0.0000
20	0.2679	0.0000
21	0.2562	0.0000
22	0.2401	0.0000
23	0.2374	0.0000
24	0.2364	0.0000
25	0.2345	0.0000
26	0.2336	0.0000
27	0.2266	0.0000
28	0.2238	0.0000
29	0.2210	0.0000
30	0.2179	0.0000
31	0.2167	0.0000
32	0.2166	0.0000
33	0.2137	0.0000
34	0.2066	0.0000
35	0.2058	0.0000
36	0.2033	0.0000
37	0.1955	0.0000
38	0.1936	0.0000
39	0.1923	0.0000
40	0.1911	0.0000
41	0.1888	0.0000
42	0.1872	0.0000
43	0.1846	0.0000
44	0.1840	0.0000
45	0.1800	0.0000
46	0.1794	0.0000
47	0.1768	0.0000
48	0.1727	0.0000
49	0.1703	0.0000
50	0.1701	0.0000
51	0.1656	0.0000
52	0.1643	0.0000
53	0.1641	0.0000
54	0.1640	0.0000
55	0.1616	0.0000
56	0.1615	0.0000
57	0.1604	0.0000
58	0.1592	0.0000
59	0.1583	0.0000
60	0.1577	0.0000
61	0.1565	0.0000
62	0.1563	0.0000
63	0.1555	0.0000
64	0.1551	0.0000
65	0.1550	0.0000

66	0.1544	0.0000
67	0.1534	0.0000
68	0.1531	0.0000
69	0.1475	0.0000
70	0.1472	0.0000
71	0.1471	0.0000
72	0.1465	0.0000
73	0.1457	0.0000
74	0.1455	0.0000
75	0.1453	0.0000
76	0.1452	0.0000
77	0.1430	0.0000
78	0.1419	0.0000
79	0.1418	0.0000
80	0.1411	0.0000
81	0.1394	0.0000
82	0.1375	0.0000
83	0.1371	0.0000
84	0.1367	0.0000
85	0.1363	0.0000
86	0.1359	0.0000
87	0.1340	0.0000
88	0.1340	0.0000
89	0.1339	0.0000
90	0.1318	0.0000
91	0.1303	0.0000
92	0.1296	0.0000
93	0.1294	0.0000
94	0.1269	0.0000
95	0.1257	0.0000
96	0.1242	0.0000
97	0.1239	0.0000
98	0.1224	0.0000
99	0.1222	0.0000
100	0.1206	0.0000
101	0.1200	0.0000
102	0.1197	0.0000
103	0.1177	0.0000
104	0.1134	0.0000
105	0.1132	0.0000
106	0.1106	0.0000
107	0.1100	0.0000
108	0.1091	0.0000
109	0.1079	0.0000
110	0.1067	0.0000
111	0.1059	0.0000
112	0.1038	0.0000
113	0.1024	0.0000
114	0.1018	0.0000
115	0.0981	0.0000
116	0.0959	0.0000
117	0.0930	0.0000
118	0.0928	0.0000
119	0.0927	0.0000
120	0.0925	0.0000
121	0.0911	0.0000

122	0.0909	0.0000
123	0.0908	0.0000
124	0.0880	0.0000
125	0.0879	0.0000
126	0.0876	0.0000
127	0.0871	0.0000
128	0.0870	0.0000
129	0.0858	0.0000
130	0.0836	0.0000
131	0.0831	0.0000
132	0.0827	0.0000
133	0.0821	0.0000
134	0.0806	0.0000
135	0.0801	0.0000
136	0.0797	0.0000
137	0.0790	0.0000
138	0.0788	0.0000
139	0.0765	0.0000
140	0.0750	0.0000
141	0.0723	0.0000
142	0.0712	0.0000
143	0.0685	0.0000
144	0.0656	0.0000
145	0.0652	0.0000
146	0.0643	0.0000
147	0.0640	0.0000
148	0.0629	0.0000
149	0.0628	0.0000
150	0.0610	0.0000
151	0.0572	0.0000
152	0.0515	0.0000
153	0.0502	0.0000
154	0.0494	0.0000
155	0.0454	0.0000
156	0.0240	0.0000
157	0.0214	0.0000
158	0.0135	0.0000

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0716	60110	16	0	Pass
0.0745	55029	15	0	Pass
0.0774	50365	15	0	Pass
0.0803	46165	15	0	Pass
0.0832	42337	15	0	Pass
0.0861	38963	14	0	Pass
0.0890	35994	13	0	Pass
0.0919	33268	13	0	Pass
0.0948	30686	13	0	Pass
0.0977	28315	13	0	Pass

0.1006	26371	13	0	Pass
0.1035	24520	12	0	Pass
0.1063	22803	12	0	Pass
0.1092	21252	12	0	Pass
0.1121	19839	12	0	Pass
0.1150	18537	12	0	Pass
0.1179	17219	12	0	Pass
0.1208	16005	12	0	Pass
0.1237	14914	12	0	Pass
0.1266	13928	12	0	Pass
0.1295	12997	12	0	Pass
0.1324	12149	12	0	Pass
0.1353	11329	12	0	Pass
0.1382	10598	12	0	Pass
0.1411	9861	12	0	Pass
0.1439	9180	12	0	Pass
0.1468	8543	12	0	Pass
0.1497	7972	12	0	Pass
0.1526	7435	12	0	Pass
0.1555	6947	12	0	Pass
0.1584	6554	12	0	Pass
0.1613	6194	12	0	Pass
0.1642	5906	12	0	Pass
0.1671	5590	12	0	Pass
0.1700	5277	11	0	Pass
0.1729	5012	11	0	Pass
0.1758	4769	11	0	Pass
0.1787	4528	11	0	Pass
0.1815	4295	11	0	Pass
0.1844	4071	11	0	Pass
0.1873	3861	11	0	Pass
0.1902	3653	11	0	Pass
0.1931	3442	11	0	Pass
0.1960	3281	11	0	Pass
0.1989	3124	11	0	Pass
0.2018	2980	10	0	Pass
0.2047	2830	10	0	Pass
0.2076	2687	10	0	Pass
0.2105	2578	10	0	Pass
0.2134	2452	10	0	Pass
0.2163	2359	10	0	Pass
0.2191	2239	10	0	Pass
0.2220	2140	10	0	Pass
0.2249	1991	10	0	Pass
0.2278	1869	10	0	Pass
0.2307	1757	10	0	Pass
0.2336	1672	9	0	Pass
0.2365	1585	8	0	Pass
0.2394	1507	8	0	Pass
0.2423	1430	8	0	Pass
0.2452	1355	8	0	Pass
0.2481	1296	8	0	Pass
0.2510	1234	8	0	Pass
0.2539	1182	7	0	Pass
0.2567	1119	6	0	Pass
0.2596	1073	6	0	Pass

0.2625	1026	6	0	Pass
0.2654	966	5	0	Pass
0.2683	895	5	0	Pass
0.2712	832	5	0	Pass
0.2741	783	5	0	Pass
0.2770	737	5	0	Pass
0.2799	679	5	0	Pass
0.2828	631	5	0	Pass
0.2857	589	5	0	Pass
0.2886	555	5	0	Pass
0.2915	510	5	0	Pass
0.2943	475	5	1	Pass
0.2972	431	5	1	Pass
0.3001	389	5	1	Pass
0.3030	367	5	1	Pass
0.3059	340	5	1	Pass
0.3088	304	5	1	Pass
0.3117	281	5	1	Pass
0.3146	265	5	1	Pass
0.3175	247	5	2	Pass
0.3204	233	5	2	Pass
0.3233	219	5	2	Pass
0.3262	205	5	2	Pass
0.3290	182	5	2	Pass
0.3319	161	5	3	Pass
0.3348	139	5	3	Pass
0.3377	117	5	4	Pass
0.3406	110	5	4	Pass
0.3435	101	5	4	Pass
0.3464	92	5	5	Pass
0.3493	85	5	5	Pass
0.3522	73	5	6	Pass
0.3551	64	5	7	Pass
0.3580	54	5	9	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.0322 **acre-feet**
On-line facility target flow: 0.0453 **cfs.**
Adjusted for 15 min: 0.0453 **cfs.**
Off-line facility target flow: 0.0264 **cfs.**
Adjusted for 15 min: 0.0264 **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 Water Quality Treated	Percent Water Quality Infiltrated	Comment
Gravel Trench Bed 1 POC	N	1981.65			N	99.99		
Total Volume Infiltrated		1981.65	0.00	0.00			99.99	
0.00	0%	No Treat. Credit						
Compliance with LID				Standard				8
Duration Analysis Result = Passed								

Perlnd and Implnd Changes

No changes have been made.

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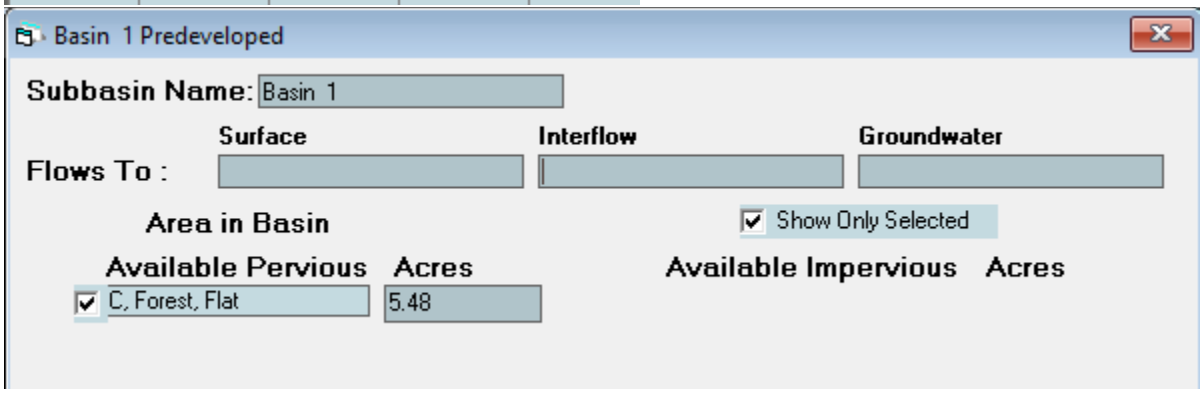
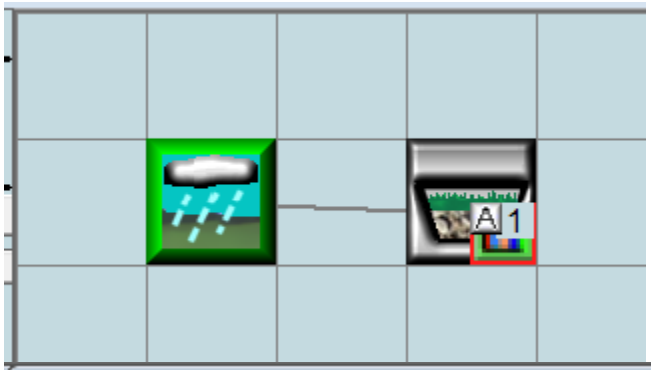
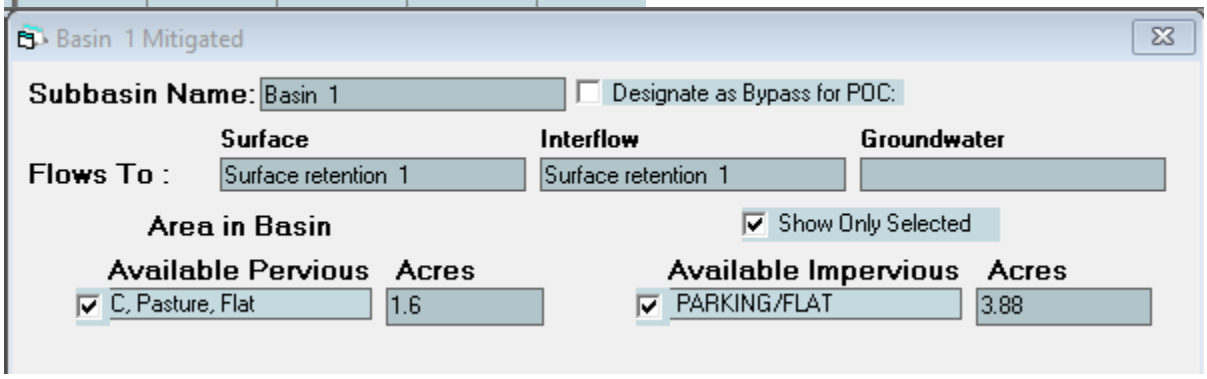
APPENDIX C – Bioretention Treatment Calculations

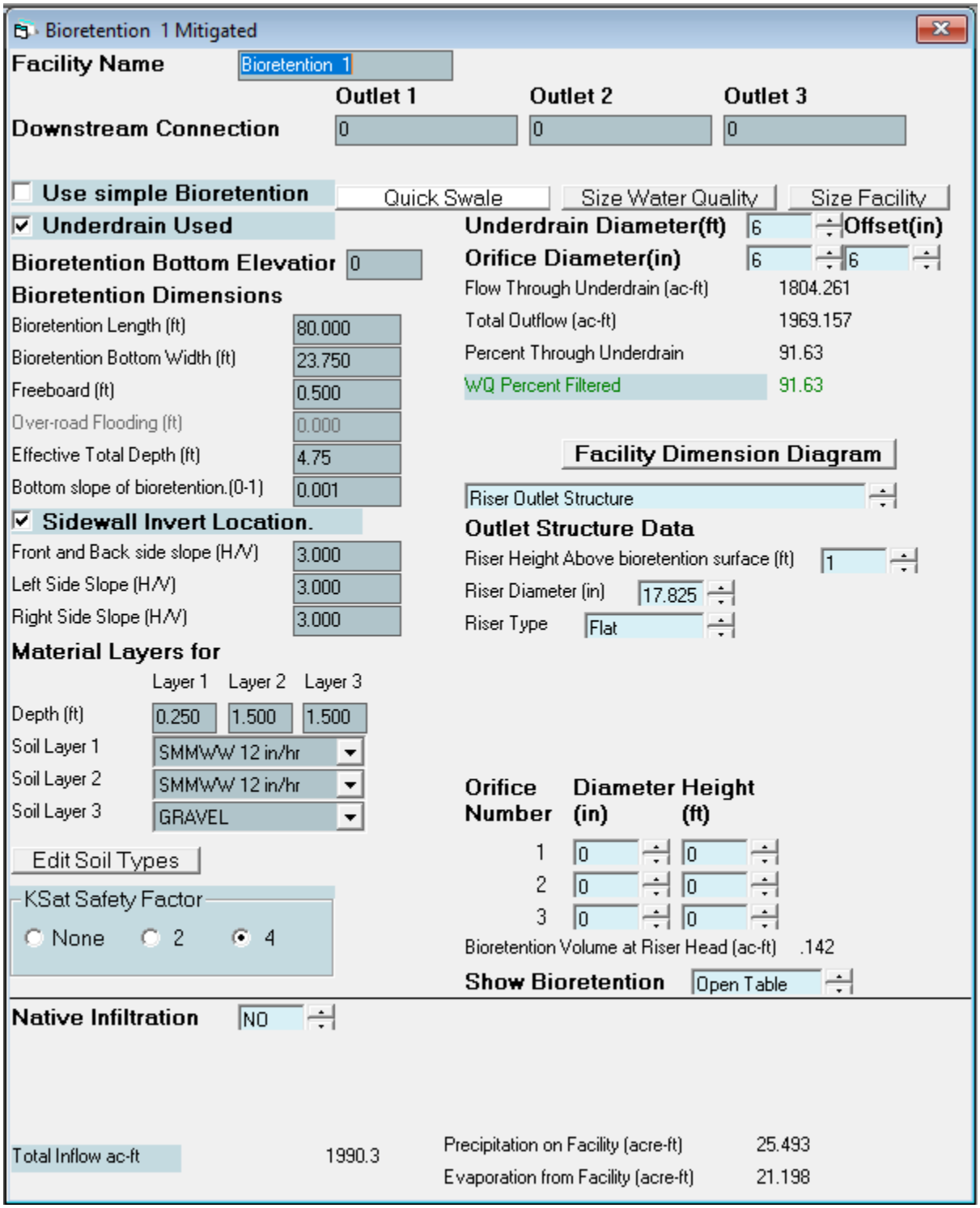
Predeveloped Conditions:



Mitigated Conditions:







WWHM2012
PROJECT REPORT

Project Name: Bioretention
Site Name: Kessler Center

Site Address:
City :
Report Date: 3/26/2020
Gage : 42 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2019/09/13
Version : 4.2.17

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	5.48
Pervious Total	5.48

Impervious Land Use	acre
Impervious Total	0
Basin Total	5.48

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	1.6
Pervious Total	1.6

Impervious Land Use	acre
PARKING FLAT	3.88
Impervious Total	3.88
Basin Total	5.48

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 1	Surface retention 1	

Name : Bioretention 1
Bottom Length: 80.00 ft.
Bottom Width: 23.75 ft.
Material thickness of first layer: 0.25
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 1.5
Material type for second layer: SMMWW 12 in/hr
Material thickness of third layer: 1.5
Material type for third layer: GRAVEL
Underdrain used
Underdrain Diameter (feet): 6
Orifice Diameter (in.): 6
Offset (in.): 6
Flow Through Underdrain (ac-ft.): 1804.261
Total Outflow (ac-ft.): 1969.157
Percent Through Underdrain: 91.63
Discharge Structure
Riser Height: 1 ft.
Riser Diameter: 17.825 in.

