STORM DRAINAGE REPORT

FOR

Best Parking Lot Cleaning
Puyallup, Washington

Revised March 2024
September 2023

Prepared for:
BPLC Properties LLC

Prepared by:
Matthew Seawright, E.I.T., Project Designer

Approved By:

Daniel Smith, P.E., Senior Project Manager

REPORT #20083

"I hereby state that this Drainage and Erosion/Sediment Control Plan for the Best Parking Lot Cleaning project has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community of professional engineers. I understand that City of Puyallup does not and will not assume liability for the sufficiency, suitability or performance of drainage facilities prepared by me."

This analysis is based on data and records either supplied to, or obtained by, C.E.S. NW, Inc. These documents are referenced within the text of the analysis. The analysis has been prepared utilizing procedures and practices within the standard accepted practices of the industry.

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STORM DRAINAGE

1. Project Overview

This report accompanies the civil engineering plans as submitted to the City of Puyallup for review and approval. This document provides site information, and the analysis used to prepare the storm drainage design. The *Washington State Department of Ecology Stormwater Management Manual for Western Washington, 2019 (Manual),* and the City of Puyallup's modifications to that document establishes the methodology and design criteria used for this project.

The Best Parking Lot Cleaning project proposes the paving of an existing gravel parking lot and accompanying storm facilities on a 1.86-acre site comprised of four parcels (2105200320, 2105200350, 2105200340 and 2105200361) zoned Limited Manufacturing (ML). The site is accessed from Inter Ave with two commercial driveway approaches. The project is located in the Puyallup River Water Resources Inventory Area (WRIA 10). The Vicinity Map has been included in Appendix "A" of this report. A project summary is as follows:

Permit Applied for –Site Development
Address – 2412 Inter Ave Puyallup, WA 98372
Parcel Numbers – 2105200320, 2105200350, 2105200340 and 2105200361
Legal description – (Per Quit Claim Deed Filed Under Recording Number 200105070774)

Parcel A (2105200320):
East 100 Feet of Block 19, Ackerson's Second Addition to Puyallup, According to Plat Recorded in Book 8 of Plats, at Game 25, in Pierce County, Washington.

Parcel B (2105200350):
West 75 Feet if that Part of Block 20, Ackerson's Second Addition to Puyallup, Situated in the City of Puyallup, According to Plat Recorded in Book 8 of Plats, at Page 25, in Pierce County, Washington.
(Per Alta Commitment for Title Insurance Issued by Chicago Title Commitment Number 0012400-Tc Dated March 25, 2014)

Parcel #2105200361:
Block 20, Ackerson's Second Addition to Puyallup. According to Plat Recorded in Volume 8 of Plats, Page 25, Records of Pierce County Auditor.
Except the West 150 Feet Thereof.
(Per Real Estate Excise Tax Affidavit Filed Under Recording Number 4337181)

Parcel #2105200340:
The East 75 Feet of the West 150 Feet of Block 20, Ackerson's Second Addition to Puyallup, According to Plat Thereof Recorded in Volume 9 of Plats, at Page 25, Records of Pierce County Auditor.

All Situate in the City of Puyallup, County of Pierce, State of Washington.

The project site historically has been used as a gravel parking lot as depicted on the pre-developed basin map (Appendix "B"). The existing site is redeveloped with landscaping and repaving of the existing gravel with asphalt upon permit approval. The property has frontage with Inter Ave along its northern property line and access is provided with two commercial driveway approaches. The project proposes approximately 51,000 sq.ft. of asphalt paving across onsite and offsite improvements; therefore, according to Figure 1-3.1 and 1-3.2 of Volume I of the Manual, the project must evaluate all minimum requirements for the new and replaced surfaces. Section 5 of this report contains a detailed discussion of the minimum requirements. The project proposes a detention pond (BMP D.1) for flow control of the site improvements, and runoff treatment is provided by a combined wet pond (BMP T10.40) underneath the detention pond and two continuous inflow biofiltration swales (BMP T9.30) within the right-of-way. All disturbed areas which are not converted to impervious surface apply soil amendments in accordance with BMP T5.13.

2. Existing Conditions Summary

The existing site is currently used as a gravel parking lot. The site is relatively flat between elevations 62-64 (NAVD 88) which gradually slopes towards Inter Avenue with a relative high spot south center of the parcels. Runoff sheet flows north across the gravel parking lot and is collected by the public closed conveyance system in Inter Ave. The public closed conveyance

system is comprised of 12-inch concrete pipes and flows west for approximately 1,500-feet towards an offsite wetland complex and Upper Deer Creek. The site is accessed by existing gravel driveway approaches from Inter Avenue.

Onsite soils have been identified as Briscot loam (6A a Type D soil) determined by the USDA SCS maps of Pierce County, Washington. A description of the USDA soils and a copy of the soil map for this portion of Pierce County have been included in Appendix "A" of this report. A draft geotechnical engineer's report has been prepared by Earth Solution NW LLC, dated February 12, 2019, with an addendum, dated August 3, 2021, where they documented groundwater table depths at a depth of 0.9 to 2.0-feet. A copy of the geotechnical report is included in Appendix "D".

There is an existing gravity sewer main in Inter Avenue which currently serves the property. There are no known aquifer recharge or wellhead protection areas that affect this property. There are no known well or septic systems onsite. If a septic system or well is discovered onsite during construction, it will be decommissioned per Tacoma-Pierce County Health Department standards. The parcel and all the proposed improvements are located within Zone X, which is considered outside of the 100-year floodplain, per FEMA Map # 53053C0334E. A copy of the FIRM Panel map can be found in Appendix 'B' of this report.

3. Off-site Analysis Report

A quarter mile downstream analysis is required by the City of Puyallup. The project proposes a detention pond for flow control, and a wetpond for treatment of runoff directed towards the onsite conveyance system and two continuous inflow bio-filtration swales in the right-of-way. Based on a field survey and public GIS information, the runoff is conveyed west within Inter Avenue's closed conveyance system towards Upper Deer Creek. The ¼ mile drainage path ends at the outfall to Upper Deer Creek. Existing wetlands are located at the outfall to Upper Deer Creek. The runoff ultimately outfalls to the Puyallup River which is located approximately 0.9-miles downstream located northwest of the project site. A downstream map is included in Appendix "B". No adverse impacts are anticipated to the downstream system as a result of the development due to the proposed detention pond.

4. Permanent Stormwater Control Plan

Existing Site Hydrology

The existing site sheet flows across the gravel parking lot and outfalls to the public storm system in Inter Avenue. The site is modeled under pre-developed conditions for the sake of calculating flow control requirements. The pre-developed basin is 1.987-acres C, Forest, Flat. The following is a summary of the pre-developed site flows:

2-year.....0.045-cfs
10-year.....0.083-cfs
50-year.....0.108-cfs
100-year.....0.116-cfs

Please refer to the Pre-Developed Basin Map in Appendix "B" and the WWHM computer results in Appendix "C".