Element Flows To:

Outlet 1	Outlet 2

Bioretention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0436	0.0000	0.0000	0.0000
0.0522	0.0436	0.0010	0.0000	0.0000
0.1044	0.0436	0.0021	0.0000	0.0000
0.1566	0.0436	0.0031	0.0000	0.0000
0.2088	0.0436	0.0042	0.0000	0.0000
0.2610	0.0436	0.0052	0.0000	0.0000
0.3132	0.0436	0.0062	0.0000	0.0000
0.3654	0.0436	0.0073	0.0000	0.0000
0.4176	0.0436	0.0083	0.0000	0.0000
0.4698	0.0436	0.0094	0.0000	0.0000
0.5220	0.0436	0.0104	0.0000	0.0000

0.5742	0.0436	0.0115	0.0000	0.0000
0.6264	0.0436	0.0125	0.0000	0.0000
0.6786	0.0436	0.0135	0.0000	0.0000
0.7308	0.0436	0.0146	0.0000	0.0000
0.7830	0.0436	0.0156	0.0000	0.0000
0.8352	0.0436	0.0167	0.0000	0.0000
0.8874	0.0436	0.0177	0.0000	0.0000
0.9396	0.0436	0.0187	0.0000	0.0000
0.9918	0.0436	0.0198	0.0000	0.0000
1.0440	0.0436	0.0208	0.0000	0.0000
1.0962	0.0436	0.0219	0.0000	0.0000
1.1484	0.0436	0.0229	0.0000	0.0000
1.2005	0.0436	0.0239	0.0000	0.0000
1.2527	0.0436	0.0250	0.0000	0.0000
1.3049	0.0436	0.0260	0.0000	0.0000
1.3571	0.0436	0.0271	0.0000	0.0000
1.4093	0.0436	0.0281	0.0000	0.0000
1.4615	0.0436	0.0292	0.0000	0.0000
1.5137	0.0436	0.0302	0.0000	0.0000
1.5659	0.0436	0.0312	0.0000	0.0000
1.6181	0.0436	0.0323	0.0000	0.0000
1.6703	0.0436	0.0333	0.0000	0.0000
1.7225	0.0436	0.0344	0.0000	0.0000
1.7747	0.0436	0.0353	0.0000	0.0000
1.8269	0.0436	0.0362	0.0000	0.0000
1.8791	0.0436	0.0372	0.0000	0.0000
1.9313	0.0436	0.0381	0.0000	0.0000
1.9835	0.0436	0.0391	0.0000	0.0000
2.0357	0.0436	0.0400	0.0000	0.0000
2.0879	0.0436	0.0410	0.0000	0.0000
2.1401	0.0436	0.0419	0.0000	0.0000
2.1923	0.0436	0.0429	0.0000	0.0000
2.2445	0.0436	0.0438	0.0000	0.0000
2.2967	0.0436	0.0448	0.0522	0.0000
2.3489	0.0436	0.0457	0.2419	0.0000
2.4011	0.0436	0.0466	0.2419	0.0000
2.4533	0.0436	0.0476	0.2419	0.0000
2.5055	0.0436	0.0485	0.2419	0.0000
2.5577	0.0436	0.0495	0.2419	0.0000
2.6099	0.0436	0.0504	0.2419	0.0000
2.6621	0.0436	0.0514	0.2419	0.0000
2.7143	0.0436	0.0523	0.2419	0.0000
2.7665	0.0436	0.0533	0.2419	0.0000
2.8187	0.0436	0.0542	0.2419	0.0000
2.8709	0.0436	0.0551	0.2419	0.0000
2.9231	0.0436	0.0561	0.2419	0.0000
2.9753	0.0436	0.0570	0.2419	0.0000
3.0275	0.0436	0.0580	0.2419	0.0000
3.0797	0.0436	0.0589	0.2419	0.0000
3.1319	0.0436	0.0599	0.2419	0.0000
3.1841	0.0436	0.0608	0.2419	0.0000
3.2363	0.0436	0.0618	0.2419	0.0000
3.2500	0.0436	0.0620	0.2419	0.0000

Surface retention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface

3.2500	0.0436	0.0620	0.0000	0.1319	0.0000
3.3022	0.0444	0.0643	0.0000	0.1319	0.0000
3.3544	0.0451	0.0666	0.0000	0.1631	0.0000
3.4066	0.0459	0.0690	0.0000	0.1677	0.0000
3.4588	0.0466	0.0714	0.0000	0.1723	0.0000
3.5110	0.0474	0.0739	0.0000	0.1769	0.0000
3.5632	0.0482	0.0764	0.0000	0.1815	0.0000
3.6154	0.0489	0.0789	0.0000	0.1861	0.0000
3.6676	0.0497	0.0815	0.0000	0.1907	0.0000
3.7198	0.0505	0.0841	0.0000	0.1953	0.0000
3.7720	0.0513	0.0868	0.0000	0.1999	0.0000
3.8242	0.0521	0.0895	0.0000	0.2044	0.0000
3.8764	0.0529	0.0922	0.0000	0.2090	0.0000
3.9286	0.0537	0.0950	0.0000	0.2136	0.0000
3.9808	0.0545	0.0978	0.0000	0.2182	0.0000
4.0330	0.0553	0.1007	0.0000	0.2228	0.0000
4.0852	0.0561	0.1036	0.0000	0.2274	0.0000
4.1374	0.0569	0.1065	0.0000	0.2320	0.0000
4.1896	0.0578	0.1095	0.0000	0.2366	0.0000
4.2418	0.0586	0.1126	0.0000	0.2412	0.0000
4.2940	0.0594	0.1156	0.1452	0.2458	0.0000
4.3462	0.0603	0.1188	0.4689	0.2504	0.0000
4.3984	0.0611	0.1219	0.8952	0.2549	0.0000
4.4505	0.0620	0.1251	1.3958	0.2595	0.0000
4.5027	0.0628	0.1284	1.9481	0.2641	0.0000
4.5549	0.0637	0.1317	2.5294	0.2687	0.0000
4.6071	0.0645	0.1351	3.1165	0.2733	0.0000
4.6593	0.0654	0.1384	3.6860	0.2779	0.0000
4.7115	0.0663	0.1419	4.2159	0.2825	0.0000
4.7500	0.0669	0.1444	4.6875	0.2859	0.0000

Name : Surface retention 1

Element Flows To:

Outlet 1	**Outlet 2**
Bioretention 1	

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:5.48
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:1.6
Total Impervious Area:3.88

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.131968
5 year	0.20247
10 year	0.245771
25 year	0.295803
50 year	0.329695
100 year	0.360874

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	1.243534
5 year	1.704423
10 year	2.030838
25 year	2.46786
50 year	2.811538
100 year	3.170968

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

Year	Predeveloped	Mitigated
1902	0.127	1.419
1903	0.081	1.694
1904	0.149	2.004
1905	0.071	0.848
1906	0.042	0.922
1907	0.206	1.411
1908	0.145	1.048
1909	0.141	1.384
1910	0.201	1.347
1911	0.131	1.328
1912	0.455	2.704
1913	0.204	0.783
1914	0.053	4.035
1915	0.090	0.710
1916	0.132	1.645
1917	0.046	0.670
1918	0.136	1.299
1919	0.114	0.650
1920	0.134	1.028
1921	0.147	0.868
1922	0.143	1.050
1923	0.117	1.092
1924	0.058	1.465
1925	0.077	0.785
1926	0.126	1.570
1927	0.104	1.156
1928	0.099	1.037
1929	0.200	1.888
1930	0.128	2.012
1931	0.126	0.947
1932	0.094	1.104
1933	0.110	1.041

1934	0.263	1.751
1935	0.123	0.878
1936	0.119	1.103
1937	0.178	1.508
1938	0.113	0.925
1939	0.012	1.128
1940	0.123	1.808
1941	0.080	1.481
1942	0.187	1.496
1943	0.088	1.516
1944	0.200	2.214
1945	0.149	1.635
1946	0.084	1.261
1947	0.067	1.005
1948	0.277	1.250
1949	0.247	1.909
1950	0.079	0.804
1951	0.101	1.053
1952	0.354	2.198
1953	0.328	1.980
1954	0.120	1.116
1955	0.104	0.750
1956	0.059	0.628
1957	0.174	0.969
1958	0.346	1.443
1959	0.215	1.457
1960	0.060	1.023
1961	0.219	3.051
1962	0.123	1.288
1963	0.058	0.746
1964	0.069	2.345
1965	0.247	1.224
1966	0.076	0.855
1967	0.111	0.953
1968	0.121	0.941
1969	0.113	1.178
1970	0.172	1.293
1971	0.258	1.335
1972	0.169	3.696
1973	0.221	2.084
1974	0.119	1.675
1975	0.269	1.926
1976	0.148	1.916
1977	0.074	0.812
1978	0.236	1.504
1979	0.073	1.351
1980	0.142	1.153
1981	0.136	1.365
1982	0.074	0.995
1983	0.218	1.543
1984	0.102	1.460
1985	0.163	1.146
1986	0.134	0.878
1987	0.252	1.303
1988	0.157	0.908
1989	0.144	0.825

1990	0.170	1.077
1991	0.134	1.447
1992	0.166	1.459
1993	0.176	1.771
1994	0.257	1.264
1995	0.063	0.737
1996	0.281	1.261
1997	0.126	0.934
1998	0.143	1.347
1999	0.020	1.162
2000	0.108	1.340
2001	0.056	0.914
2002	0.190	1.961
2003	0.165	1.091
2004	0.141	1.647
2005	0.272	2.710
2006	0.086	0.847
2007	0.094	1.621
2008	0.143	1.112
2009	0.098	1.022
2010	0.084	1.366
2011	0.077	0.674
2012	0.131	1.336
2013	0.084	0.899
2014	0.060	1.087
2015	0.116	1.993
2016	0.047	0.731
2017	0.190	2.003
2018	0.348	1.312
2019	0.368	1.821
2020	0.111	1.481
2021	0.180	1.279
2022	0.076	1.925
2023	0.151	2.321
2024	0.407	2.899
2025	0.135	0.778
2026	0.216	1.424
2027	0.085	1.287
2028	0.073	0.535
2029	0.144	1.082
2030	0.265	1.578
2031	0.085	0.699
2032	0.059	0.766
2033	0.080	0.654
2034	0.081	1.076
2035	0.310	1.423
2036	0.159	0.958
2037	0.046	1.166
2038	0.134	1.431
2039	0.022	2.529
2040	0.081	1.135
2041	0.096	1.372
2042	0.312	1.530
2043	0.151	1.437
2044	0.197	1.202
2045	0.130	1.017

2046	0.153	0.958
2047	0.114	1.399
2048	0.151	1.137
2049	0.136	1.624
2050	0.098	1.168
2051	0.157	1.805
2052	0.086	0.901
2053	0.146	1.105
2054	0.177	1.743
2055	0.073	1.256
2056	0.066	1.449
2057	0.101	0.883
2058	0.125	1.350
2059	0.209	1.419

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

Rank	Predeveloped	Mitigated
1	0.4546	4.0353
2	0.4073	3.6964
3	0.3676	3.0506
4	0.3544	2.8988
5	0.3480	2.7101
6	0.3456	2.7042
7	0.3277	2.5291
8	0.3125	2.3455
9	0.3098	2.3205
10	0.2807	2.2138
11	0.2772	2.1976
12	0.2719	2.0837
13	0.2686	2.0123
14	0.2647	2.0037
15	0.2628	2.0035
16	0.2580	1.9929
17	0.2569	1.9805
18	0.2520	1.9613
19	0.2470	1.9261
20	0.2468	1.9250
21	0.2360	1.9156
22	0.2211	1.9087
23	0.2187	1.8885
24	0.2178	1.8206
25	0.2160	1.8084
26	0.2151	1.8046
27	0.2087	1.7714
28	0.2061	1.7511
29	0.2035	1.7428
30	0.2007	1.6945
31	0.1996	1.6750
32	0.1995	1.6472
33	0.1969	1.6447
34	0.1903	1.6346
35	0.1896	1.6238
36	0.1873	1.6210
37	0.1800	1.5784

38	0.1783	1.5696
39	0.1771	1.5431
40	0.1760	1.5297
41	0.1739	1.5156
42	0.1724	1.5078
43	0.1700	1.5038
44	0.1694	1.4958
45	0.1658	1.4813
46	0.1652	1.4811
47	0.1628	1.4648
48	0.1590	1.4601
49	0.1569	1.4594
50	0.1567	1.4574
51	0.1525	1.4491
52	0.1514	1.4474
53	0.1511	1.4427
54	0.1510	1.4369
55	0.1489	1.4314
56	0.1488	1.4239
57	0.1477	1.4226
58	0.1466	1.4192
59	0.1458	1.4191
60	0.1452	1.4111
61	0.1441	1.3985
62	0.1440	1.3836
63	0.1432	1.3716
64	0.1428	1.3659
65	0.1427	1.3647
66	0.1422	1.3515
67	0.1412	1.3499
68	0.1410	1.3474
69	0.1359	1.3468
70	0.1356	1.3399
71	0.1355	1.3357
72	0.1349	1.3354
73	0.1342	1.3282
74	0.1340	1.3119
75	0.1338	1.3027
76	0.1337	1.2986
77	0.1317	1.2929
78	0.1307	1.2883
79	0.1306	1.2868
80	0.1299	1.2788
81	0.1284	1.2637
82	0.1266	1.2606
83	0.1263	1.2605
84	0.1259	1.2557
85	0.1255	1.2503
86	0.1252	1.2244
87	0.1234	1.2016
88	0.1234	1.1780
89	0.1233	1.1685
90	0.1214	1.1658
91	0.1200	1.1620
92	0.1194	1.1562
93	0.1192	1.1533

94	0.1169	1.1464
95	0.1158	1.1365
96	0.1144	1.1354
97	0.1141	1.1284
98	0.1127	1.1162
99	0.1125	1.1120
100	0.1110	1.1054
101	0.1106	1.1039
102	0.1102	1.1035
103	0.1084	1.0919
104	0.1045	1.0907
105	0.1042	1.0871
106	0.1018	1.0821
107	0.1013	1.0769
108	0.1005	1.0756
109	0.0994	1.0535
110	0.0983	1.0497
111	0.0976	1.0480
112	0.0956	1.0414
113	0.0943	1.0370
114	0.0938	1.0285
115	0.0903	1.0226
116	0.0883	1.0224
117	0.0857	1.0166
118	0.0855	1.0048
119	0.0854	0.9955
120	0.0852	0.9686
121	0.0839	0.9584
122	0.0837	0.9576
123	0.0836	0.9525
124	0.0810	0.9468
125	0.0809	0.9409
126	0.0806	0.9345
127	0.0802	0.9253
128	0.0801	0.9219
129	0.0790	0.9145
130	0.0770	0.9079
131	0.0766	0.9010
132	0.0762	0.8985
133	0.0756	0.8831
134	0.0743	0.8784
135	0.0738	0.8777
136	0.0734	0.8679
137	0.0727	0.8554
138	0.0726	0.8481
139	0.0705	0.8469
140	0.0691	0.8252
141	0.0665	0.8117
142	0.0655	0.8042
143	0.0631	0.7853
144	0.0605	0.7834
145	0.0600	0.7777
146	0.0593	0.7663
147	0.0590	0.7496
148	0.0579	0.7455
149	0.0578	0.7373

150	0.0562	0.7311
151	0.0527	0.7100
152	0.0474	0.6989
153	0.0462	0.6742
154	0.0455	0.6701
155	0.0418	0.6541
156	0.0221	0.6502
157	0.0197	0.6278
158	0.0124	0.5350

Stream Protection Duration
POC #1
The Facility FAILED

Facility FAILED duration standard for 1+ flows.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0660	664808	926853	139	Fail
0.0686	643201	907462	141	Fail
0.0713	622703	888626	142	Fail
0.0740	603313	871452	144	Fail
0.0766	584477	854832	146	Fail
0.0793	566749	839874	148	Fail
0.0820	549630	824916	150	Fail
0.0846	533231	811065	152	Fail
0.0873	517774	797769	154	Fail
0.0900	502539	785581	156	Fail
0.0926	488412	773947	158	Fail
0.0953	474396	762313	160	Fail
0.0979	461044	751233	162	Fail
0.1006	447803	740707	165	Fail
0.1033	435227	730734	167	Fail
0.1059	423316	721316	170	Fail
0.1086	411571	712452	173	Fail
0.1113	400380	703588	175	Fail
0.1139	389245	695278	178	Fail
0.1166	378442	686968	181	Fail
0.1193	368026	679212	184	Fail
0.1219	358054	671456	187	Fail
0.1246	348525	664254	190	Fail
0.1273	339218	657606	193	Fail
0.1299	330409	650958	197	Fail
0.1326	321656	643755	200	Fail
0.1352	313180	637661	203	Fail
0.1379	305091	631567	207	Fail
0.1406	297058	626027	210	Fail
0.1432	289524	619933	214	Fail
0.1459	282155	614393	217	Fail
0.1486	275009	609407	221	Fail
0.1512	268139	603867	225	Fail
0.1539	261269	598881	229	Fail
0.1566	254788	593895	233	Fail
0.1592	248527	588909	236	Fail
0.1619	242489	584477	241	Fail
0.1645	236616	580045	245	Fail

0.1672	231076	575613	249	Fail
0.1699	225425	571181	253	Fail
0.1725	219885	566749	257	Fail
0.1752	214733	562871	262	Fail
0.1779	209525	558438	266	Fail
0.1805	204539	554560	271	Fail
0.1832	199664	550627	275	Fail
0.1859	194899	546804	280	Fail
0.1885	190412	543203	285	Fail
0.1912	185925	539436	290	Fail
0.1938	181714	535890	294	Fail
0.1965	177614	532289	299	Fail
0.1992	173570	528855	304	Fail
0.2018	169581	525364	309	Fail
0.2045	165648	521985	315	Fail
0.2072	161991	518716	320	Fail
0.2098	158335	515337	325	Fail
0.2125	154789	512124	330	Fail
0.2152	151299	508910	336	Fail
0.2178	148086	505808	341	Fail
0.2205	144762	502595	347	Fail
0.2231	141438	499437	353	Fail
0.2258	138335	496501	358	Fail
0.2285	135233	493454	364	Fail
0.2311	132241	490573	370	Fail
0.2338	129305	487581	377	Fail
0.2365	126369	484589	383	Fail
0.2391	123543	481709	389	Fail
0.2418	120829	478662	396	Fail
0.2445	118225	475781	402	Fail
0.2471	115621	472844	408	Fail
0.2498	113239	469853	414	Fail
0.2524	110690	466861	421	Fail
0.2551	108253	463925	428	Fail
0.2578	105871	461044	435	Fail
0.2604	103599	458163	442	Fail
0.2631	101328	455282	449	Fail
0.2658	99112	452512	456	Fail
0.2684	96951	450629	464	Fail
0.2711	94957	448801	472	Fail
0.2738	92851	447028	481	Fail
0.2764	90857	445310	490	Fail
0.2791	88863	443538	499	Fail
0.2817	87034	441820	507	Fail
0.2844	85206	440103	516	Fail
0.2871	83378	438441	525	Fail
0.2897	81661	436834	534	Fail
0.2924	80054	435117	543	Fail
0.2951	78392	433510	553	Fail
0.2977	76730	431848	562	Fail
0.3004	75123	430297	572	Fail
0.3031	73572	428635	582	Fail
0.3057	72021	427084	592	Fail
0.3084	70580	425588	602	Fail
0.3110	69085	424036	613	Fail
0.3137	67644	422541	624	Fail

0.3164	66315	421100	634	Fail
0.3190	65040	419604	645	Fail
0.3217	63766	418109	655	Fail
0.3244	62492	416668	666	Fail
0.3270	61273	415228	677	Fail
0.3297	60110	413787	688	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 BMP Flow and Volume for POC #1
On-line facility volume: 0.1405 **acre-feet**
On-line facility target flow: 0.1719 **cfs.**
Adjusted for 15 min: 0.1719 **cfs.**
Off-line facility target flow: 0.0991 **cfs.**
Adjusted for 15 min: 0.0991 **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 Water Quality Treated	Comment
retention 1 POC	N	1791.93			N	0.00	
Total Volume Infiltrated		1791.93	0.00	0.00		0.00	
0.00	0%	No Treat. Credit					
Compliance with LID Standard							8
Duration Analysis Result = Failed							

Perlnd and Implnd Changes

No changes have been made.