Developed Site Hydrology

Under the developed condition, the project site proposes 44,578 sq.ft. of asphalt paving across onsite improvements and offsite driveway approach improvements. The landscape and yard areas can be modeled as "pasture" due to soil amendment per Ecology BMP T5.13. The post developed basin is summarized in the below:

Sub-Basin	Land-use	WWHM Description	Area (ac)
Post Dev A	Road (Inter Ave to Pond)	Roads, Flat	0.066
Post Dev B	Parking Lot (to Pond)	Parking, Flat	1.008
Post Dev C	Landscaping (to Pond)	C, Pasture, Flat	0.494
Post Dev D	Detention Pond	Pond	0.240
Bypass A	Road (Inter Ave Bypass)	Roads, Flat	0.105
Bypass B	Landscaping (Inter Ave Bypass)	C, Pasture, Flat	0.074
Total			**1.987**

Table 1 – Post Developed Basin

The following is a summary of the unmitigated post developed site flows:

2-year.....0.516-cfs

10-year.....0.820-cfs

50-year.....1.136-cfs

100-year.....1.285-cfs

Please refer to the Post Developed Basin Map in Appendix 'B' and the WWHM computer results in Appendix "C".

Pond Sizing

The project proposes a detention pond for flow control and runoff treatment. As calculated by the WWHM computer program, a 3.5-foot deep detention pond with a bottom area of 9,352 sq.ft. and a volume at top of riser of 0.791 acre-feet is required. The project proposes a 3.5-foot deep pond with 9,374 sq.ft. bottom area and 0.799 acre-feet of volume. A copy of the computer modeling report is included in Appendix "C". The pond discharges to Inter Avenue with the use of a riser control structure to meter the post developed runoff. The riser schedule is summarized in Table 9.1 below.

Elev.	Type	Size.
55.50	Orifice	0.68-in
60.64	Weir	1.25-in wide

Table 9.1 – Riser Schedule

Emergency Overflow Spillway

The outlet length of the proposed detention pond is determined by the following equation:

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

Where;

L = Length of weir outlet (ft)

Q_{100} = Peak 100-year flow rate (1.52 cfs)

H = Height of water over weir (0.5-ft)

H = Calculated at <0.2 using Hydraflow Express; therefore, assume 0.2 as minimum

$L = [Q_{100}/(3.21H^{3/2})]-2.4H = [1.52\ cfs/(3.21*(0.5^{3/2}))]-2.4*0.5 = 0.14$-feet; therefore, use **6-feet**.

Runoff Treatment

Combined Detention/Wet Pond (BMP T10.40)

Runoff that is directed towards the onsite conveyance system is treated with a wetpond at the bottom of the detention pond. The required treatment volume is 6,660- cubic-feet (0.15 acre-feet) as calculated by the WWHM computer program. The wetpond provides 8,800 cubic-feet (0.202 acre-feet) of dead storage; therefore, sufficient treatment volume is provided. A copy of the computer modeling report is included in Appendix *"C"*.

Continuous Inflow Biofiltration Swale (BMP T9.30)

Runoff that bypasses the pond in the right-of-way is treated with two 100-foot long continuous inflow biofiltration swales. The swales are 2-feet wide and 6-inches deep with a channel slope of 1.5%. The channel velocity is calculated using AutoDesk's Hydraflow Express at the water quality flow rate of 0.0157-cfs and a Manning's coefficient of 0.20. As calculated the channel velocity is 0.12-fps; therefore, the required bio-filtration swale length is 129.6-feet and 200-feet is provided. The swale length is calculated as follows:

L = 1080[sec] * V_{wq} = 1080[sec] * 0.12-fps = 129.6-feet required, and two 100-foot swales provided.

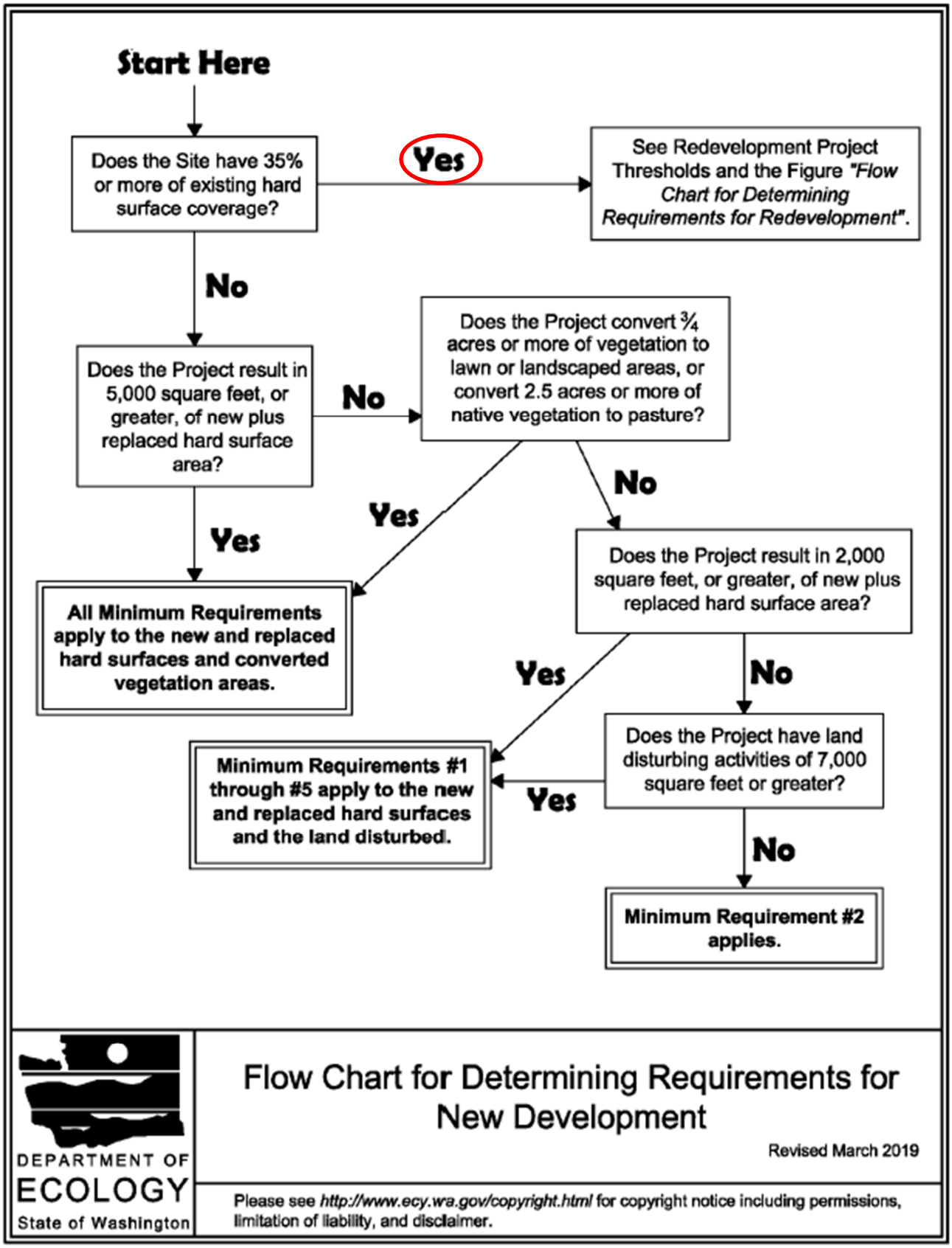
A copy of the Hydraflow Express calculations is included in Appendix "C".