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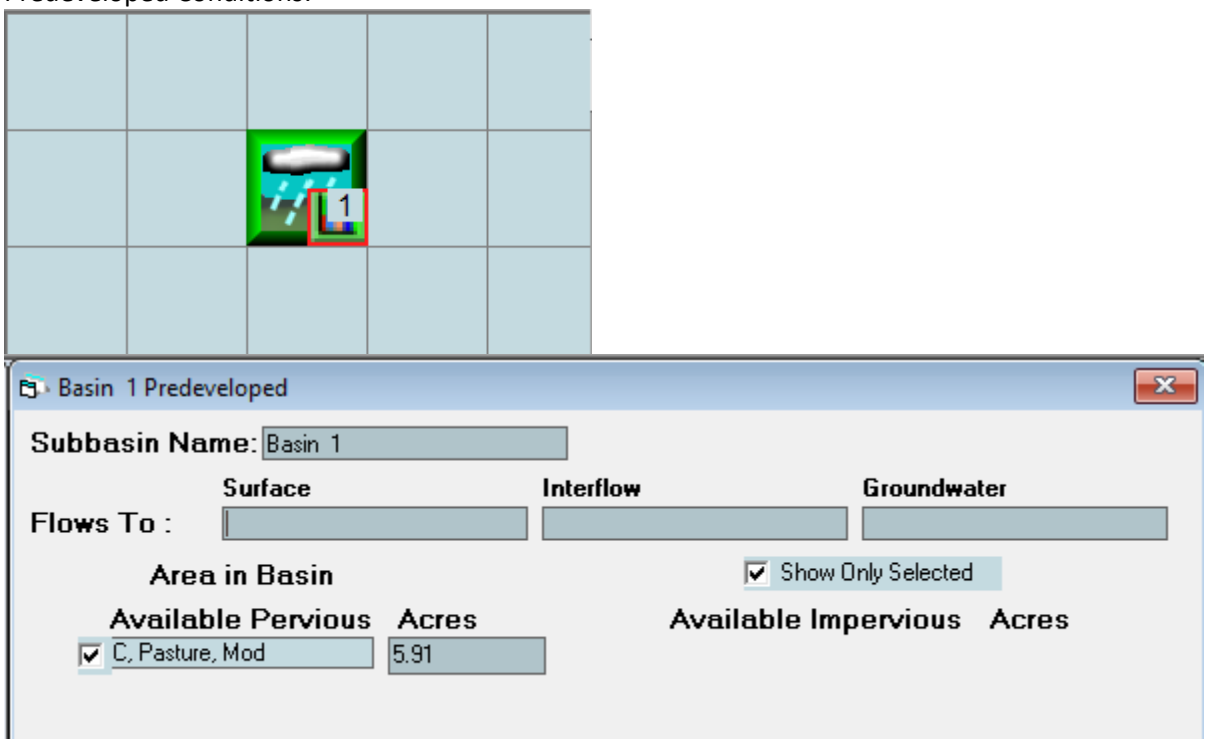
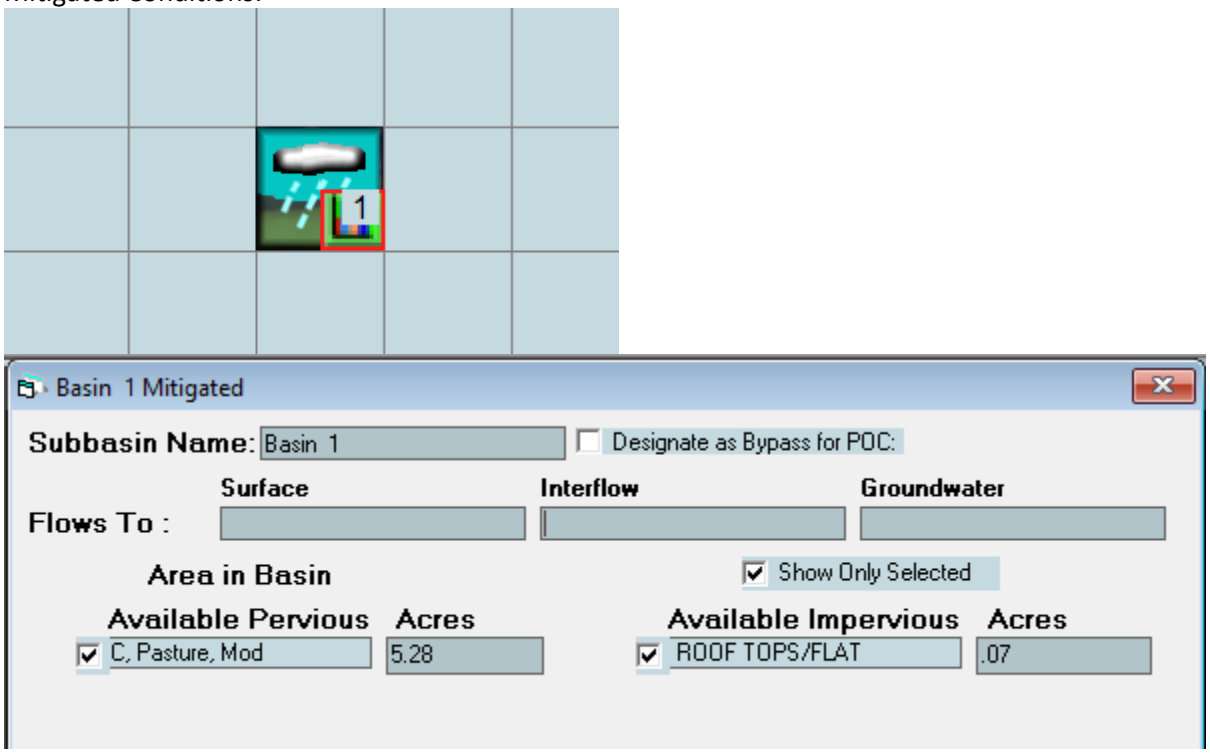
APPENDIX D – Wetland Analysis

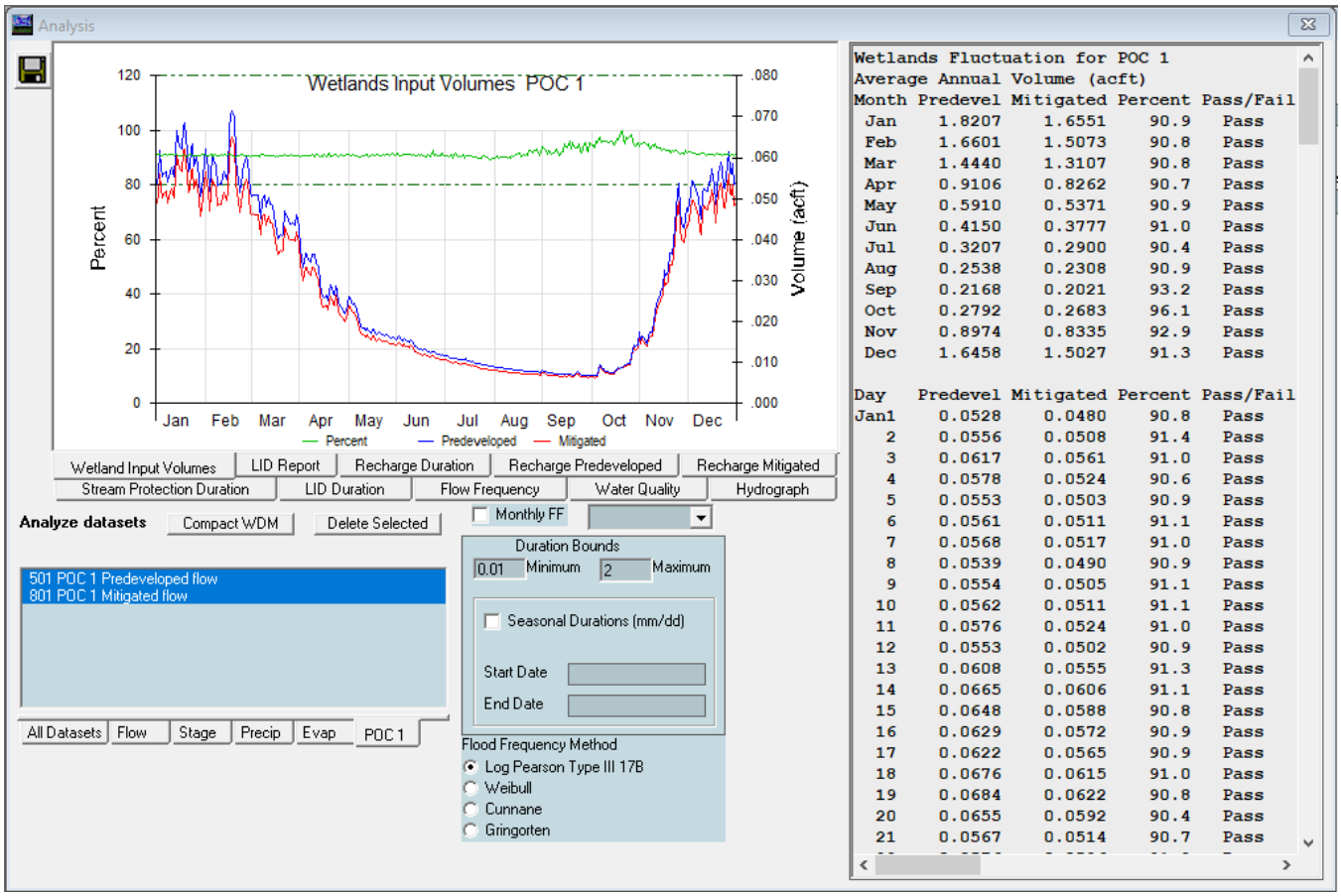
Figure 5 shows a map of the basin areas used for this analysis.

Predeveloped Conditions:



Mitigated Conditions:





Wetlands Fluctuation for POC 1
Average Annual Volume (acft)

Month	Predevel	Mitigated	Percent	Pass/Fail
Jan	1.8207	1.6551	90.9	Pass
Feb	1.6601	1.5073	90.8	Pass
Mar	1.4440	1.3107	90.8	Pass
Apr	0.9106	0.8262	90.7	Pass
May	0.5910	0.5371	90.9	Pass
Jun	0.4150	0.3777	91.0	Pass
Jul	0.3207	0.2900	90.4	Pass
Aug	0.2538	0.2308	90.9	Pass
Sep	0.2168	0.2021	93.2	Pass
Oct	0.2792	0.2683	96.1	Pass
Nov	0.8974	0.8335	92.9	Pass
Dec	1.6458	1.5027	91.3	Pass

Day	Predevel	Mitigated	Percent	Pass/Fail
Jan1	0.0528	0.0480	90.8	Pass
2	0.0556	0.0508	91.4	Pass
3	0.0617	0.0561	91.0	Pass
4	0.0578	0.0524	90.6	Pass
5	0.0553	0.0503	90.9	Pass
6	0.0561	0.0511	91.1	Pass
7	0.0568	0.0517	91.0	Pass
8	0.0539	0.0490	90.9	Pass
9	0.0554	0.0505	91.1	Pass
10	0.0562	0.0511	91.1	Pass
11	0.0576	0.0524	91.0	Pass
12	0.0553	0.0502	90.9	Pass
13	0.0608	0.0555	91.3	Pass
14	0.0665	0.0606	91.1	Pass
15	0.0648	0.0588	90.8	Pass
16	0.0629	0.0572	90.9	Pass
17	0.0622	0.0565	90.9	Pass
18	0.0676	0.0615	91.0	Pass
19	0.0684	0.0622	90.8	Pass
20	0.0655	0.0592	90.4	Pass
21	0.0567	0.0514	90.7	Pass

WWHM2012
PROJECT REPORT

Project Name: Wetland Analysis
Site Name: Kessler Center
Site Address:
City :
Report Date: 12/17/2019
Gage : 42 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2019/09/13
Version : 4.2.17

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	5.91
Pervious Total	5.91

Impervious Land Use	acre
Impervious Total	0
Basin Total	5.91

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Mod	5.28
Pervious Total	5.28

Impervious Land Use	acre
ROOF TOPS FLAT	0.07
Impervious Total	0.07
Basin Total	5.35

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:5.91
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:5.28
Total Impervious Area:0.07

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.183536
5 year	0.293951
10 year	0.381913
25 year	0.511001
50 year	0.620892
100 year	0.743144

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.175517
5 year	0.279134
10 year	0.363076
25 year	0.488247
50 year	0.596455
100 year	0.718424

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

Year	Predeveloped	Mitigated
1902	0.157	0.148
1903	0.126	0.119
1904	0.432	0.424
1905	0.110	0.111
1906	0.065	0.064
1907	0.262	0.254
1908	0.186	0.172
1909	0.179	0.169
1910	0.275	0.269
1911	0.180	0.167
1912	1.070	1.001
1913	0.264	0.244
1914	0.077	0.114
1915	0.131	0.127
1916	0.183	0.167
1917	0.078	0.075
1918	0.185	0.170
1919	0.160	0.148

1920	0.180	0.165
1921	0.194	0.188
1922	0.262	0.262
1923	0.175	0.162
1924	0.107	0.101
1925	0.120	0.114
1926	0.185	0.183
1927	0.144	0.136
1928	0.140	0.143
1929	0.278	0.269
1930	0.172	0.163
1931	0.171	0.163
1932	0.136	0.138
1933	0.176	0.177
1934	0.405	0.385
1935	0.164	0.154
1936	0.162	0.152
1937	0.281	0.279
1938	0.167	0.154
1939	0.039	0.042
1940	0.170	0.160
1941	0.114	0.114
1942	0.252	0.231
1943	0.131	0.138
1944	0.370	0.368
1945	0.203	0.194
1946	0.184	0.187
1947	0.099	0.094
1948	0.345	0.318
1949	0.323	0.297
1950	0.117	0.108
1951	0.144	0.140
1952	0.578	0.554
1953	0.431	0.420
1954	0.162	0.160
1955	0.137	0.129
1956	0.095	0.088
1957	0.217	0.200
1958	0.437	0.407
1959	0.346	0.334
1960	0.095	0.093
1961	0.358	0.348
1962	0.172	0.162
1963	0.101	0.095
1964	0.155	0.193
1965	0.313	0.289
1966	0.113	0.107
1967	0.206	0.206
1968	0.190	0.178
1969	0.163	0.156
1970	0.230	0.215
1971	0.319	0.291
1972	0.213	0.204
1973	0.300	0.293
1974	0.221	0.221
1975	0.431	0.419

1976	0.309	0.312
1977	0.110	0.101
1978	0.321	0.313
1979	0.110	0.103
1980	0.189	0.195
1981	0.181	0.167
1982	0.111	0.112
1983	0.274	0.249
1984	0.169	0.163
1985	0.282	0.281
1986	0.185	0.173
1987	0.397	0.379
1988	0.196	0.181
1989	0.191	0.179
1990	0.221	0.202
1991	0.191	0.176
1992	0.211	0.201
1993	0.230	0.213
1994	0.329	0.307
1995	0.094	0.092
1996	0.388	0.367
1997	0.167	0.160
1998	0.218	0.220
1999	0.071	0.077
2000	0.155	0.144
2001	0.091	0.098
2002	0.433	0.422
2003	0.217	0.209
2004	0.193	0.190
2005	0.661	0.626
2006	0.127	0.120
2007	0.127	0.123
2008	0.190	0.175
2009	0.138	0.130
2010	0.121	0.113
2011	0.109	0.102
2012	0.214	0.209
2013	0.117	0.118
2014	0.104	0.105
2015	0.340	0.341
2016	0.080	0.075
2017	0.236	0.226
2018	0.457	0.430
2019	0.621	0.588
2020	0.187	0.195
2021	0.232	0.214
2022	0.107	0.107
2023	0.199	0.184
2024	1.102	1.034
2025	0.188	0.175
2026	0.282	0.264
2027	0.137	0.130
2028	0.114	0.107
2029	0.192	0.182
2030	0.329	0.312
2031	0.126	0.119

2032	0.090	0.094
2033	0.120	0.112
2034	0.120	0.113
2035	0.395	0.364
2036	0.213	0.207
2037	0.076	0.071
2038	0.247	0.247
2039	0.048	0.061
2040	0.123	0.119
2041	0.137	0.126
2042	0.435	0.413
2043	0.220	0.214
2044	0.253	0.230
2045	0.171	0.157
2046	0.201	0.190
2047	0.165	0.156
2048	0.198	0.184
2049	0.185	0.182
2050	0.139	0.131
2051	0.284	0.287
2052	0.122	0.117
2053	0.199	0.192
2054	0.544	0.528
2055	0.111	0.106
2056	0.104	0.097
2057	0.151	0.138
2058	0.176	0.162
2059	0.324	0.315

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

Rank	Predeveloped	Mitigated
1	1.1021	1.0343
2	1.0702	1.0011
3	0.6606	0.6262
4	0.6208	0.5879
5	0.5779	0.5540
6	0.5442	0.5283
7	0.4569	0.4301
8	0.4373	0.4236
9	0.4354	0.4218
10	0.4325	0.4202
11	0.4316	0.4186
12	0.4311	0.4132
13	0.4306	0.4072
14	0.4045	0.3855
15	0.3969	0.3791
16	0.3952	0.3675
17	0.3875	0.3670
18	0.3704	0.3643
19	0.3579	0.3475
20	0.3457	0.3414
21	0.3453	0.3345
22	0.3397	0.3176
23	0.3289	0.3151

24	0.3285	0.3130
25	0.3238	0.3123
26	0.3228	0.3122
27	0.3211	0.3066
28	0.3187	0.2971
29	0.3130	0.2925
30	0.3091	0.2913
31	0.3002	0.2887
32	0.2843	0.2867
33	0.2822	0.2806
34	0.2817	0.2786
35	0.2814	0.2688
36	0.2785	0.2687
37	0.2747	0.2643
38	0.2737	0.2622
39	0.2641	0.2543
40	0.2621	0.2491
41	0.2619	0.2469
42	0.2530	0.2443
43	0.2520	0.2307
44	0.2468	0.2302
45	0.2363	0.2263
46	0.2320	0.2212
47	0.2304	0.2203
48	0.2297	0.2145
49	0.2207	0.2142
50	0.2206	0.2142
51	0.2198	0.2131
52	0.2182	0.2091
53	0.2169	0.2090
54	0.2167	0.2067
55	0.2140	0.2063
56	0.2131	0.2042
57	0.2128	0.2023
58	0.2110	0.2009
59	0.2062	0.1998
60	0.2026	0.1948
61	0.2006	0.1947
62	0.1991	0.1944
63	0.1990	0.1926
64	0.1983	0.1917
65	0.1961	0.1905
66	0.1945	0.1904
67	0.1927	0.1883
68	0.1920	0.1865
69	0.1913	0.1843
70	0.1912	0.1838
71	0.1902	0.1832
72	0.1896	0.1817
73	0.1891	0.1817
74	0.1884	0.1808
75	0.1875	0.1795
76	0.1864	0.1778
77	0.1852	0.1770
78	0.1848	0.1763
79	0.1848	0.1754

80	0.1848	0.1750
81	0.1843	0.1730
82	0.1826	0.1723
83	0.1807	0.1702
84	0.1799	0.1693
85	0.1797	0.1675
86	0.1793	0.1670
87	0.1764	0.1666
88	0.1759	0.1648
89	0.1747	0.1631
90	0.1722	0.1630
91	0.1721	0.1630
92	0.1712	0.1622
93	0.1706	0.1618
94	0.1699	0.1615
95	0.1695	0.1601
96	0.1672	0.1599
97	0.1665	0.1598
98	0.1652	0.1565
99	0.1642	0.1561
100	0.1635	0.1556
101	0.1625	0.1542
102	0.1615	0.1537
103	0.1599	0.1516
104	0.1568	0.1483
105	0.1554	0.1477
106	0.1553	0.1442
107	0.1506	0.1432
108	0.1442	0.1401
109	0.1441	0.1384
110	0.1401	0.1383
111	0.1387	0.1375
112	0.1384	0.1359
113	0.1368	0.1306
114	0.1365	0.1300
115	0.1365	0.1299
116	0.1364	0.1289
117	0.1314	0.1272
118	0.1309	0.1256
119	0.1268	0.1225
120	0.1267	0.1203
121	0.1263	0.1192
122	0.1256	0.1188
123	0.1231	0.1187
124	0.1223	0.1179
125	0.1212	0.1167
126	0.1203	0.1137
127	0.1203	0.1136
128	0.1197	0.1136
129	0.1169	0.1133
130	0.1169	0.1131
131	0.1138	0.1123
132	0.1136	0.1117
133	0.1127	0.1113
134	0.1114	0.1084
135	0.1106	0.1073

136	0.1100	0.1071
137	0.1096	0.1068
138	0.1096	0.1061
139	0.1087	0.1052
140	0.1071	0.1031
141	0.1066	0.1022
142	0.1038	0.1012
143	0.1038	0.1009
144	0.1011	0.0985
145	0.0993	0.0972
146	0.0953	0.0951
147	0.0946	0.0938
148	0.0939	0.0937
149	0.0908	0.0934
150	0.0899	0.0925
151	0.0799	0.0884
152	0.0779	0.0771
153	0.0774	0.0755
154	0.0762	0.0753
155	0.0709	0.0715
156	0.0646	0.0640
157	0.0482	0.0611
158	0.0394	0.0424

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0918	79888	62437	78	Pass
0.0971	67035	51877	77	Pass
0.1025	58226	44730	76	Pass
0.1078	50553	38697	76	Pass
0.1131	42980	32736	76	Pass
0.1185	37722	28653	75	Pass
0.1238	33290	25091	75	Pass
0.1292	28781	21639	75	Pass
0.1345	25584	19185	74	Pass
0.1399	22748	16975	74	Pass
0.1452	19933	14570	73	Pass
0.1506	17817	12919	72	Pass
0.1559	15867	11451	72	Pass
0.1612	13806	9900	71	Pass
0.1666	12393	8698	70	Pass
0.1719	11086	7723	69	Pass
0.1773	9684	6692	69	Pass
0.1826	8642	6017	69	Pass
0.1880	7717	5462	70	Pass
0.1933	6742	4893	72	Pass
0.1987	6127	4487	73	Pass
0.2040	5540	4030	72	Pass
0.2094	5087	3683	72	Pass
0.2147	4695	3351	71	Pass

0.2200	4282	3014	70	Pass
0.2254	3937	2779	70	Pass
0.2307	3586	2559	71	Pass
0.2361	3254	2340	71	Pass
0.2414	3033	2152	70	Pass
0.2468	2797	1899	67	Pass
0.2521	2566	1696	66	Pass
0.2575	2409	1533	63	Pass
0.2628	2216	1408	63	Pass
0.2681	1976	1279	64	Pass
0.2735	1796	1186	66	Pass
0.2788	1661	1074	64	Pass
0.2842	1484	969	65	Pass
0.2895	1383	868	62	Pass
0.2949	1287	776	60	Pass
0.3002	1175	666	56	Pass
0.3056	1083	596	55	Pass
0.3109	1004	523	52	Pass
0.3162	896	465	51	Pass
0.3216	786	410	52	Pass
0.3269	684	360	52	Pass
0.3323	615	312	50	Pass
0.3376	549	278	50	Pass
0.3430	496	240	48	Pass
0.3483	437	199	45	Pass
0.3537	390	164	42	Pass
0.3590	346	134	38	Pass
0.3643	318	115	36	Pass
0.3697	277	97	35	Pass
0.3750	238	87	36	Pass
0.3804	203	77	37	Pass
0.3857	167	66	39	Pass
0.3911	138	54	39	Pass
0.3964	118	45	38	Pass
0.4018	104	45	43	Pass
0.4071	89	40	44	Pass
0.4124	79	35	44	Pass
0.4178	69	29	42	Pass
0.4231	54	24	44	Pass
0.4285	45	21	46	Pass
0.4338	31	20	64	Pass
0.4392	25	20	80	Pass
0.4445	23	19	82	Pass
0.4499	23	19	82	Pass
0.4552	22	19	86	Pass
0.4606	20	19	95	Pass
0.4659	19	19	100	Pass
0.4712	19	18	94	Pass
0.4766	19	18	94	Pass
0.4819	19	18	94	Pass
0.4873	19	18	94	Pass
0.4926	19	18	94	Pass
0.4980	18	17	94	Pass
0.5033	18	16	88	Pass
0.5087	18	16	88	Pass
0.5140	17	15	88	Pass

0.5193	17	15	88	Pass
0.5247	17	14	82	Pass
0.5300	16	13	81	Pass
0.5354	16	12	75	Pass
0.5407	16	12	75	Pass
0.5461	15	12	80	Pass
0.5514	13	12	92	Pass
0.5568	12	11	91	Pass
0.5621	12	11	91	Pass
0.5674	12	11	91	Pass
0.5728	12	11	91	Pass
0.5781	11	11	100	Pass
0.5835	11	11	100	Pass
0.5888	11	10	90	Pass
0.5942	11	10	90	Pass
0.5995	11	10	90	Pass
0.6049	11	10	90	Pass
0.6102	11	10	90	Pass
0.6155	11	10	90	Pass
0.6209	11	10	90	Pass

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

LID Report

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

Perlnd and Implnd Changes

No changes have been made.

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APPENDIX E – Wetland Reports

PUYALLUP SCHOOL DISTRICT

SOUTH HILL TRANSPORTATION CENTER
CRITICAL AREAS REPORT

Grette Associates LLC
ENVIRONMENTAL CONSULTANTS

PUYALLUP SCHOOL DISTRICT

SOUTH HILL TRANSPORTATION CENTER
CRITICAL AREAS REPORT

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MAY, 2019
DATE

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1 INTRODUCTION

Grette Associates, LLC is under contract with the Puyallup School District to conduct a verification of a wetland located at the corner of 39th Ave SW and 17th Street SW in Puyallup, WA (Figure 1). The project site is within Section 04, Township 19N, and Range 04E, W.M. The purpose of this report is to verify the boundaries and ratings of the existing wetland and to document all critical areas within 300 feet of the project site in conformance with critical areas regulations under Puyallup Municipal Code (PMC) Chapters 21.06.530 and 21.06.950.

Figure 1. Vicinity map (project site area in red)

2 FEATURE SUMMARY

A Grette Associates biologist visited the subject property on April 17, 2019 to verify the boundaries and rating of the existing wetland near the project site. Grette Associates staff also inspected the surrounding 300 feet to identify and rate wetlands that may be present outside of the area of the project site. Wetland A was originally delineated and rated in 2017 by Habitat Technologies. Wetland A was originally rated as a Category IV wetland. Grette Associates rated Wetland A as a Category IV wetland based on the requirements in PMC 21.06.910. A summary of the critical areas identified during the site assessment is provided below in Table 1. A critical areas map is provided in Appendix A.

Table 1. Natural water feature identification summary

Feature	Approximate Size	Cowardin Class[2]	Hydrology Modifier	HGM Class	Wetland Category[1]	Buffer Width[2]
A	34,500 sq. ft.	PFO/EM	Seasonally Flooded and Saturated	Depressional	IV	50

[1] Wetlands were rated according to PMC 21.06.910
[2] Buffers widths are based on PMC 21.06.930

Figure 2. Category IV Wetland (green) with 50-foot buffer (red)

3 BACKGROUND

3.1 Existing Conditions

Wetland A is situated in an undeveloped area that straddles Pierce County Tax Parcel Nos 0419043091 and 0419043117. Approximately 300 feet to the northeast of Wetland A is the Puyallup School District Technology Support Center. The topography of the assessed area is generally flat and upland vegetation is dominated by large patches of Himalayan blackberry (*Rubus armeniacus*). Wetland A is located in a closed depression that has existing vegetation classes with both forest and emergent species. Historical satellite photos indicate that portions of the site have been disturbed and manipulated in the past. Manipulations to the upland areas include historic residential development, mowing, and development of adjacent properties.

3.2 Local Critical Areas Inventory

The City of Puyallup's official Critical Areas Map was queried to determine if any wetlands are identified on or within 300 feet of the project site (City of Puyallup 2019). City maps indicate a field-verified wetland in the approximate location of Wetland A.

Additionally, Pierce County's Public GIS database was queried to determine if any potential wetlands are identified within 300 feet of the project site (Pierce County 2019). According to Pierce County's Public GIS, the project site is within an area designated as a potential wetland area. Potential wetland areas are based on a combination of hydric, hydrology, and wetland themes.

3.3 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 on or within 300 feet of the subject property (USFWS 2019). According to the NWI Interactive Online Mapper, an unnamed stream approximately 700 feet to the east of the project site is designated as a seasonally flooded riverine system (Appendix B). No other wetlands are identified by the NWI on or near the subject property.

3.4 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 on or near the subject property (WDFW 2019a). According to the PHS database, no priority species or habitats are mapped on or within 300 feet of the subject property (Appendix B).

WDFW's SalmonScape was queried to identify any streams and determine if state or federally listed fish or wildlife species occur on or near the subject property (WDFW 2019b). According to SalmonScape, the unnamed stream approximately 700 feet to the east of the project site does not have any documentation of fish utilizing the stream.

The WDNR Natural Heritage Information System was queried to determine if the subject property occurs in a location reported to contain high quality natural heritage wetland occurrences or occurrences of natural heritage features commonly associated with wetlands. According to WDNR data dated March, 18 2019, there are no records of rare plants or high-quality native ecosystems occurring on or in the vicinity of the Site.

3.5 WDNR Stream Mapping

The WDNR Forest Practice Application Mapping Tool was queried to identify any streams mapped by WDNR in the vicinity of the project site (WDNR 2019). According to WDNR, the nearest stream to the subject property is an unnamed stream approximately 700 feet to the east. WDNR has designated the stream as a Type F stream. Type F streams are known to be used by fish, or meet the physical criteria to be potentially used by fish.

3.6 Soil Information

According to the Natural Resources Conservation Service's (NRCS) Web Soil Survey (NRCS 2019), the soils within the subject property are Alderwood gravelly sandy loam and Indianola loamy sand (Appendix B). Alderwood gravelly sandy loam soils are not rated by the NRCS as being hydric soils. The NRCS also maps other minor component soils under the Alderwood gravelly sandy loam unit such as Mckenna (5%), Shalcar (3%) and Norma (2%) that are listed as hydric soils. Norma (2%) is the only hydric soil component of the Indianola loamy sand soil.

4 PRECIPITATION ANALYSIS

During the site assessment, the McMillin Reservoir National Weather Station (NWS Station 455224) recorded 0.11 inches of rainfall (NOAA 2019). In the 14 days preceding the site assessment, 2.96 inches of rainfall was recorded at the station (NOAA 2019). The total precipitation recorded at the McMillin Reservoir station from April 1, 2018 through March 31, 2019 (34.86 inches) was approximately 80 percent of the normal rainfall (43.49 inches) that occurs during the same time (NOAA 2019 and NRCS 2019a). Table 3 below presents an analysis of the appropriate NRCS WETS table (NRCS 2019b) for the three months preceding the field investigation.

Table 2. WETS precipitation analysis

Preceding Month	WETS Rainfall Percentile (inches)		Measured Rainfall[1] (inches)	Conditions[2]	Condition Value[3]	Month Weight	Value
	30%	70%					
March	3.60	5.44	1.23	Dry	1	3	3
February	2.91	5.16	4.90	Normal	2	2	4
January	4.13	6.82	4.05	Dry	1	1	1
						Sum:	8

[1] Observed rainfall for the month (NOAA 2019b)
[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

Bins are established to evaluate the overall rainfall conditions leading up to the field investigation; drier (sum is 6-9), normal (sum is 10-14), wet (sum is 15-18). A sum of 8 indicates that hydrologic conditions at the site were drier than normal at the time of the site investigation.

5 METHODS

The assessment area was traversed and data were collected to confirm the wetland boundary. Wetland A was assessed according to the procedures described in the U.S. Army Corps of Engineers (USACE) *Federal Wetland Delineation Manual* (1987), and the Corps' *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)* (2010). Guidance from the Corps' *Regional Supplement* was used to evaluate the site's conditions

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.

Additionally, the area within 300 ft of the parcel boundary was inspected either visually or through aerial photograph interpretation to determine if other critical areas are within the assessment area.

5.1 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 3). 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 3). 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 Corps' *National Wetland Plant List* (Lichvar 2016) was used to determine vegetation indicator status.

Table 3. 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

5.2 Wetland Hydrology

Evidence of permanent or periodic inundation (water marks, drift lines, drainage patterns), or soil saturation to the surface for 12 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.

5.3 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 Corps' *Regional Supplement*.

6 WETLAND VERIFICATION

Grette Associates visited the site on April 17, 2019 to conduct a verification of the previously delineated wetland. The verification was conducted to identify the delineated wetland boundaries and to ensure the areas still meet the wetland criteria defined in the USACE's *Federal Wetland Delineation Manual* (1987) and *Regional Supplement* (Version 2.0) (2010). The boundary verification of the wetland was conducted to identify the current boundary locations and to verify the locations of the required wetland buffer. The verification also was conducted to update the wetland ratings using Ecology's Washington State Wetland Rating System for Western Washington – 2014 Update (Hruby 2014).

The boundary of Wetland A was confirmed to be in the same location as was previously delineated in 2017. Flagging from the previous delineation were located, and they were determined to represent the current wetland boundaries. The wetland is located within a closed depression, and no encroachments or development were observed with the wetland that would have changed its boundaries.

6.1 Wetland A

Wetland A is a Palustrine Forested/Emergent, Seasonally Flooded and Saturated wetland that is approximately 34,500 square feet in size and is situated in a topographic depression with no surface water outlet (Appendix A).

6.1.1 Vegetation

Vegetation within Wetland A largely consists of forested species dominated almost entirely by black cottonwood (*Populus balsamifera*). Emergent species in Wetland A were dominated by reed canarygrass (*Phalaris arundinacea*). Buffer vegetation consisted mainly of Himalayan blackberry.

6.1.2 Hydrology

Wetland A is hydrogeomorphically described as a depressional system and hydrologic support is provided by surface flow and shallow groundwater. Heavy precipitation events can result in periodic sheet flow into the wetland. On the day of investigation, both saturation and a high water table were observed within the wetland. There is no surface water outlet from the wetland.

6.1.3 Hydric Soils

Soils observed within the wetland consisted of a layer of dark gray (10YR 4/1) sandy loam. The upper portion of the soil profile had more organic content and the lower portion had brown redoximorphic features (10YR 4/3). Soils within Wetland A meet the definition of a hydric soil by demonstrating the field indictors of a Depleted Matrix (F3). Of the assessed soils, redox concentrations were observed throughout approximately 40% of the soil matrix.

6.1.4 Wetland Categorization

To determine the categorization of the wetland within the assessment area based on function, the wetland classification guidelines in Ecology's wetland rating system (Hruby 2014) were used (PMC 21.06.910). Based on this guidance, the wetland was given a score for each of three functions: Water Quality, Hydrology, and Habitat (Table 4). The rating forms used to score the wetlands are included in Appendix C.

Table 4. Wetland rating and categorization summary

Feature	Cowardin Class	HGM Class	Water Quality	Hydrology	Habitat	Total	Category
Wetland A	PFO/EM	Depressional	5	6	4	15	IV

While the wetland provides moderate water quality and hydrology function, due to its geomorphic position within the landscape, Wetland A provides low habitat function. As a result, Wetland A is classified as a Category IV wetland and is subject to a 50-foot buffer according to PMC 21.06.930. This rating is consistent with the rating previously accepted by the City of Puyallup for the 2017 delineation conducted by Habitat Technologies.

6.1.5 Functions and Values

Wetland A likely provides some level of water quality enhancement, hydrology, and habitat functions. This wetland likely filters out sediments and toxins from shallow groundwater, preventing them from entering the surrounding landscape. Additionally, the wetland likely provides some foraging and refuge for small mammals as well as passerine foraging and refuge.

7 DISCUSSION

Grette Associates identified one wetland feature that is located in the general area where the previous Category IV wetland was delineated. Based on topographic constraints and data collected, Grette Associates does not believe that the wetland boundary has significantly changed since the previous wetland delineation. Furthermore, Grette Associates preliminarily rated this feature according to the requirements defined in Chapter 21.06 of the Puyallup Municipal Code (PMC). Based on these requirements, the wetland feature is considered a Category IV wetland. According to PMC 21.06.930, Category IV wetlands with a high intensity land use are subject to a 50-foot buffer (PMC 21.06.930).

8 BIOLOGIST QUALIFICATIONS

8.1 Tom Peterman

Tom Peterman is a Biologist with training in wetland science and ecology restoration. Tom also has professional experience in fisheries, wetland and stream restoration, mitigation monitoring, and fish and wildlife assessments. Tom has earned a graduate degree and a certificate in wetland science and management from the University of Washington. For a list of representative projects, please contact him at Grette Associates.