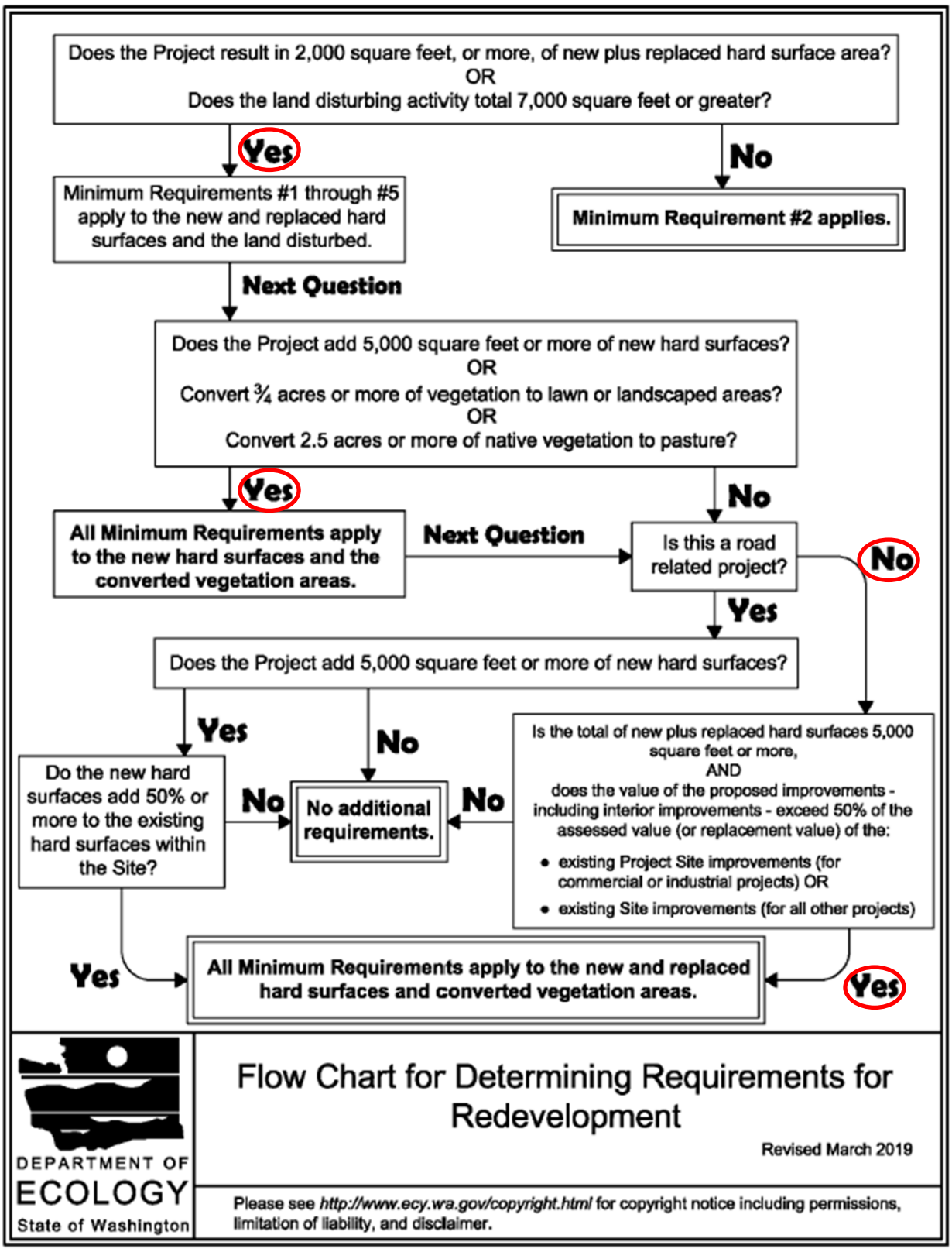
Conveyance Calculations

The project proposes an onsite closed conveyance system. This system is comprised of catch basins, PVC pipes and ductile iron pipe. The rational method is used to demonstrate that the system's ability to convey the site's overflow 100-year event as calculated using equations from the Manual on a Excel spreadsheet. The conveyance basin is provided in Appendix "B" and the rational method results are provided in Appendix "C".

5. Discussion of Minimum Requirements

The project is the redevelopment of two parcels that proposes more than 5,000 sq.ft. of new plus replaced hard surfaces; therefore, as required by Figure 1-3.1 and 1-3.2 of Volume I of the Manual all minimum requirement applies to the new and replaced surfaces.


Start Here
Does the Site have 35% or more of existing hard surface coverage?
Yes
See Redevelopment Project Thresholds and the Figure "Flow Chart for Determining Requirements for Redevelopment".
No
Does the Project result in 5,000 square feet, or greater, of new plus replaced hard surface area?
No
Does the Project convert ¾ acres or more of vegetation to lawn or landscaped areas, or convert 2.5 acres or more of native vegetation to pasture?
Yes
No
Yes
All Minimum Requirements apply to the new and replaced hard surfaces and converted vegetation areas.
Does the Project result in 2,000 square feet, or greater, of new plus replaced hard surface area?
Yes
No
Minimum Requirements #1 through #5 apply to the new and replaced hard surfaces and the land disturbed.
Does the Project have land disturbing activities of 7,000 square feet or greater?
Yes
No
Minimum Requirement #2 applies.
DEPARTMENT OF ECOLOGY
State of Washington
Flow Chart for Determining Requirements for New Development
Revised March 2019
Please see http://www.ecy.wa.gov/copyright.html for copyright notice including permissions, limitation of liability, and disclaimer.