9 REFERENCES

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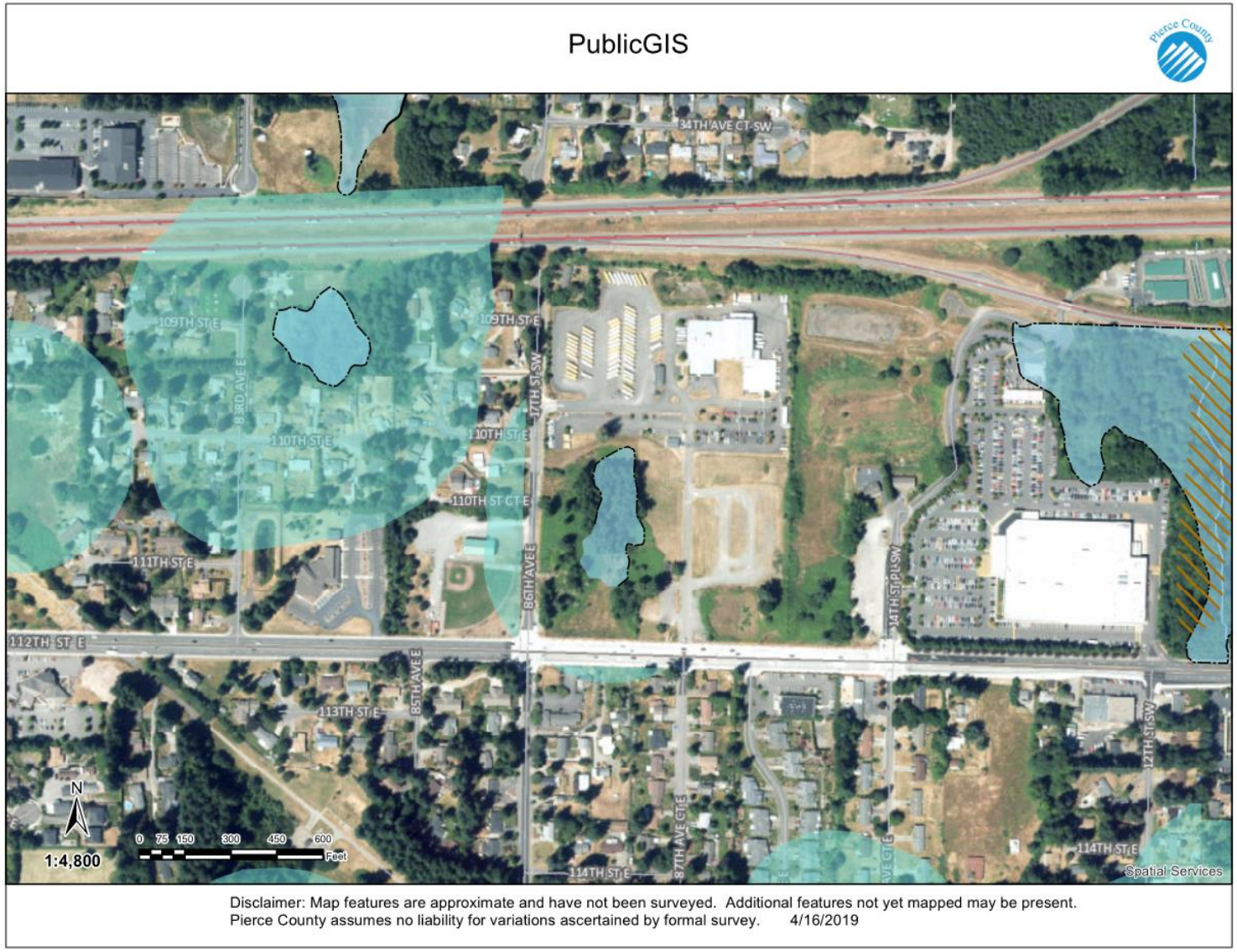
PUYALLUP SCHOOL DISTRICT

SOUTH HILL TRANSPORTATION CENTER
CRITICAL AREAS REPORT
APPENDIX A: CRITICAL AREAS MAP

Critical Areas Map
Legend
Type II stream
Wetland
109th St E
110th St E
110th St Ct E
17th St SW
112th St E
39th Ave SW
14th St Pl SW
85th Ave E
86th Ave E
88th Ave E
Google Earth
© 2013 Google
200 m
N

PUYALLUP SCHOOL DISTRICT

SOUTH HILL TRANSPORTATION CENTER
CRITICAL AREAS REPORT
APPENDIX B: QUERIED DATABASE FIGURES


PublicGIS
Pierce County
34TH AVE CT SW
109TH ST E
83RD AVE E
110TH ST E
110TH ST CT E
111TH ST E
112TH ST E
113TH ST E
85TH AVE E
86TH AVE E
87TH AVE CT E
114TH ST E
17TH ST SW
14TH ST PL SW
12TH ST SW
N
0 75 150 300 450 600
Feet
1:4,800
Spatial Services
Disclaimer: Map features are approximate and have not been surveyed. Additional features not yet mapped may be present.
Pierce County assumes no liability for variations ascertained by formal survey. 4/16/2019

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
PRIORITY HABITATS AND SPECIES REPORT

SOURCE DATASET: PHSPlusPublic
REPORT DATE: 04/16/2019 1.54

Query ID: P190416135419

Common Name Scientific Name Notes	Site Name Source Dataset Source Record Source Date	Priority Area Occurrence Type More Information (URL) Mgmt Recommendations	Accuracy	Federal Status State Status PHS Listing Status	Sensitive Data Resolution	Source Entity Geometry Type
Freshwater Emergent	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Forested/Shrub	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Freshwater Pond	N/A NWIWetlands	Aquatic Habitat Aquatic habitat http://www.ecy.wa.	NA	N/A N/A PHS Listed	N AS MAPPED	US Fish and Wildlife Service Polygons
Wetlands	LOWER PUYALLUP RIVER PHSREGION 902559	Aquatic Habitat N/A http://www.ecy.wa.	1/4 mile (Quarter	N/A N/A PHS LISTED	N AS MAPPED	WA Dept. of Fish and Wildlife Polygons
Wetlands	SOUTH PUYALLUP PHSREGION 902560	Aquatic Habitat N/A http://www.ecy.wa.	1/4 mile (Quarter	N/A N/A PHS LISTED	N AS MAPPED	WA Dept. of Fish and Wildlife Polygons

DISCLAIMER. This report includes information that the Washington Department of Fish and Wildlife (WDFW) maintains in a central computer database. It is not an attempt to provide you with an official agency response as to the impacts of your project on fish and wildlife. This information only documents the location of fish and wildlife resources to the best of our knowledge. It is not a complete inventory and it is important to note that fish and wildlife resources may occur in areas not currently known to WDFW biologists, or in areas for which comprehensive surveys have not been conducted. Site specific surveys are frequently necesssary to rule out the presence of priority resources. Locations of fish and wildlife resources are subject to vraition caused by disturbance, changes in season and weather, and other factors. WDFW does not recommend using reports more than six months old.

WDFW Test Map

Hydric Soil List - All Components

This table lists the map unit components and their hydric status in the survey area. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; Hurt and others, 2002).

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for all of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are dominantly made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units dominantly made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

The criteria for hydric soils are represented by codes in the table (for example, 2). Definitions for the codes are as follows:

1. All Histels except for Folistels, and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
   A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
   B. Show evidence that the soil meets the definition of a hydric soil;
3. Soils that are frequently ponded for long or very long duration during the growing season.
   A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
   B. Show evidence that the soil meets the definition of a hydric soil;
4. Map unit components that are frequently flooded for long duration or very long duration during the growing season that:
   A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
   B. Show evidence that the soil meets the definition of a hydric soil;

Hydric Condition: Food Security Act information regarding the ability to grow a commodity crop without removing woody vegetation or manipulating hydrology.

References:

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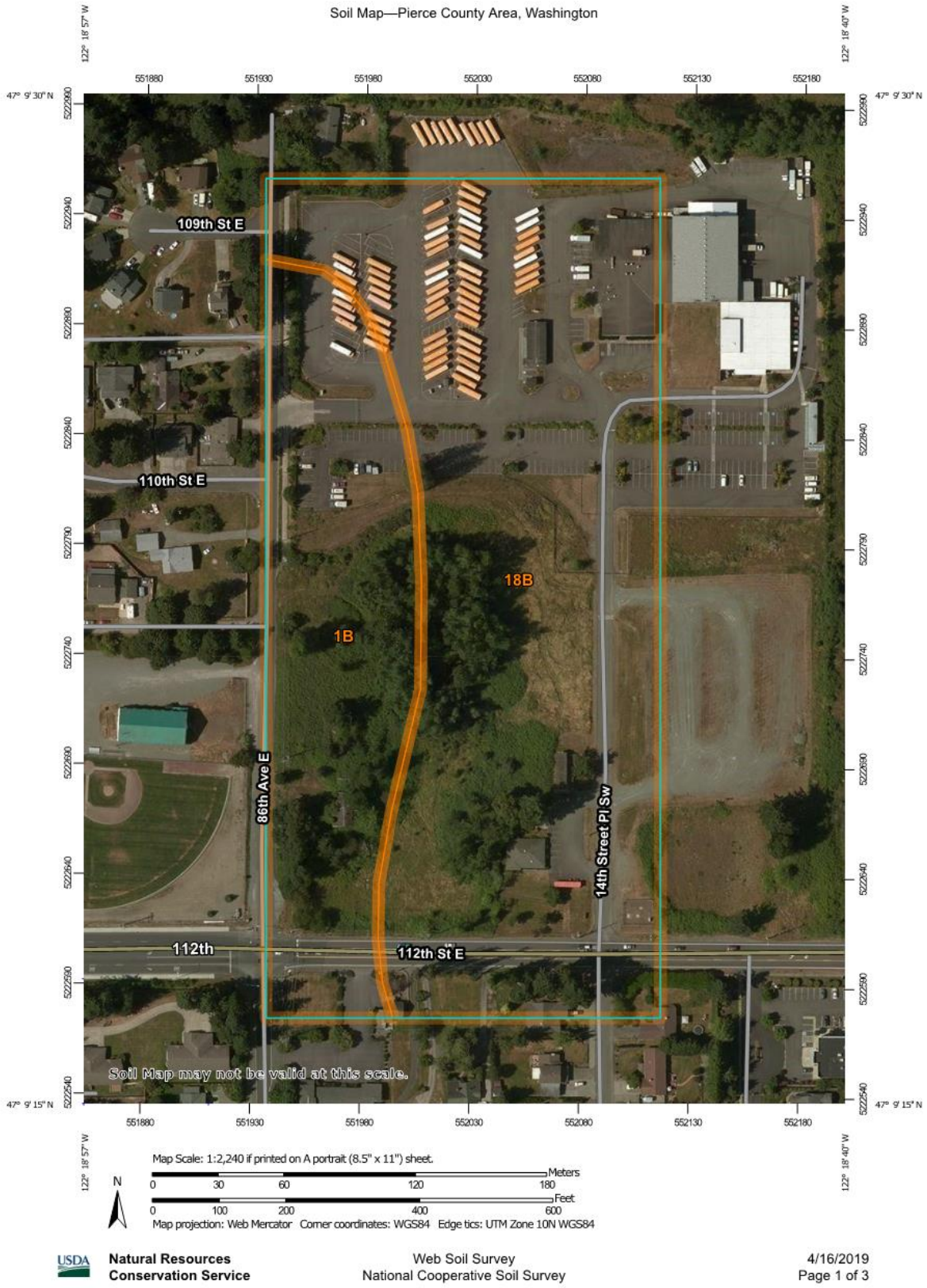
Report—Hydric Soil List - All Components

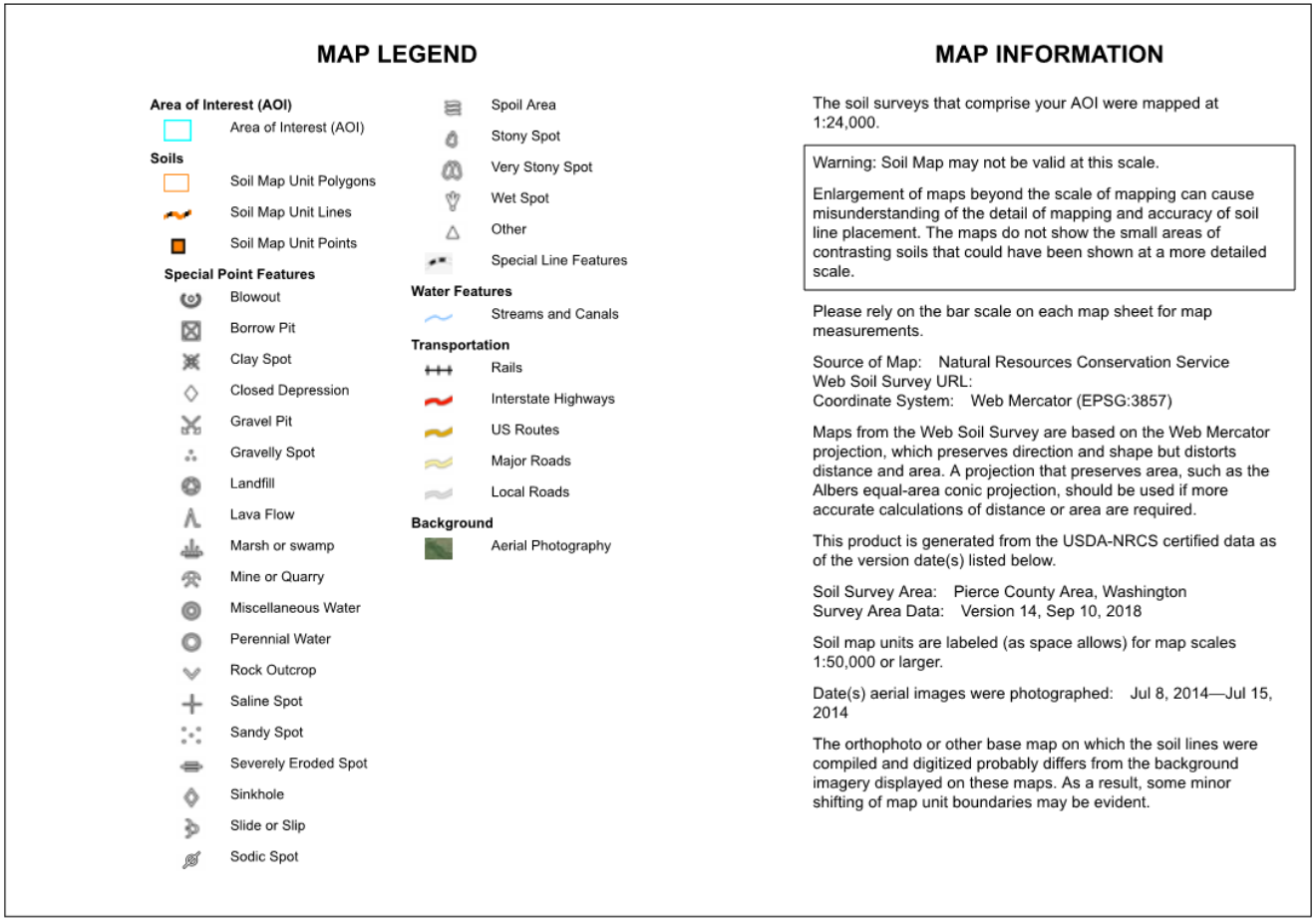
Hydric Soil List - All Components–WA653-Pierce County Area, Washington					
Map symbol and map unit name	**Component/Local Phase**	**Comp. pct.**	**Landform**	**Hydric status**	**Hydric criteria met (code)**
1B: Alderwood gravelly sandy loam, 0 to 8 percent slopes	Alderwood	85	Ridges,hills	No	—
	Everett	5	Kames,eskers,moraines	No	—
	McKenna	5	Depressions,drainageways	Yes	2,3
	Shalcar	3	Depressions	Yes	1,3
	Norma	2	Depressions,drainageways	Yes	2,3
18B: Indianola loamy sand, 0 to 5 percent slopes	Indianola	85	Eskers,kames,terraces	No	—
	Alderwood	8	Ridges,hills	No	—
	Everett	5	Kames,eskers,moraines	No	—
	Norma	2	Depressions,drainageways	Yes	2,3

Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 14, Sep 10, 2018

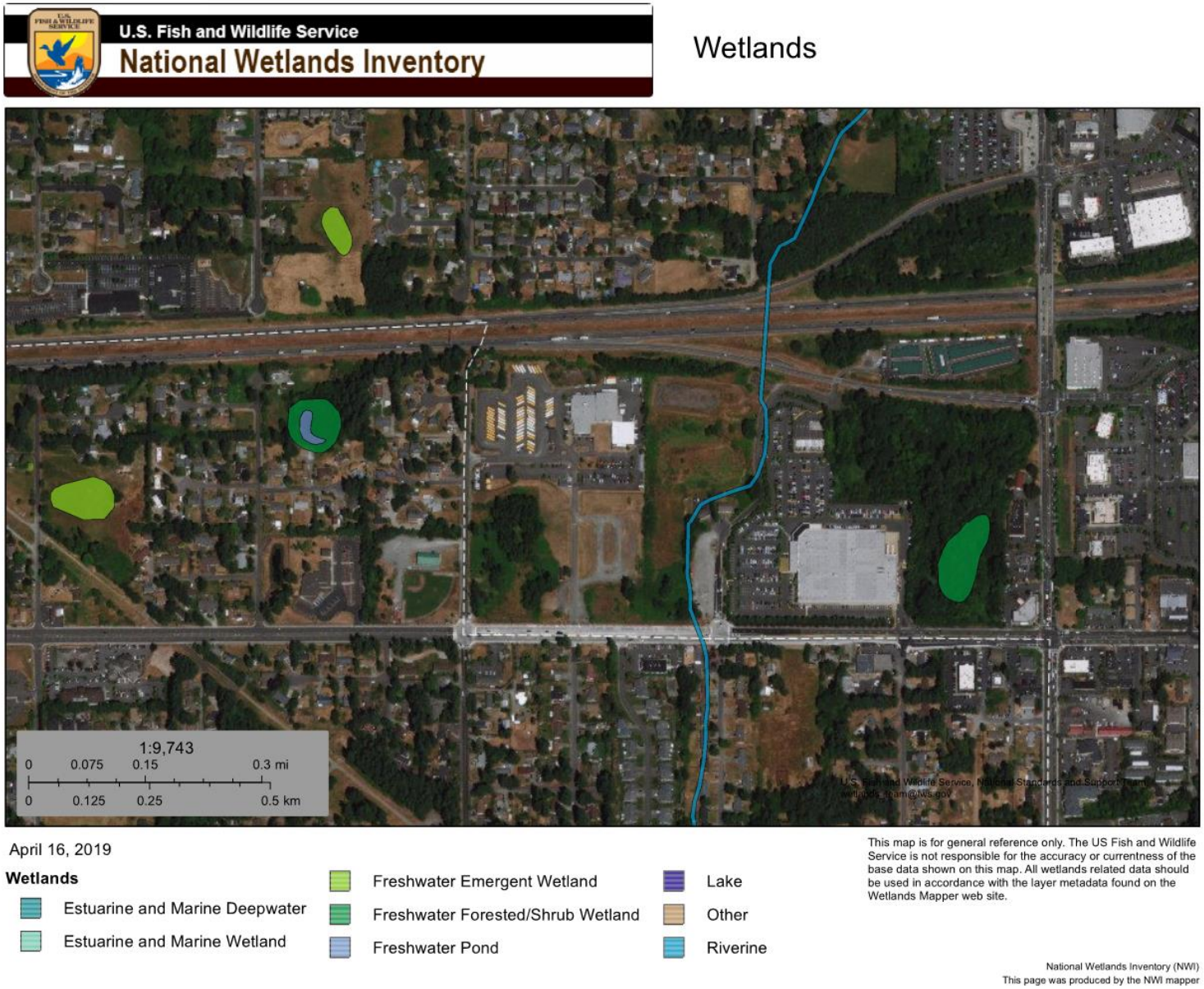

Soil Map—Pierce County Area, Washington
122° 18' 57" W
122° 18' 40" W
47° 9' 30" N
47° 9' 15" N
551880
551930
551980
552030
552080
552130
552180
5222990
5222940
5222890
5222840
5222790
5222740
5222690
5222640
5222590
5222540
109th St E
110th St E
112th
112th St E
86th Ave E
14th Street Pl Sw
18B
1B
Soil Map may not be valid at this scale.
Map Scale: 1:2,240 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 30 60 120 180
Feet
0 100 200 400 600
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84
USDA
Natural Resources
Conservation Service
Web Soil Survey
National Cooperative Soil Survey
4/16/2019
Page 1 of 3