Does the Project result in 2,000 square feet, or more, of new plus replaced hard surface area?
OR
Does the land disturbing activity total 7,000 square feet or greater?
Yes
No
Minimum Requirements #1 through #5 apply to the new and replaced hard surfaces and the land disturbed.
Minimum Requirement #2 applies.
Next Question
Does the Project add 5,000 square feet or more of new hard surfaces?
OR
Convert ¾ acres or more of vegetation to lawn or landscaped areas?
OR
Convert 2.5 acres or more of native vegetation to pasture?
Yes
No
All Minimum Requirements apply to the new hard surfaces and the converted vegetation areas.
Next Question
Is this a road related project?
No
Yes
Does the Project add 5,000 square feet or more of new hard surfaces?
Yes
No
Do the new hard surfaces add 50% or more to the existing hard surfaces within the Site?
No
No additional requirements.
No
Is the total of new plus replaced hard surfaces 5,000 square feet or more,
AND
does the value of the proposed improvements - including interior improvements - exceed 50% of the assessed value (or replacement value) of the:
existing Project Site improvements (for commercial or industrial projects) OR
existing Site improvements (for all other projects)
Yes
All Minimum Requirements apply to the new and replaced hard surfaces and converted vegetation areas.
Yes
DEPARTMENT OF ECOLOGY
State of Washington
Flow Chart for Determining Requirements for Redevelopment
Revised March 2019
Please see http://www.ecy.wa.gov/copyright.html for copyright notice including permissions, limitation of liability, and disclaimer.

The following is a summary of the minimum requirements as described in Chapter 2 of Volume I of the Manual.

5.1 Minimum Requirement #1: Preparation of a Stormwater Site Plan

The Stormwater Site Plan is prepared and is provided with this document.

5.2 Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP)

A SWPP Plan has been prepared. It is submitted alongside this report as the erosion control report.

5.3 Minimum Requirement #3: Source Control of Pollution

Permanent source control BMPs are required for the development's daily operations as described in the Pollution Source Control Manual for Commercial/Industrial Activities included as a separate document.

5.4 Minimum Requirement #4: Preservation of Natural Drainage System and Outfalls

Under existing conditions, stormwater runoff is collected onsite and discharged into the public conveyance system in Inter Avenue south of the site. The proposed improvements maintain the existing outfalls for the project site.

5.5 Minimum Requirement #5: Onsite Stormwater Management

This project must meet minimum requirements 1-9; therefore, this project must either evaluate List 2 for onsite stormwater management compliance or meet the LID Performance Standard. The project will evaluate List 2 for onsite stormwater management compliance. BMPs from List 2 were evaluated as follows:

<u>Lawn and Landscape Areas</u>

- **Soil Preservation and Amendment** (Ecology BMP T5.13).

  All disturbed areas which are not converted to impervious areas shall apply soil amendment per Ecology BMP T5.13.

<u>Roof Areas</u>

- The Project does not propose this surface type.

Other Hard Surfaces

- **65/10 Dispersion** is deemed **infeasible** due to limited site area.
- **Permeable pavement** and **bioretention** are deemed **infeasible** due to the shallow groundwater table.
- **Sheet flow dispersion** is deemed **infeasible** due to limited site area.

5.6 Minimum Requirement #6: Runoff Treatment

The project exceeds runoff treatment thresholds and meets this requirement with a wetpond located below the detention pond, and two continuous inflow bio-filtration swales in the right-of-way. Sizing calculations is provided in Section 4 of this report.

5.7 Minimum Requirement #7: Flow Control

The project meets the Flow Control Performance Standard with the use of an onsite detention pond.

5.8 Minimum Requirement #8: Wetlands Protection

This requirement is not applicable to the project since the closest wetland is more than ¼ mile downstream of the site at Inter Ave's outfall to Upper Deer Creek.

5.9 Minimum Requirement #9: Operation and Maintenance

An Operation and Maintenance Manual is submitted alongside this report.

6. Other Permits

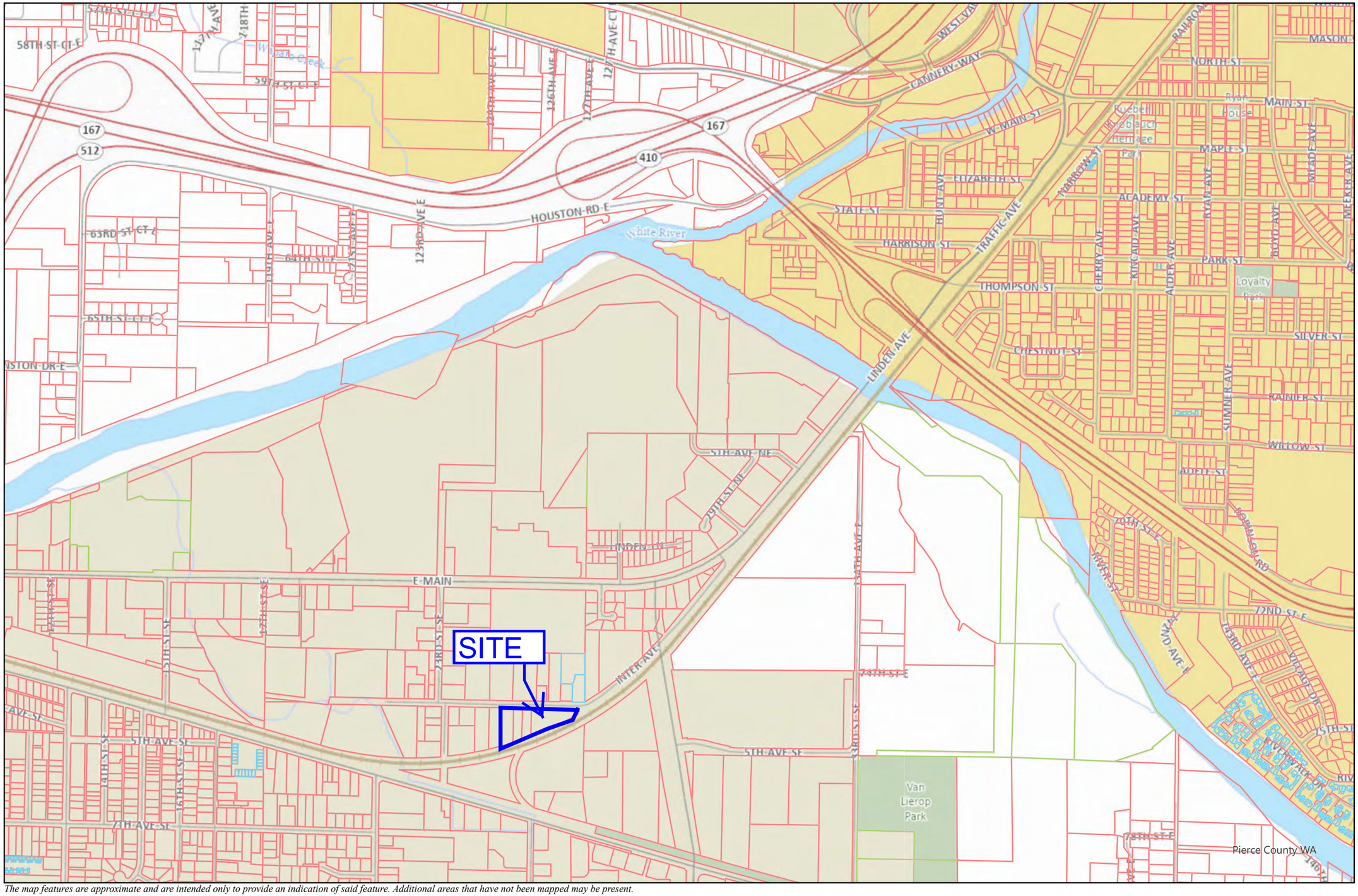
Other necessary permits and approvals include:

- Right of Way Permit
- Building Permits (Pond Walls)
- NPDES Permit

APPENDIX A

General Exhibits

VICINITY MAP



Legend

Tax Parcels

- Base Parcel
- Condominium
- Other

N

0 195 390 780

Feet

CES • NW
INCORPORATED
CIVIL ENGINEERING & SURVEYING
429 29th St NE, Suite D · Puyallup, WA 98372
PH: 253.848.4282
www.cesnwinc.com

Date: 8/31/2023 03:49 PM

Soil Map—Pierce County Area, Washington
(ProVac-South)

Map Scale: 1:985 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 10 20 40 60

Feet
0 45 90 180 270

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 18, Sep 8, 2022

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

Date(s) aerial images were photographed: Jul 31, 2022—Aug 8, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6A	Briscot loam	2.9	100.0%
Totals for Area of Interest		**2.9**	**100.0%**

APPENDIX B

Basin Exhibits

BEST PARKING LOT CLEANING

A PORTION OF NW1/4 OF THE SE1/4 OF SEC. 26, T20N, R04E
WILLAMETTE MERIDIAN, PIERCE COUNTY, WASHINGTON

30 0 15 30 60
1 inch = 30 feet.

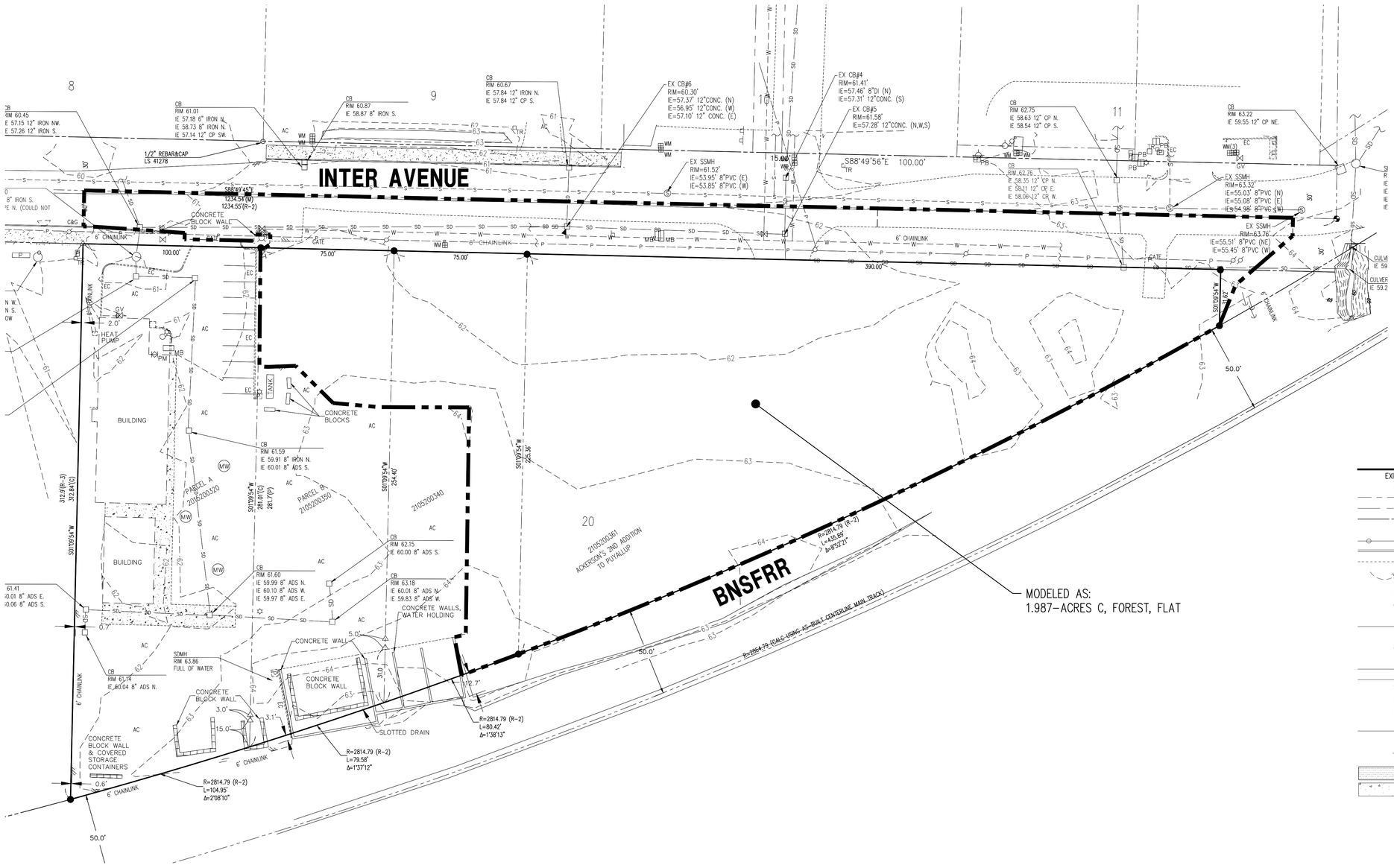
APPROVED

BY _____
CITY OF PUYALLUP
DEVELOPMENT ENGINEERING

DATE _____

NOTE: THIS APPROVAL IS VOID AFTER 180 DAYS FROM APPROVAL DATE. THE CITY WILL NOT BE RESPONSIBLE FOR ERRORS AND/OR OMISSIONS ON THESE PLANS. FIELD CONDITIONS MAY DICTATE CHANGES TO THESE PLANS AS DETERMINED BY THE DEVELOPMENT ENGINEERING MANAGER.