Soil Map—Pierce County Area, Washington



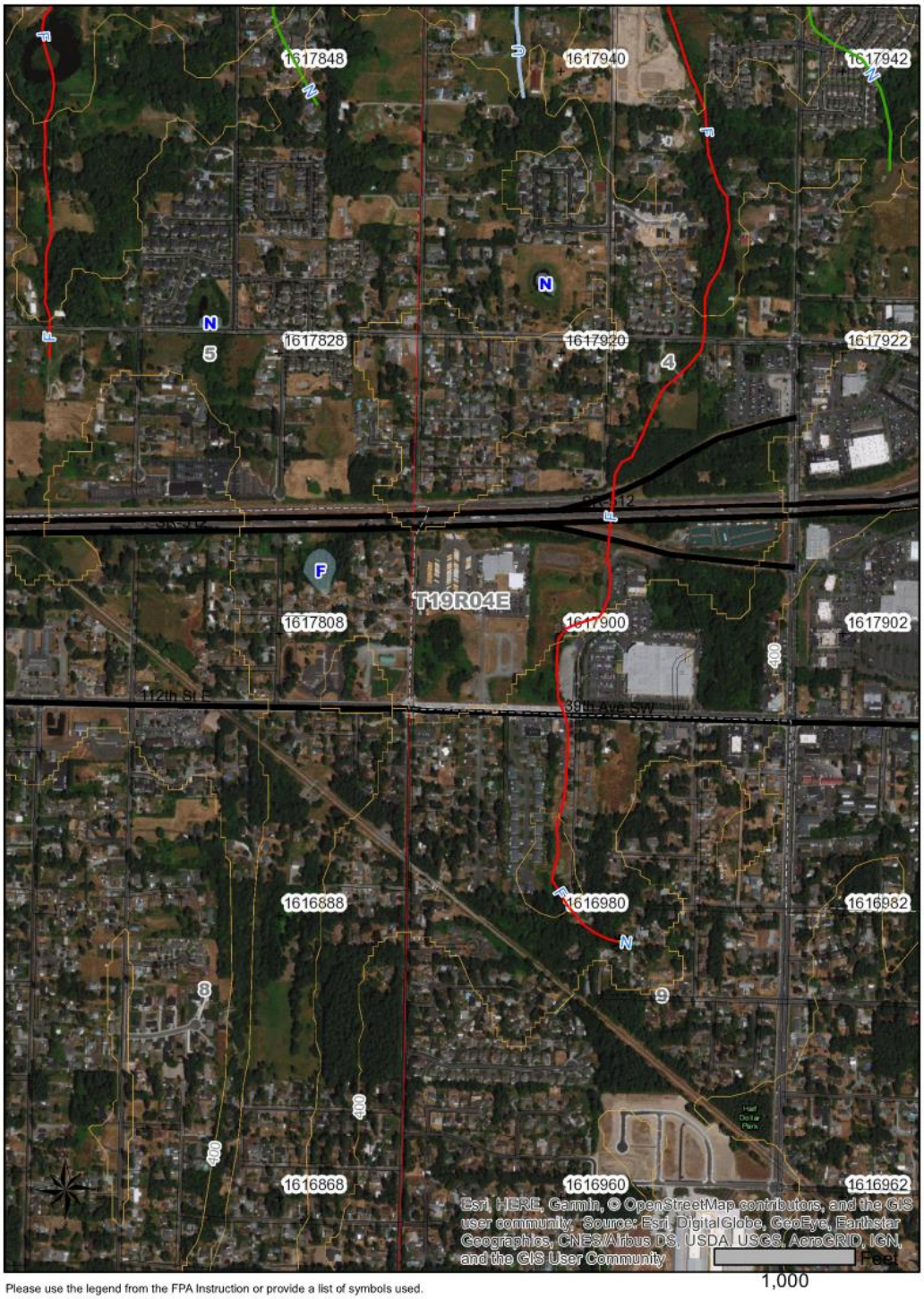
Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1B	Alderwood gravelly sandy loam, 0 to 8 percent slopes	5.1	29.8%
18B	Indianola loamy sand, 0 to 5 percent slopes	12.0	70.2%
Totals for Area of Interest		**17.0**	**100.0%**


U.S. Fish and Wildlife Service
National Wetlands Inventory
Wetlands
1:9,743
0 0.075 0.15 0.3 mi
0 0.125 0.25 0.5 km
U.S. Fish and Wildlife Service, National Standards and Support Team
wetlands_team@fws.gov
April 16, 2019
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

Forest Practices Activity Map

Application #:



Please use the legend from the FPA Instruction or provide a list of symbols used.

Date: 4/16/2019 Time: 12:43:05 PM

NAD 83 Scale: 1:12,000

Contour Interval: 40 Feet

PUYALLUP SCHOOL DISTRICT

SOUTH HILL TRANSPORTATION CENTER
CRITICAL AREAS REPORT
APPENDIX C: WETLAND RATING FORMS

SD Puyallup

Wetland name or number Wetland A

RATING SUMMARY – Western Washington

Name of wetland (or ID #): Wetland A Date of site visit: 4/17/19

Rated by Tom Peterson Trained by Ecology? ✓ Yes ___ No Date of training _____

HGM Class used for rating Depressional Wetland has multiple HGM classes? ___ Y X N

NOTE: Form is not complete without the figures requested *(figures can be combined).*
Source of base aerial photo/map Google Earth

OVERALL WETLAND CATEGORY IV (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
_____ **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	5	6	4	15

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

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

2. Category based on SPECIAL CHARACTERISTICS of wetland

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

Wetland Rating System for Western WA: 2014 Update
Rating Form – Effective January 1, 2015

1

Wetland name or number Wetland A

Maps and figures required to answer questions correctly for Western Washington

Depressional Wetlands

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

Riverine Wetlands

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

Lake Fringe Wetlands

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

Slope Wetlands

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

Wetland name or number Wetland A

HGM Classification of Wetlands in Western Washington

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

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

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

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

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

   NO – Saltwater Tidal Fringe (Estuarine) **YES – Freshwater Tidal Fringe**
   *If your wetland can be classified as a Freshwater Tidal Fringe use the forms for **Riverine** wetlands. If it is Saltwater Tidal Fringe it is an **Estuarine** wetland and is not scored. This method **cannot** be used to score functions for estuarine wetlands.*

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

   NO – go to 3 **YES** – The wetland class is **Flats**
   *If your wetland can be classified as a Flats wetland, use the form for **Depressional** wetlands.*

3. Does the entire wetland unit **meet all** of the following criteria?
   ___The vegetated part of the wetland is on the shores of a body of permanent open water (without any plants on the surface at any time of the year) at least 20 ac (8 ha) in size;
   ___At least 30% of the open water area is deeper than 6.6 ft (2 m).

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

4. Does the entire wetland unit **meet all** of the following criteria?
   ___The wetland is on a slope (*slope can be very gradual*),
   ___The water flows through the wetland in one direction (unidirectional) and usually comes from seeps. It may flow subsurface, as sheetflow, or in a swale without distinct banks,
   ___The water leaves the wetland **without being impounded**.

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

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

5. Does the entire wetland unit **meet all** of the following criteria?
   ___The unit is in a valley, or stream channel, where it gets inundated by overbank flooding from that stream or river,
   ___The overbank flooding occurs at least once every 2 years.

Wetland name or number Wetland A

NO – go to 6 **YES** – The wetland class is **Riverine**

NOTE: The Riverine unit can contain depressions that are filled with water when the river is not flooding

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

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

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

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

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

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

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

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

Wetland name or number Wetland A

DEPRESSIONAL AND FLATS WETLANDS

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

D 1.0. Does the site have the potential to improve water quality?	
D 1.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression (QUESTION 7 on key) with no surface water leaving it (no outlet). points = 3 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet. points = 2 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 1 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch. points = 1	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	4
Total for D 1 Add the points in the boxes above	10

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	0
D 2.2. Is > 10% of the area within 150 ft of the wetland in land uses that generate pollutants? Yes = 1 No = 0	0
D 2.3. Are there septic systems within 250 ft of the wetland? Yes = 1 No = 0	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	0

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	0
Total for D 3 Add the points in the boxes above	1

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

Wetland name or number Wetland A

DEPRESSIONAL AND FLATS WETLANDS

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

D 4.0. Does the site have the potential to reduce flooding and erosion?	
D 4.1. Characteristics of surface water outflows from the wetland: Wetland is a depression or flat depression with no surface water leaving it (no outlet) points = 4 Wetland has an intermittently flowing stream or ditch, OR highly constricted permanently flowing outlet points = 2 Wetland is a flat depression (QUESTION 7 on key), whose outlet is a permanently flowing ditch points = 1 Wetland has an unconstricted, or slightly constricted, surface outlet that is permanently flowing points = 0	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	3
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	10

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	0
D 5.2. Is >10% of the area within 150 ft of the wetland in land uses that generate excess runoff? Yes = 1 No = 0	0
D 5.3. Is more than 25% of the contributing basin of the wetland covered with intensive human land uses (residential at >1 residence/ac, urban, commercial, agriculture, etc.)? Yes = 1 No = 0	1
Total for D 5 Add the points in the boxes above	1

Rating of Landscape Potential If score is: ___**3 = H** ✓**1 or 2 = (M)** ___**0 = L** *Record the rating on the first page*

D 6.0. Are the hydrologic functions provided by the site valuable to society?	
D 6.1. The unit is in a landscape that has flooding problems. *Choose the description that best matches conditions around the wetland unit being rated. Do not add points. Choose the highest score if more than one condition is met.* The wetland captures surface water that would otherwise flow down-gradient into areas where flooding has damaged human or natural resources (e.g., houses or salmon redds): • Flooding occurs in a sub-basin that is immediately down-gradient of unit. points = 2 • Surface flooding problems are in a sub-basin farther down-gradient. points = 1 Flooding from groundwater is an issue in the sub-basin. points = (1) The existing or potential outflow from the wetland is so constrained by human or natural conditions that the water stored by the wetland cannot reach areas that flood. *Explain why* _____ points = 0 There are no problems with flooding downstream of the wetland. points = 0	1
D 6.2. Has the site been identified as important for flood storage or flood conveyance in a regional flood control plan? Yes = 2 No = 0	0
Total for D 6 Add the points in the boxes above	1

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

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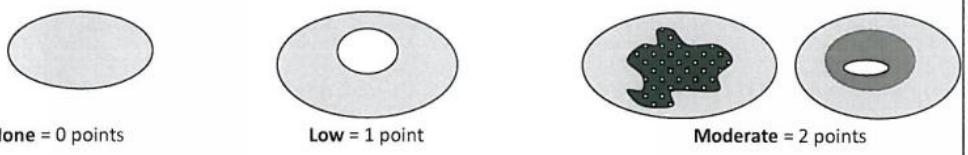
Wetland name or number Wetland A

These questions apply to wetlands of all HGM classes. **HABITAT FUNCTIONS** - Indicators that site functions to provide important habitat	
H 1.0. Does the site have the potential to provide habitat?	
H 1.1. Structure of plant community: *Indicators are Cowardin classes and strata within the Forested class.* Check the Cowardin plant classes in the wetland. *Up to 10 patches may be combined for each class to meet the threshold of ¼ ac or more than 10% of the unit if it is smaller than 2.5 ac. Add the number of structures checked.* ___Aquatic bed — 4 structures or more: points = 4 _✓_Emergent — 3 structures: points = 2 ___Scrub-shrub (areas where shrubs have > 30% cover) — 2 structures: points = 1 _✓_Forested (areas where trees have > 30% cover) — 1 structure: points = 0 *If the unit has a Forested class, check if:* _✓_The Forested class has 3 out of 5 strata (canopy, sub-canopy, shrubs, herbaceous, moss/ground-cover) that each cover 20% within the Forested polygon	2
H 1.2. Hydroperiods Check the types of water regimes (hydroperiods) present within the wetland. The water regime has to cover more than 10% of the wetland or ¼ ac to count (*see text for descriptions of hydroperiods*). ___Permanently flooded or inundated — 4 or more types present: points = 3 _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 ___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

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Wetland name or number Wetland A

H 1.5. Special habitat features:	
Check the habitat features that are present in the wetland. *The number of checks is the number of points.*	
✓ Large, downed, woody debris within the wetland (> 4 in diameter and 6 ft long).	
✓ Standing snags (dbh > 4 in) within the wetland	
___ Undercut banks are present for at least 6.6 ft (2 m) **and/or** overhanging plants extends at least 3.3 ft (1 m) over a stream (or ditch) in, or contiguous with the wetland, for at least 33 ft (10 m)	
___ Stable steep banks of fine material that might be used by beaver or muskrat for denning (> 30 degree slope) OR signs of recent beaver activity are present *(cut shrubs or trees that have not yet weathered where wood is exposed)*	2
___ 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*)	
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___ + [(% moderate and low intensity land uses)/2]___ = _____%	
If total accessible habitat is:	
> 1/3 (33.3%) of 1 km Polygon — points = 3	0
20-33% of 1 km Polygon — points = 2	
10-19% of 1 km Polygon — points = 1	
< 10% of 1 km Polygon — points = 0	
H 2.2. Undisturbed habitat in 1 km Polygon around the wetland.	
Calculate: % undisturbed habitat___ + [(% moderate and low intensity land uses)/2]___ = _____%	
Undisturbed habitat > 50% of Polygon — points = 3	1
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	
H 2.3. Land use intensity in 1 km Polygon: If	
> 50% of 1 km Polygon is high intensity land use — points = (- 2)	-2
≤ 50% of 1 km Polygon is high intensity — points = 0	
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** ✓ **< 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	0
— 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	

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

Wetland name or number Wetland A

WDFW Priority Habitats

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

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

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

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

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

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

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

— **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 Wetland A

CATEGORIZATION BASED ON SPECIAL CHARACTERISTICS

Wetland Type *Check off any criteria that apply to the wetland. Circle the category when the appropriate criteria are met.*	Category
SC 1.0. Estuarine wetlands Does the wetland meet the following criteria for Estuarine wetlands? — The dominant water regime is tidal, — Vegetated, and — With a salinity greater than 0.5 ppt Yes –Go to **SC 1.1** (No) = **Not an estuarine wetland**	
SC 1.1. Is the wetland within a National Wildlife Refuge, National Park, National Estuary Reserve, Natural Area Preserve, State Park or Educational, Environmental, or Scientific Reserve designated under WAC 332-30-151? Yes = **Category I** No - Go to **SC 1.2**	**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**

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Wetland name or number Wetland A

SC 4.0. Forested Wetlands Does the wetland have at least 1 contiguous acre of forest that meets one of these criteria for the WA Department of Fish and Wildlife's forests as priority habitats? ***If you answer YES you will still need to rate the wetland based on its functions.*** — **Old-growth forests** (west of Cascade crest): Stands of at least two tree species, forming a multi-layered canopy with occasional small openings; with at least 8 trees/ac (20 trees/ha) that are at least 200 years of age OR have a diameter at breast height (dbh) of 32 in (81 cm) or more. — **Mature forests** (west of the Cascade Crest): Stands where the largest trees are 80- 200 years old OR the species that make up the canopy have an average diameter (dbh) exceeding 21 in (53 cm). Yes = **Category I** (No) = **Not a forested wetland for this section**	**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	

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Wetland name or number Wetland A