No.	Revision:	Int.	Date:

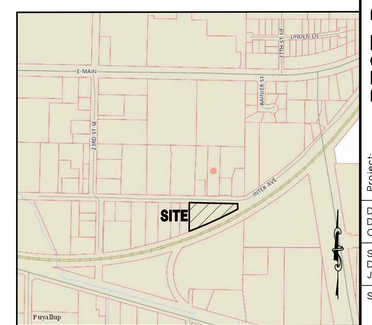


LEGEND

EXISTING	DESCRIPTION	PROPOSED
⊕	MONUMENT	⊕
	MONUMENT LINE	
	PROPERTY LINE	
	RIGHT OF WAY LINE	
	EASEMENT LINE	
	CHAIN LINK FENCE	
	CURB & GUTTER	
	EDGE OF PAVEMENT	
300	CONTOURS	300
	STREET SIGN	
	STORM DRAIN CATCH BASIN	
Ⓓ	STORM DRAIN MANHOLE	
○	STORM DRAIN CLEANOUT	
SD	STORM DRAIN LINE	SD
	WALL DRAIN LINE	WD
Ⓢ	SANITARY SEWER MANHOLE	
○	SANITARY SEWER CLEANOUT	
S	SANITARY SEWER LINE	S
SS	SANITARY SEWER STUB	SS
	FIRE HYDRANT	
	WATER VALVE	
	WATER METER	
	THRUST BLOCKING	
W	WATER MAIN	W
	LUMINAIRE	
	POWER/UTILITY POLE	
	SAWCUT LINE	
	ASPHALT CONCRETE	
	CEMENT CONCRETE	
	PERMEABLE ASPHALT	
	GRIND/OVERLAY	
	LANDSCAPE AREAS	
	LANDSCAPE WALL	

CALL 48 HOURS BEFORE YOU DIG DIAL 811

FEATURES CONTAINED IN THIS DRAWING, INCLUDING BUT NOT LIMITED TO, BOUNDARY, RIGHT-OF-WAY, EASEMENT, PARCEL LINES, BEARINGS, DISTANCES, WETLANDS AND BUFFERS, WERE DERIVED FROM PUBLIC RECORDS OR ACQUIRED FROM AUTOCAD DRAWINGS SUPPLIED BY OTHERS.



VICINITY MAP

DANIEL PAUL SMITH
STATE OF WASHINGTON
47023
REGISTERED
PROFESSIONAL ENGINEER

C.E.S. NW INC
CIVIL ENGINEERING & SURVEYING
PH: (253) 848-4282
cesrvices@cesnwllc.com
429 - 29TH ST. NE, SUITE D
PUYALLUP, WA 98372

Project: **BEST PARKING LOT CLEANING**
PRE-DEVELOPED BASIN MAP

Client: **PRO VAC**
GMITARCHITECTURE@CENTURYLINK.NET

Designed:	MAS
Drawn:	MAS
Checked:	DPS
Scale:	1"=30'
Date:	03/29/24
Job No.:	20083

Sheet No.:
B1
1 of 3 Sheets

BEST PARKING LOT CLEANING

A PORTION OF NW1/4 OF THE SE1/4 OF SEC. 26, T20N, R04E
WILLAMETTE MERIDIAN, PIERCE COUNTY, WASHINGTON

30 0 15 30 60
1 inch = 30 feet.

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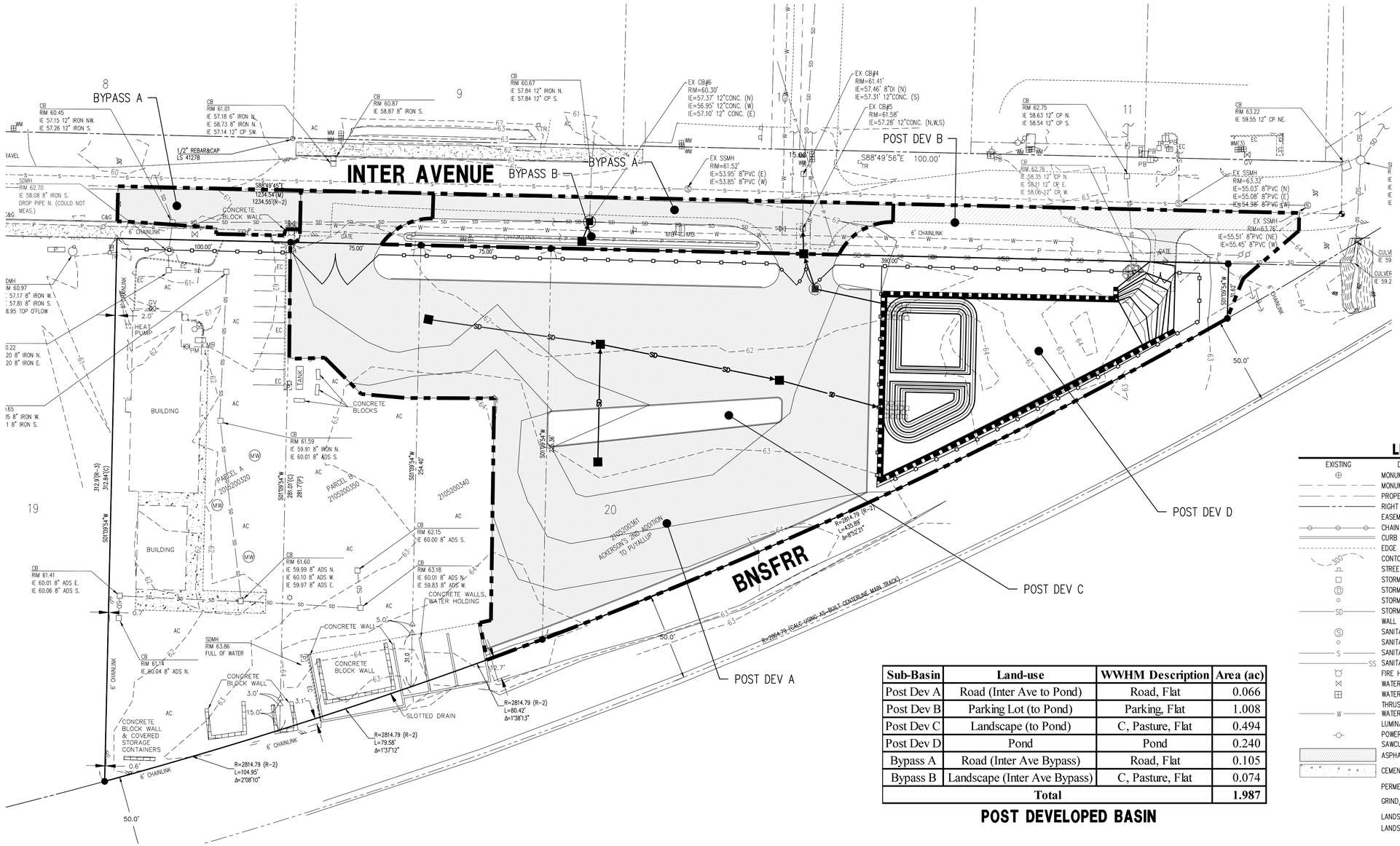

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Total			**1.987**

POST DEVELOPED BASIN

LEGEND

EXISTING	DESCRIPTION	PROPOSED
⊕	MONUMENT	⊕
	MONUMENT LINE	
	PROPERTY LINE	
	RIGHT OF WAY LINE	
	EASEMENT LINE	
-o-o-o-	CHAIN LINK FENCE	-o-o-o-
	CURB & GUTTER	
	EDGE OF PAVEMENT	
300	CONTOURS	300
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SD	STORM DRAIN LINE	SD
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Ⓢ	SANITARY SEWER MANHOLE	Ⓢ
○	SANITARY SEWER CLEANOUT	●
S	SANITARY SEWER LINE	S
SS	SANITARY SEWER STUB	SS
	FIRE HYDRANT	
	WATER VALVE	
	WATER METER	
	THRUST BLOCKING	
W	WATER MAIN	W
	LUMINAIRE	
-o-	POWER/UTILITY POLE	
	SAWCUT LINE	
	ASPHALT CONCRETE	
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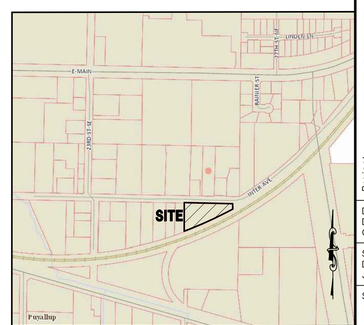

VICINITY MAP

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STATE OF WASHINGTON
47023
REGISTERED
PROFESSIONAL ENGINEER

C.E.S. NW INC
CIVIL ENGINEERING & SURVEYING
429 – 29TH ST. NE, SUITE D
PUYALLUP, WA 98372
PH: (253) 848-4282
cesrvices@cesnwinc.com

Project: **BEST PARKING LOT CLEANING**
DEVELOPED BASIN MAP

Client: **PRO VAC**
GMITARCHITECTURE@CENTURYLINK.NET

Designed: MAS
Drawn: MAS
Checked: DPS

Scale: 1"=30'
Date: 03/29/24
Job No.: 20083

Sheet No.:
B2
2 of 3 Sheets

BEST PARKING LOT CLEANING

A PORTION OF NW1/4 OF THE SE1/4 OF SEC. 26, T20N, R04E
WILLAMETTE MERIDIAN, PIERCE COUNTY, WASHINGTON

30 0 15 30 60
1 inch = 30 feet.

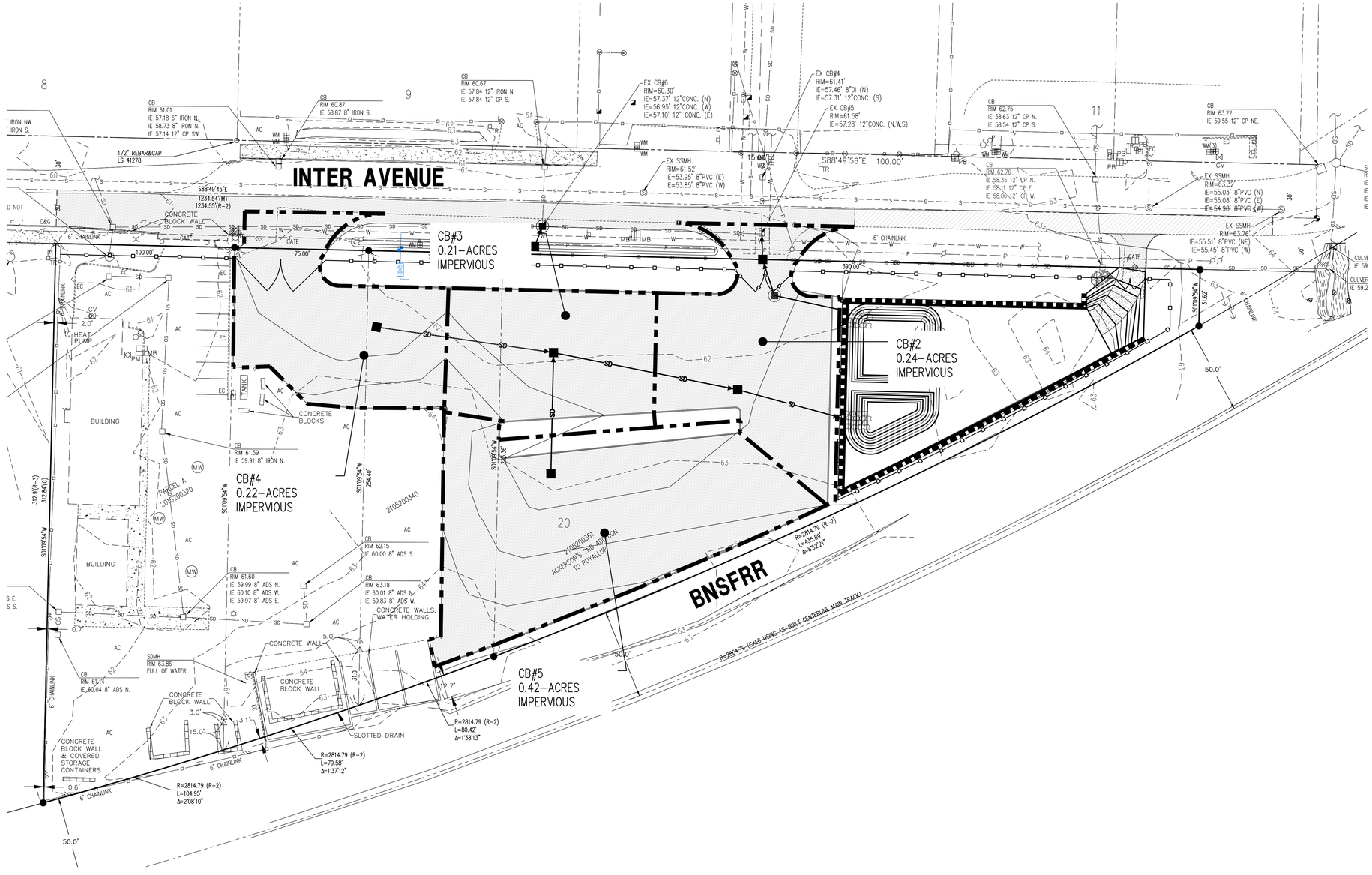
APPROVED

BY _____
CITY OF PUYALLUP
DEVELOPMENT ENGINEERING

DATE _____

NOTE: THIS APPROVAL IS VOID AFTER 180 DAYS FROM APPROVAL DATE. THE CITY WILL NOT BE RESPONSIBLE FOR ERRORS AND/OR OMISSIONS ON THESE PLANS.
FIELD CONDITIONS MAY DICTATE CHANGES TO THESE PLANS AS DETERMINED BY THE DEVELOPMENT ENGINEERING MANAGER.