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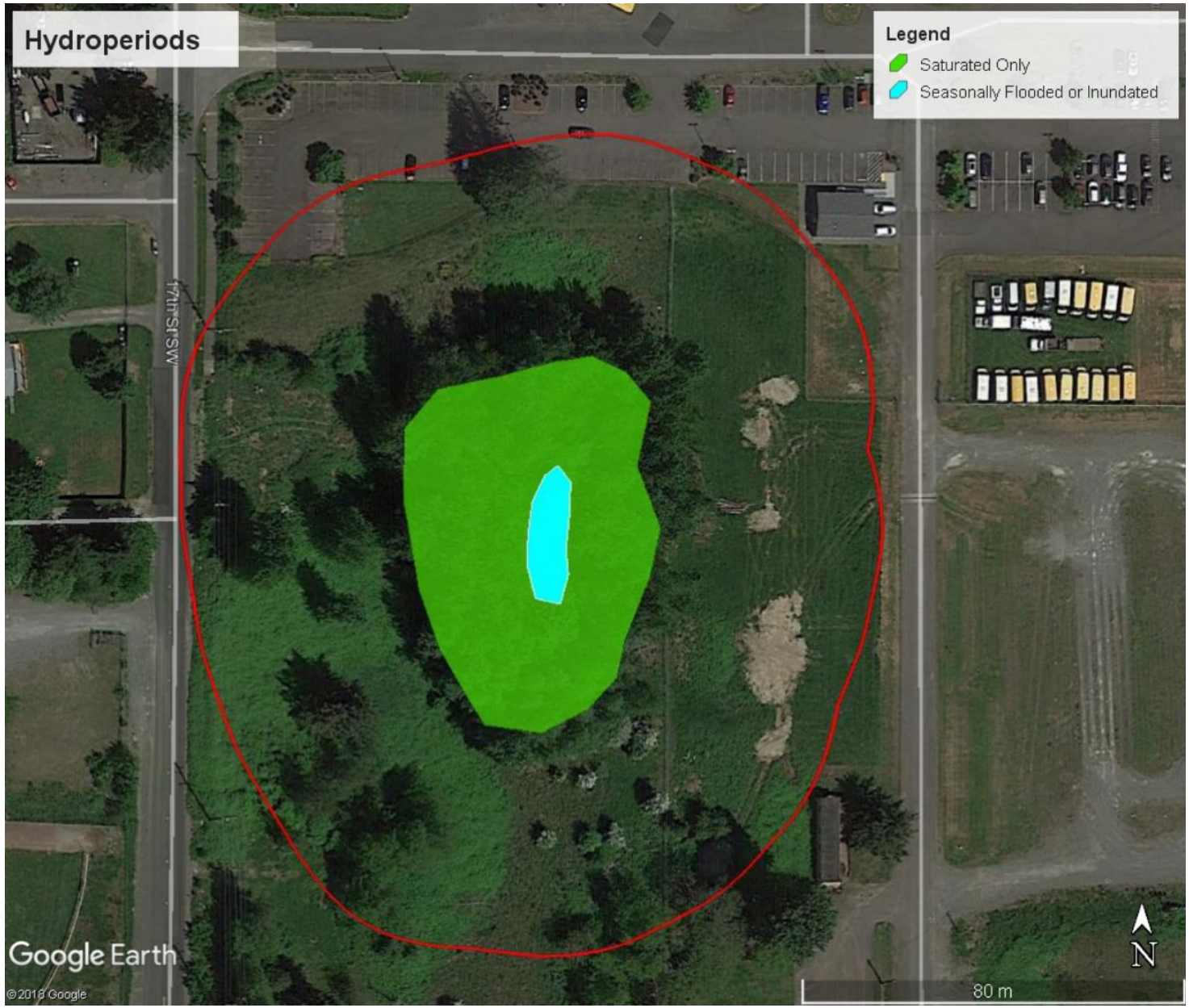
Cowardin Classes
Legend
Emergent Vegetation
Forested Vegetation
17th St SW
Google Earth
© 2018 Google
80 m
N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Legend
Saturated Only
Seasonally Flooded or Inundated
17th St SW
Google Earth
© 2018 Google
80 m
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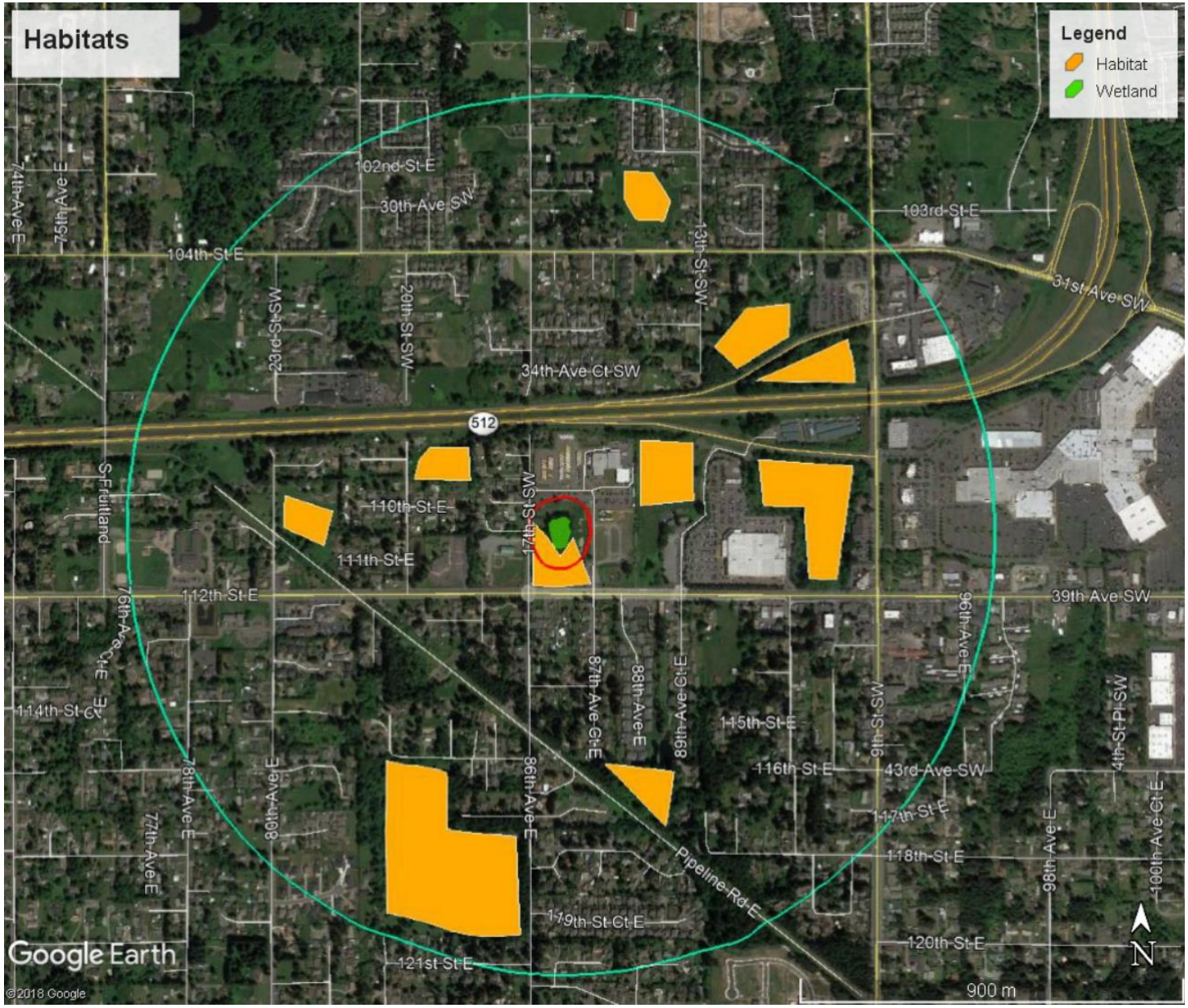
Habitats
Legend
Habitat
Wetland
102nd St E
30th Ave SW
104th St E
103rd St E
31st Ave SW
13th St SW
20th St SW
23rd St SW
34th Ave Ct SW
512
S Fruitland
110th St E
111th St E
17th St SW
112th St E
39th Ave SW
96th Ave E
87th Ave Ct E
88th Ave E
89th Ave E
115th St E
116th St E
43rd Ave SW
117th St E
118th St E
86th Ave E
78th Ave E
80th Ave E
77th Ave E
Pipeline Rd E
119th St Ct E
120th St E
121st St E
98th Ave E
100th Ave Ct E
Google Earth
©2018 Google
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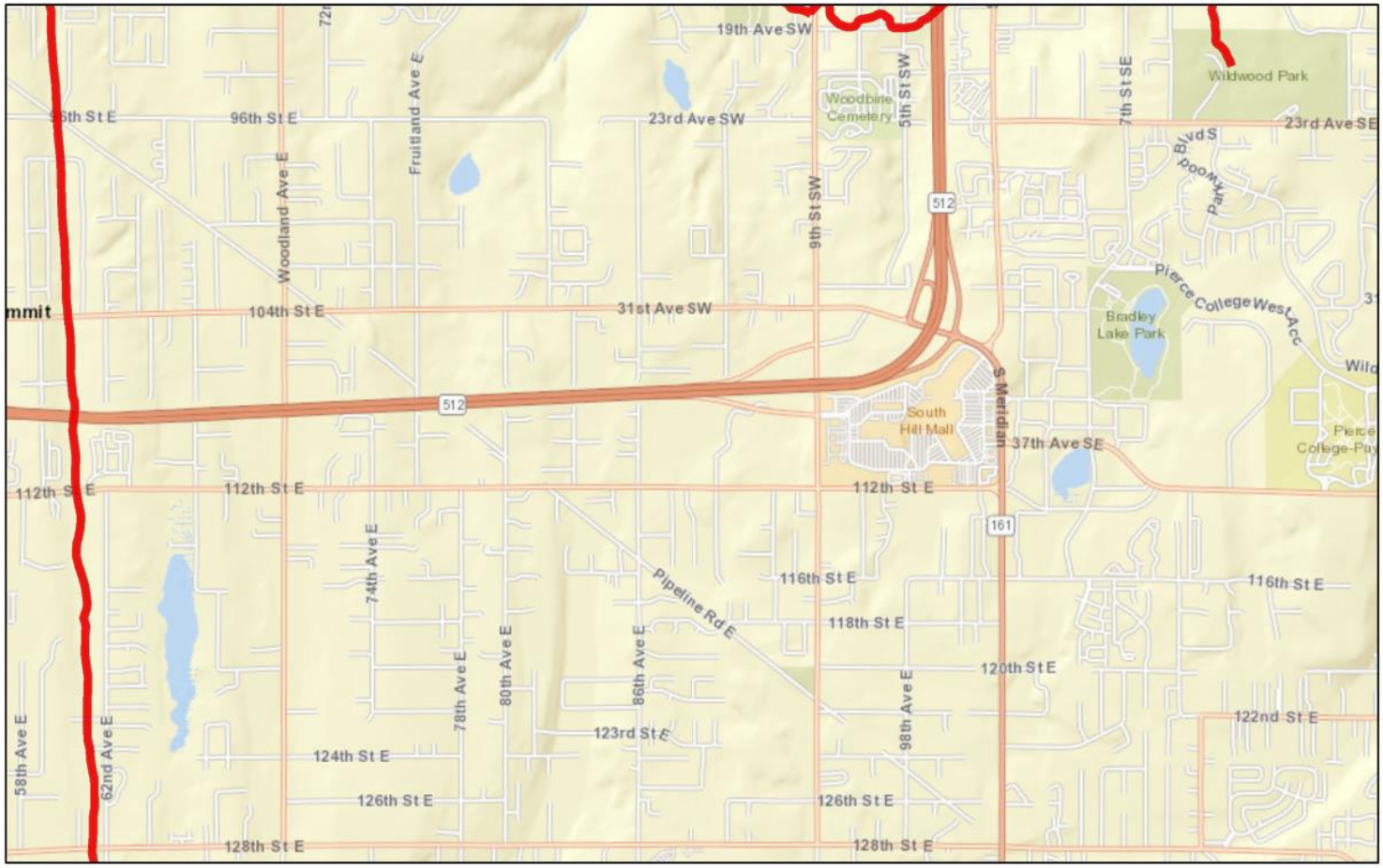


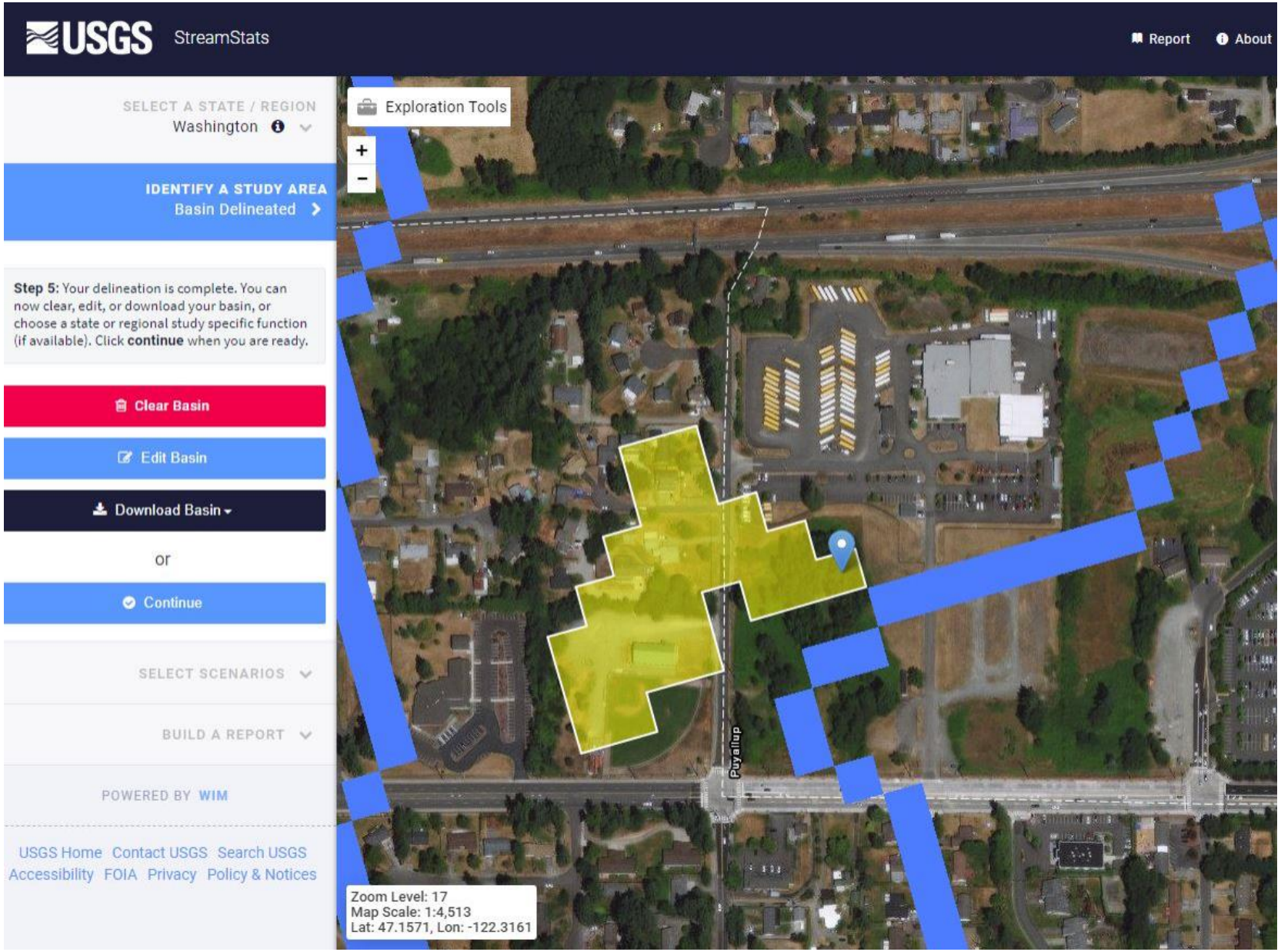
April 16, 2019

1:36,112

0 0.2 0.4 0.8 mi

0 0.33 0.65 1.3 km

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand),


USGS StreamStats
Report
About
SELECT A STATE / REGION
Washington
IDENTIFY A STUDY AREA
Basin Delineated
Step 5: Your delineation is complete. You can now clear, edit, or download your basin, or choose a state or regional study specific function (if available). Click continue when you are ready.
Clear Basin
Edit Basin
Download Basin
or
Continue
SELECT SCENARIOS
BUILD A REPORT
POWERED BY WIM
USGS Home Contact USGS Search USGS
Accessibility FOIA Privacy Policy & Notices
Exploration Tools
Puyallup
Zoom Level: 17
Map Scale: 1:4,513
Lat: 47.1571, Lon: -122.3161

HABITAT TECHNOLOGIES

CRITICAL AREAS ASSESSMENT

PARCEL 0419043091

3803 - 17th Street Southwest
City of Puyallup, Pierce County, Washington

prepared for

Ms. Dawn Markakis
Land Development Analysis Process Administrator
@ Abbey Road Group Land Development Services Company LLC
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Revised
June 7, 2017

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INTRODUCTION

This document details the culmination of activities and onsite evaluations undertaken to complete assessment of potential critical areas - in particular wetlands, streams, and critical habitats - within and immediately adjacent to **Parcel 0419043091 (project site).** The project site was located at the northeastern corner of the intersection of 112th Street East (39th Avenue SE) and 17th Street SW within the City of Puyallup, Pierce County, Washington (part of Section 04, Township 19 North, Range 04 East, Quarter 33, W.M.) (Figure 1). The evaluation and characterization of onsite and adjacent critical areas is a vital element in land use planning. The goal of this approach is to ensure that present and future proposed planned site development, to include the establishment of protective buffers, does not result in adverse environmental impacts to identified wetlands, streams, critical habitats, their associated buffer, or local water quality.

The assessment and evaluation of critical areas within and immediately adjacent to the project site was completed following the methods and procedures defined in the *Corps of Engineers Wetland Delineation Manual* (1987 Manual) with the 2010 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (2010 Supplement); the Washington State *Wetlands Rating System* (Hruby 2014); the State of Washington Department of Natural Resources (WDNR) Forest Practice Rules (WAC 222-16-030); and the City of Puyallup Chapter 21.

PROJECT SITE DESCRIPTION

The project site was rectangular in shape and approximately 3.9-acres in size. The project site was located within an area of existing residential and increasing commercial development along the 112th Street East Corridor. The project site had undergone prior land use manipulations to include forest harvest, clearing and grading, historic homesite development and land management, the development of adjacent properties, and the development of public roadway/utility corridors. A topographic depression was present in the northeastern portion of the project site.

Legal Description: Section 04 Township 19 Range 04 Quarter 33 BEG 30 FT N & 15 FT E OF SW COR TH N 553.14 FT TH E 315 FT TH S 553.14 FT TH W 315 FT TO BEG EXC POR CYD TO CY OF PUYALLUP PER ETN 4339081 EASE #2326342 OUT OF 3/015 & 3/901 SEG K1899 DL DL PP DC00375917 8/21

Directions to Project Site: From Meridian Avenue southbound turn west on 39th Avenue SW. Continue west of 39th Avenue SW (112th Street East) to 17th Street SW. Turn north onto 17th Street SW - the project site is to the northeast corner of the intersection of 39th Avenue SW and 17th Street SW.

BACKGROUND INFORMATION

NATIONAL WETLAND INVENTORY

The National Wetland Inventory (NWI) mapping completed by the U.S. Fish and Wildlife Service was reviewed as a part of this assessment (Figure 2). This mapping resource did not identify any wetlands or stream within or immediately adjacent to the project site.

STATE OF WASHINGTON PRIORITY HABITATS AND SPECIES

The State of Washington Priority Habitats and Species (PHS) Mapping was reviewed as a part of this assessment (Figure 3). This mapping resource did not identify any priority habitats or species within or immediately adjacent to the project site.

STATE OF WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

The State of Washington Department of Fish and Wildlife (WDFW) mapping was reviewed as a part of this assessment (Figure 4). This mapping resource did not identify any drainage corridors within the project site. This mapping resource generally identified an offsite drainage corridor to the east of the project site. This mapping resource did not identify any salmonid species within the vicinity of the project site.

STATE OF WASHINGTON DEPARTMENT OF NATURAL RESOURCES

The State of Washington Department of Natural Resources (WDNR) mapping was reviewed as a part of this assessment (Figure 5). This mapping resource did not identify any drainage corridors within the project site. This mapping resource generally identified an offsite drainage corridor as noted in the WDFW mapping resource above to the east of the project site. This offsite drainage corridor was identified as a WDNR Type F Water (fish presence).

CITY OF PUYALLUP MAPPING

The City of Puyallup inventory mapping was reviewed as a part of this assessment (Figure 6). This mapping resource identified a wetland within the northeastern portion of the project site. This mapping resource also identified soils which have been defined to potentially support Mazama pocket gophers (*Thomomys mazama*) along the eastern portion of the project site.

SOILS MAPPING

The soil mapping inventory completed by the Soils Conservation Service was reviewed as a part of this assessment (Figure 7). This mapping resource identified the soil throughout the western and central portions of the project site as Alderwood gravelly sandy loam (1B). The Alderwood soil series is defined as moderately well drained; as formed in glacier till; and as listed as to have inclusions of "hydric" soil areas.

The eastern portion of the project site was identified to contain Indianola loamy sand (18B). The Indianola soil series is defined as somewhat excessively drained, as formed in sandy glacial outwash, and as not listed as "hydric" soil.

PRIOR ONSITE AND ADJACENT ASSESSMENTS

Over the past several years Habitat Technologies has completed at least three (3) formal wetland delineations for the project site as well as a number of wetland delineations for a variety of adjacent parcels. These prior assessments have identified that an isolated topographic depression was present in the northeastern corner of the project site. In addition, the plant communities throughout the project site had been managed generally through mowing to control the establishment of invasive shrub thickets.

ONSITE ANALYSIS

CRITERIA FOR CRITICAL AREAS IDENTIFICATION

The City of Puyallup defines "critical areas" to include wetlands, fish and wildlife habitat areas, critical aquifer recharge areas, geologically hazardous areas, and frequently flooded areas. The critical areas assessment reported in this document has been limited to address wetlands and fish and wildlife habitat areas.

Wetlands: Wetlands are transitional areas between aquatic and upland habitats. In general terms, wetlands are lands where the extent and duration of saturation with water is the primary factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin, et al., 1979). Wetlands are generally defined within land use regulations as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (United States Army Corps of Engineers, 1987). Wetlands exhibit three essential characteristics, all of which must be present for an area to meet the established criteria (United States Army Corps of Engineers, 1987 and United States Army Corps of Engineers, 2010). These essential characteristics are:

1. **Hydrophytic Vegetation:** The assemblage of macrophytes that occurs in areas where inundation or soil saturation is either permanent or of sufficient frequency and duration to influence plan occurrence. Hydrophytic vegetation is present when the plant community is dominated by species that require or can tolerate prolonged inundation or soil saturation during the growing season.

2. **Hydric Soil:** A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions

in the upper parts. Most hydric soils exhibit characteristic morphologies that result from repented periods of saturation or inundation. These processes result in distinctive characteristics that persist in the soil during both wet and dry periods.

3. **Wetland Hydrology:** Permanent or periodic inundation, or surface soil saturation, at least seasonally. Wetland hydrology indicators are used in combination with indicators of hydric soil and hydrophytic vegetation to define the area. Wetland hydrology indications provide evidence that the site has a continuing wetland hydrology regime. Where hydrology has not been altered vegetation and soils provide strong evidence that wetland hydrology is present.

Fish and Wildlife Habitat Areas: The City of Puyallup has defined "fish and wildlife habitat areas" to include those areas necessary for maintaining species in suitable habitats within their natural geographic distribution so that isolated subpopulations are not created as designated by WAC 365-190-080. These areas include:

(a) Areas with which state or federally designated endangered, threatened, and sensitive species have a primary association;
(b) Habitats of local importance, including but not limited to areas designated as priority habitat by the Department of Fish and Wildlife;
(c) Streams and surface waters within the jurisdiction of the state of Washington; and
(d) Land essential for preserving connections between habitats and open spaces.

STUDY METHODS

Habitat Technologies completed a series of onsite assessments during March and April 2017. In addition, Habitat Technologies has completed similar assessments for parcels located within the general area of the project site over the past several decades. The objective of this evaluation was to define and delineate potential critical areas (wetlands; streams; and fish and wildlife habitats) that may be present within or immediately adjacent to the project area. Onsite activities were completed in accordance with criteria and procedures established in the *Corps of Engineers Wetland Delineation Manual* (1987 Manual) with the 2010 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (2010 Supplement); the Washington State *Wetlands Rating System* (Hruby 2014); the State of Washington Department of Natural Resources (WDNR) Forest Practice Rules (WAC 222-16-030); and the City of Puyallup Chapter 21..

FIELD OBSERVATION

The project site was accessed via an existing driveway connection to 17th Street SW along the western boundary of the project site. This existing driveway at one time provided access for the single-family home (now demolished) and what may have at

one time been a small veterinarian clinic. The majority of the project site appeared to have been historically managed as livestock pasture. However, this use had discontinued in past years and the majority of the project site was now dominated by dense thickets of Himalayan blackberry (*Rubus procera*) that appear regularly mowed as a control measure. The project site was surrounded by previously developed parcels and public roadways. Field data are provided in Appendix A.

- **Soils**

As documented at representative sample plots within the majority of the project site, the soil exhibited a sandy loam to gravelly sandy loam texture and coloration typical of both the Alderwood and Indianola soils. The surface soil within the project site was generally very dark grayish brown to dark grayish brown (10YR 3/2 to 10YR 3/3). The subsoil to a depth of 24 inches was generally dark grayish brown to brown (10YR 3/3 to 10YR 4/3). The majority of the onsite soil appeared to drain moderately well and did not exhibit prominent redoximorphic features.

Within the depression in the northeastern portion of the project site the surface soils exhibited a dark gray coloration (10YR 3/1) and silty loam texture with a high content of decomposing organic materials from onsite vegetation. The subsoil exhibited a dark gray to dark grayish brown coloration (10YR 3/1 to 10YR 4/2) and silty loam texture. The subsoil within this depression exhibited prominent redoximorphic features.

- **Hydrology**

Onsite hydrology appeared to be the result of seasonal stormwater runoff from onsite and adjacent parcels. The majority of the project site appeared to drain moderately well to well following seasonal storm events. In addition, the onsite assessments were completed during a period of generally higher than normal seasonal rainfall.

An isolated depression was identified within the northeastern portion of the project site. This depression was identified to seasonally pond surface water throughout the majority of the wetland area. As noted during prior assessments this depression would remain seasonally ponded/saturated into at least the early portion of the growing season. Prior assessments also did not identify an outlet for this depression and the seasonal ponding did not generally exceed three to four feet at the deepest point.

- **Vegetation**

The project site was dominated by plant communities typically associated with a managed lawn/pasture with areas of remnant retained trees. The majority of the project site exhibited large areas dominated by dense thickets of Himalayan blackberry. Observed species throughout the project site included a few retained Douglas fir (*Pseudotsuga menziesii*), black cottonwood (*Populus trichocarpa*), cherry (*Prunus virginiana*), domestic plum (*Prunus spp.*), hawthorne (*Crataegus monogyna*), locust (*Robinia* spp.), evergreen blackberry (*Rubus laciniatus*), Pacific blackberry (*Rubus*

ursinus), Scot's broom (*Cytisus scoparius*), rose (*Rosa* spp.), Indian plum (*Oemleria cerasiformis*), Pacific red elderberry (*Sambucus racemosa*), English ivy (*Hedera helix*), bracken fern (*Pteridium aquilium*), nettle (*Urtica dioica*), Canadian thistle (*Cirsium arvensis*), bull thistle (*Cirsium vulgare*), smooth cats ear (*Hypochaeris glabra*), hairy cats ear (*Hypochaeris radicata*), sheep sorrel (*Rumex acetosella*), dandelion (*Taraxacum officinale*), geranium (*Geranium* spp.), daisy (*Bellis* spp.), clover (*Trifolium* spp.), wheatgrass (*Agropyron* spp.), bentgrass (*Agrostis tenuis* and *Agrostis alba*), orchard grass (*Dactylis glomerata*), fescue (*Festuca spp.*), vernal grass (*Anthoxanthum odoratum*), bluegrass (*Poa spp.*), and buttercup (*Ranunculus repens*). This plant community was identified as non-hydrophytic in character (i.e. typical of uplands).

Onsite management actions have included the routine mowing of blackberry thickets. In addition, the northern and eastern boundaries of the project site have been routinely mowed by the adjacent neighbor in what best appeared an attempt to control the spread of blackberries from the project site offsite to the north and east.

The depression within the northeastern portion of the project site exhibited a plant community typically associated with damp to saturated soils. Observed species included black cottonwood, crabapple (*Pyrus fusca*), black twinberry (*Lonicera involucrata*), salmonberry (*Rubus spectabilis*), Douglas spiraea (*Spiraea douglasii*), hairy nightshade (*Solanum sarrachoides*), speedwell (*Veronica* spp.), buttercup (*Ranunculus repens*), and reed canarygrass (*Phalaris arundinacea*). This plant community was identified as hydrophytic in character (i.e. typical of wetlands).

- **Wildlife**

Wildlife species observed onsite during the present and prior assessments, as well as those species that would be reasonably expected to utilize the habitats provided within or adjacent to the project site would include red tailed hawk (*Buteo jamaicensis*), American crow (*Corvus brachynchos*), Northern flicker (*Colaptes auratus*), Steller's jay (*Cyanocitta stelleri*), American robin (*Turdus migratorius*), black capped chickadee (*Parus atricapillus*), rufous-sided towhee (*Pipilo erythrophthalmus*), dark eyed junco (*Junco hyemalis*), rufous hummingbird (*Selasphorus rufus*), common raven (*Corvus corax*), merlin (*Falco columbarius*), mourning dove (*Zenaida macroura*), chestnut backed chickadee (*Parus rufescens*), black-capped chickadee (*Parus atricapillus*), golden crowned sparrow (*Zonotrichia atricapilla*), song sparrow (*Melospiza melodia*), white crowned sparrow (*Zonotrichia leucophrys*), red winged blackbird (*Agelaius phoenisues*), rock dove (*Columbia livia*), house finch (*Carpodacus mexicanus*), starling (*Sturnus vulgaris*), American goldfinch (*Carduelis tristis*), purple finch (*Carpodacus purpureus*), violet green swallow (*Tachycineta thallassina*), tree swallow (*Tachycineta bicolor*), great blue heron (*Ardea herodias*), common mallard (*Anas platyrhynchos*), Canada goose (*Branta canadensis*), marsh wren (*Cistothorus palustirs*), black tailed deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), coyote (*Canis latrans*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginianus*), deer mouse (*Peromyscus maniculatus*), shrew (*Sorex* spp.), Townsend mole (*Scapanus townsendii*), bats (*Myotis* spp.), voles (*Microtus* spp.), Norway rat (*Rattus norvegicus*), and bats (*Myotis spp.*).

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The project site would also provide habitats for Pacific treefrog (*Hyla regilla*) and common garter snake (*Thamnophis sirtalis*).

The project site has not been documented to provide direct habitats for fish species.

Wildlife Movement Corridors: The project site was within an area of residential and increasing commercial development. As identified by onsite wildlife trials, small, medium, and large mammals appeared to be moving throughout the project site. However, the project site does not appear to provide a seasonal mitigation corridor for mammals. The project site is also within the general area of the migratory movement of passerine birds and waterfowl.

State Priority Species: Several species identified by the State of Washington as "Priority Species" were observed onsite or potentially may utilize the project site. Priority species require protective measures for their survival due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance.

Game Species: "Game species" are regulated by the State of Washington through recreational hunting bag limits, harvest seasons, and harvest area restrictions. Observed or documented "game species" within and adjacent to the project site included black-tailed deer, common mallard, Canada goose, and mourning dove.

State Monitored: State Monitored species are native to Washington but require habitat that has limited availability, are indicators of environmental quality, require further assessment, have unresolved taxonomy, may be competing with other species of concern, or have significant popular appeal. State Monitored species – great blue heron – may potentially utilize the habitats associated with the wetland.

State Candidate: State Candidate species are presently under review by the State of Washington Department of Fish and Wildlife (WDFW) for possible listing as endangered, threatened, or sensitive. No State Candidate species would be expected to use the habitats within the project site.

State Sensitive: State Sensitive species are native to Washington and is vulnerable to declining and is likely to become endangered or threatened throughout a significant portion of its range without cooperative management or removal of threats. No State Sensitive species were observed as a part of this assessment. However, bald eagles (*Haliaeetus leucocephalus*) are documented to use the habitats along the Puyallup River Corridor and the Clarks Creek Corridor. As such, this species may overfly the project site.

State Threatened: State Threatened species means any wildlife species native to the state of Washington that is likely to become an endangered species within

the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats. The project site did not appear to provide direct critical habitats for State Threatened species.

State Endangered: State endangered species means any species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state. The project site did not appear to provide direct critical habitats for State Endangered species.

Federally Listed Species: The project site has not been documented to provide critical habitats for federally listed species. A single, federally listed species of concern – bald eagle – has been documented to use the habitats associated with the Puyallup River Corridor and Clarks Creek Corridor.

As noted above, the eastern portion of the project site has been mapped as dominated by Indianola loamy sand which has been defined to potentially support Mazama pocket gophers. During prior assessments of the project site completed by Habitat Technologies there was no documented observations of the potential presence of this species. The entire project site - along with the adjacent parcels - has been managed for several years and has not been documented to provide critical habitats for this species. In addition, absent routine mowing and other management actions the project site and adjacent parcels would be dominated by dense thickets of invasive species which would over time convert into mixed forested area. The project site was also surrounded by existing and increasing urban development such that the movement of this species into the project site would not be reasonably expected.

CRITICAL AREAS DETERMINATION

WETLANDS

Wetland determination was based on observations of hydrophytic vegetation, hydric soils, and wetland hydrology in accordance with the United States Army Corps of Engineers, 1987 and United States Army Corps of Engineers, 2010. Based on these observations one area within the project site was identified to exhibit all three of the established wetland criteria.

WETLAND	CLASSIFICATION (USFWS)	CITY OF PUYALLUP CATEGORY	WDOE RATING SCORE	WDOE HABITAT SCORE	BUFFER WIDTH (high intensity)
A	PFOC/PEMC	4	15	4	50 feet

Wetland A: Wetland A was identified within the northeastern portion of the project site within an isolated, topographic depression. Wetland A was dominated by a dense stand of black cottonwood around the perimeter and by primarily reed canarygrass within the interior. This wetland also included a variety of intermixed small clusters of sapling

trees and shrubs. Wetland hydrology was provided by seasonal stormwater sheetflow, potentially by groundwater, soils characteristics, and the lack of an outlet for this isolated topographic depression.

Wetland A met the U.S. Fish and Wildlife Service (USFWS) criteria for classification of palustrine, forested, seasonally flooded (PFOC); and palustrine, emergent, seasonally flooded (PEMC). Wetland A appeared to meet the criteria for designation as a City of Puyallup Category 4 Wetland. Wetland A achieved a total functions score of 15 points utilizing the Washington State Department of Ecology (WDOE) Wetland Rating Form for Western Washington (Appendix B).

FISH AND WILDLIFE HABITAT AREAS

As defined by onsite assessment, prior assessments, and a review of existing resource agency information the project site was identified to provide very limited fish and wildlife habitat areas.

- The project site has not been documented and has not been observed to provide critical habitats which state or federally designated endangered, threatened, and sensitive species have a primary association.
- The project site has not been documented and has not been observed to provide habitats of local importance, including but not limited to areas designated as priority habitat by the Department of Fish and Wildlife.
- The project site has not been documented and has not been observed to provide land essential for preserving connections between habitats and open spaces.
- The project site has not been documented and has not been observed to exhibit a stream which would be within the jurisdiction of the State of Washington.
- The project site has been identified to exhibit a wetland. This wetland would be considered within the jurisdiction of the State of Washington.

SELECTED DEVELOPMENT ACTION

The *Selected Development Action* for the project site (Parcel 0419043091) has not yet been fully defined. As presently understood, the future development of the project site may be completed without direct adverse impact to the identified onsite Category III Wetland or is associated buffer as identified within the City of Puyallup Chapter 21.

STANDARD OF CARE

This document has been completed by Habitat Technologies for use by **Abbey Road Group Land Development Services Company LLC**. Prior to extensive site planning the findings documented in this document should be reviewed and verified by the City of Puyallup. Habitat Technologies has provided professional services that are in accordance with the degree of care and skill generally accepted in the nature of the work accomplished. No other warranties are expressed or implied. Habitat Technologies is not responsible for design costs incurred before this document is approved by the appropriate resource and permitting agencies.

Thomas D. Deming

Bryan W. Peck
Wetland Biologist

Thomas D. Deming, PWS
Habitat Technologies

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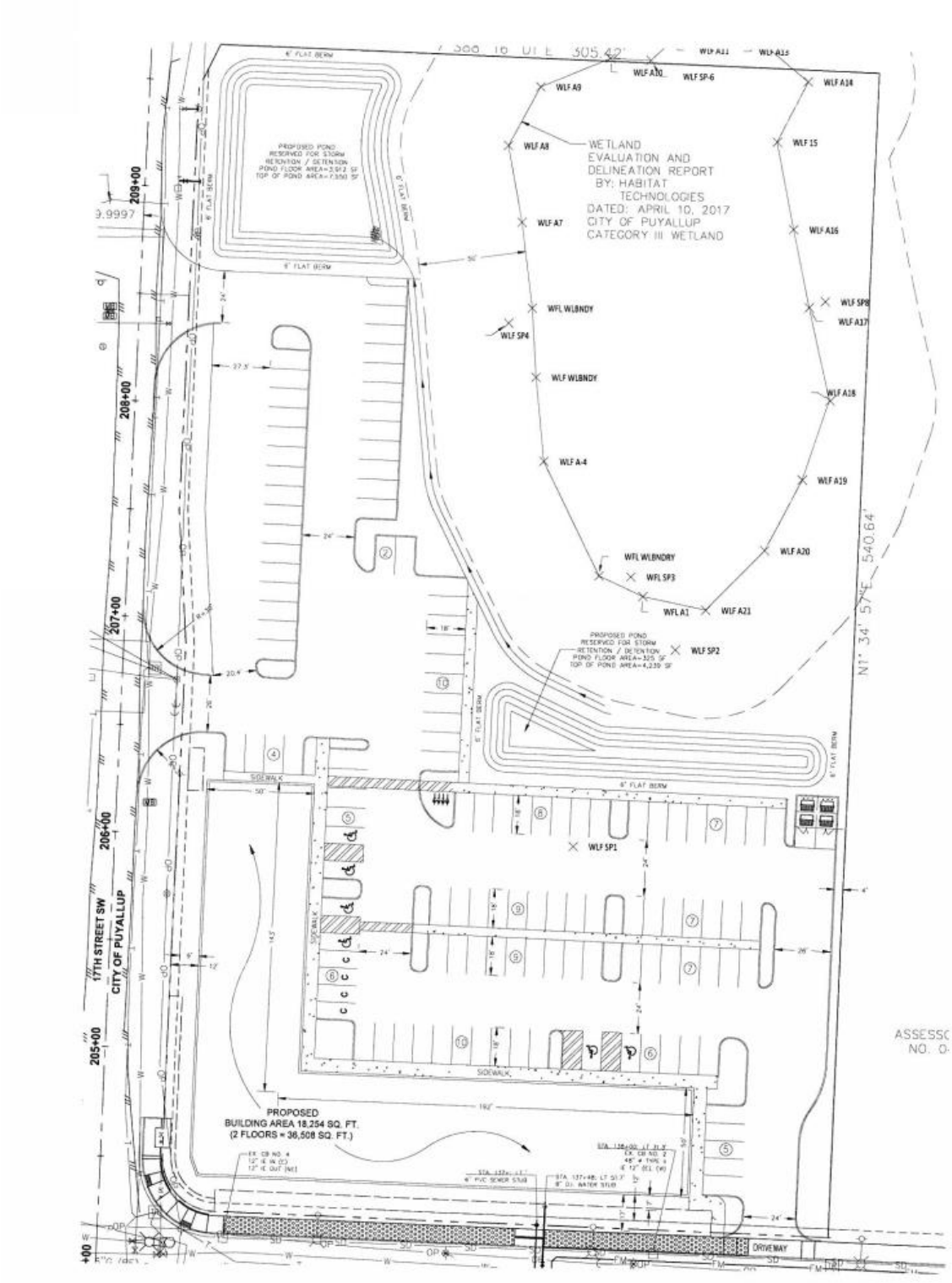
WETLAND
EVALUATION AND
DELINEATION REPORT
BY: HABITAT
TECHNOLOGIES
DATED: APRIL 10, 2017
CITY OF PUYALLUP
CATEGORY III WETLAND
WLF A8
WLF A9
WLF SP-6
WLF A14
WLF 15
WLF A7
WLF A16
WLF SP5
WLF A17
WFL WLBNDY
WLF SP4
WLF WLBNDY
WLF A18
WLF A-4
WLF A19
WFL WLBNDRY
WFL SP3
WLF A20
WFL A1
WLF A21
WLF SP2
WLF SP1
PROPOSED POND
RESERVED FOR STORM
RETENTION / DETENTION
8' FLAT BERM
SIDEWALK
17TH STREET SW
CITY OF PUYALLUP
209+00
208+00
207+00
206+00
205+00
PROPOSED
BUILDING AREA 18,254 SQ. FT.
(2 FLOORS = 36,508 SQ. FT.)
DRIVEWAY
N1° 34' 57"E 540.64'