No.	Revision:	Int.	Date:

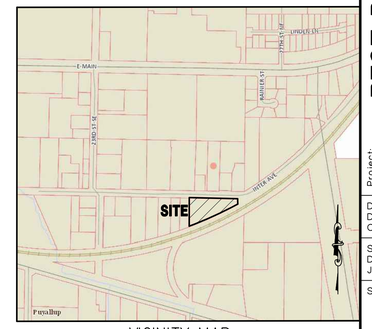


LEGEND

EXISTING	DESCRIPTION	PROPOSED
⊕	MONUMENT	⊕
	MONUMENT LINE	
	PROPERTY LINE	
	RIGHT OF WAY LINE	
	EASEMENT LINE	
	CHAIN LINK FENCE	
	CURB & GUTTER	
	EDGE OF PAVEMENT	
300	CONTOURS	300
	STREET SIGN	
	STORM DRAIN CATCH BASIN	
Ⓓ	STORM DRAIN MANHOLE	Ⓓ
○	STORM DRAIN CLEANOUT	●
SD	STORM DRAIN LINE	SD
	WALL DRAIN LINE	WD
Ⓢ	SANITARY SEWER MANHOLE	Ⓢ
○	SANITARY SEWER CLEANOUT	●
S	SANITARY SEWER LINE	S
SS	SANITARY SEWER STUB	SS
	FIRE HYDRANT	
	WATER VALVE	
	WATER METER	
	THRUST BLOCKING	
W	WATER MAIN	W
	LUMINAIRE	
	POWER/UTILITY POLE	
	SAWCUT LINE	
	ASPHALT CONCRETE	
	CEMENT CONCRETE	
	PERMEABLE ASPHALT	
	GRIND/OVERLAY	
	LANDSCAPE AREAS	
	LANDSCAPE WALL	

CALL 48 HOURS BEFORE YOU DIG DIAL 811

FEATURES CONTAINED IN THIS DRAWING, INCLUDING BUT NOT LIMITED TO, BOUNDARY, RIGHT-OF-WAY, EASEMENT, PARCEL LINES, BEARINGS, DISTANCES, WETLANDS AND BUFFERS, WERE DERIVED FROM PUBLIC RECORDS OR ACQUIRED FROM AUTOCAD DRAWINGS SUPPLIED BY OTHERS.



VICINITY MAP

DANIEL PAUL SMITH
STATE OF WASHINGTON
47023
REGISTERED PROFESSIONAL ENGINEER

C.E.S. NW INC
CIVIL ENGINEERING & SURVEYING
429 - 29TH ST. NE, SUITE D
PUYALLUP, WA 98372
PH: (253) 848-4282
cesnwinc@cesnwinc.com

Project: **BEST PARKING LOT CLEANING**
CONVEYANCE BASIN MAP

Client: GMIT ARCHITECTURE@CENTURYLINK.NET
PRO VAC

Designed:	MAS
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Date:	03/29/24
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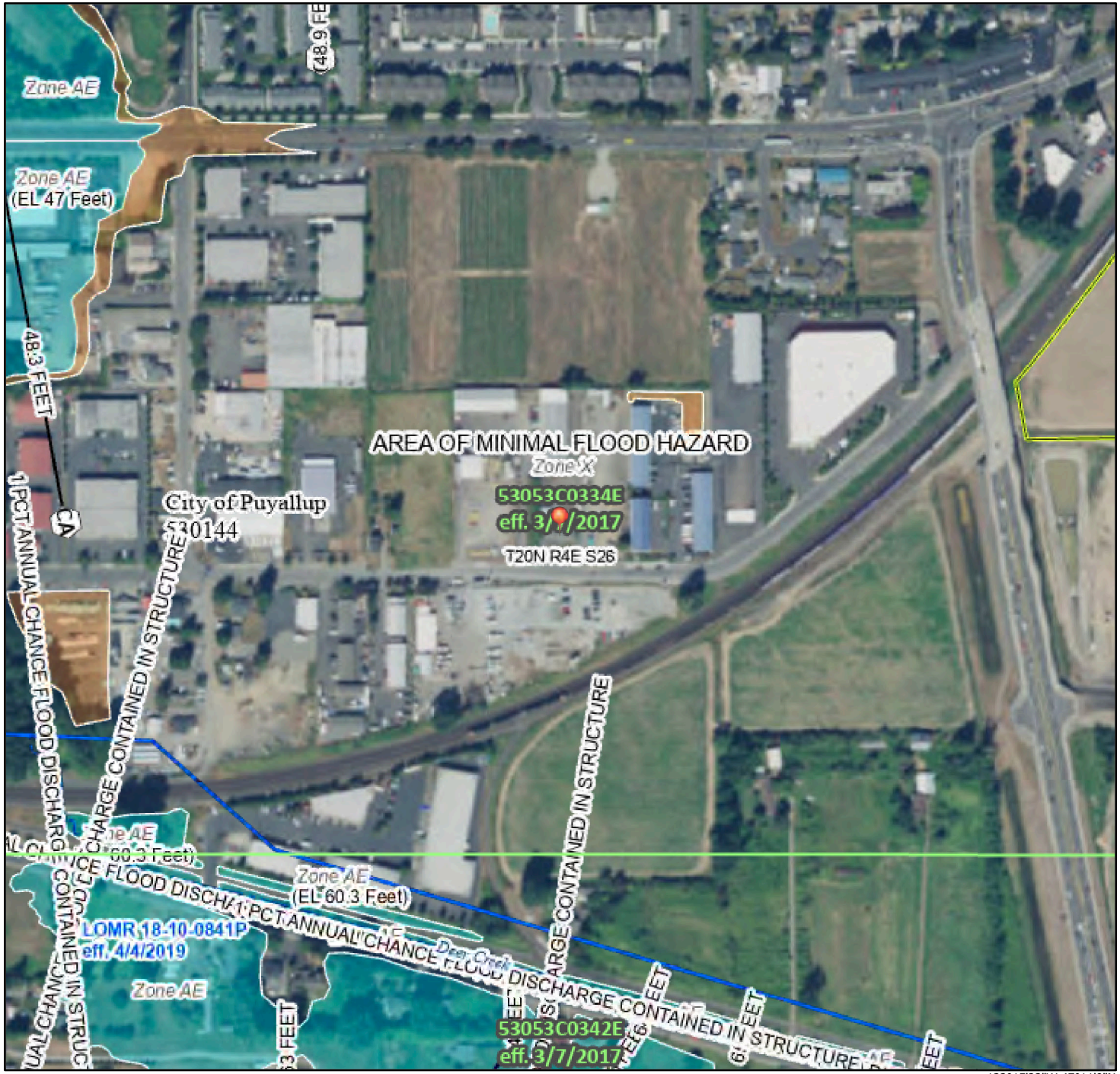
Sheet No.:
B3
3 of 3 Sheets

National Flood Hazard Layer FIRMette

FEMA

122°16'W 47°11'34"N



122°15'22"W 47°11'9"N

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

1:6,000

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

Legend

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

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

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

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

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

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

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

N

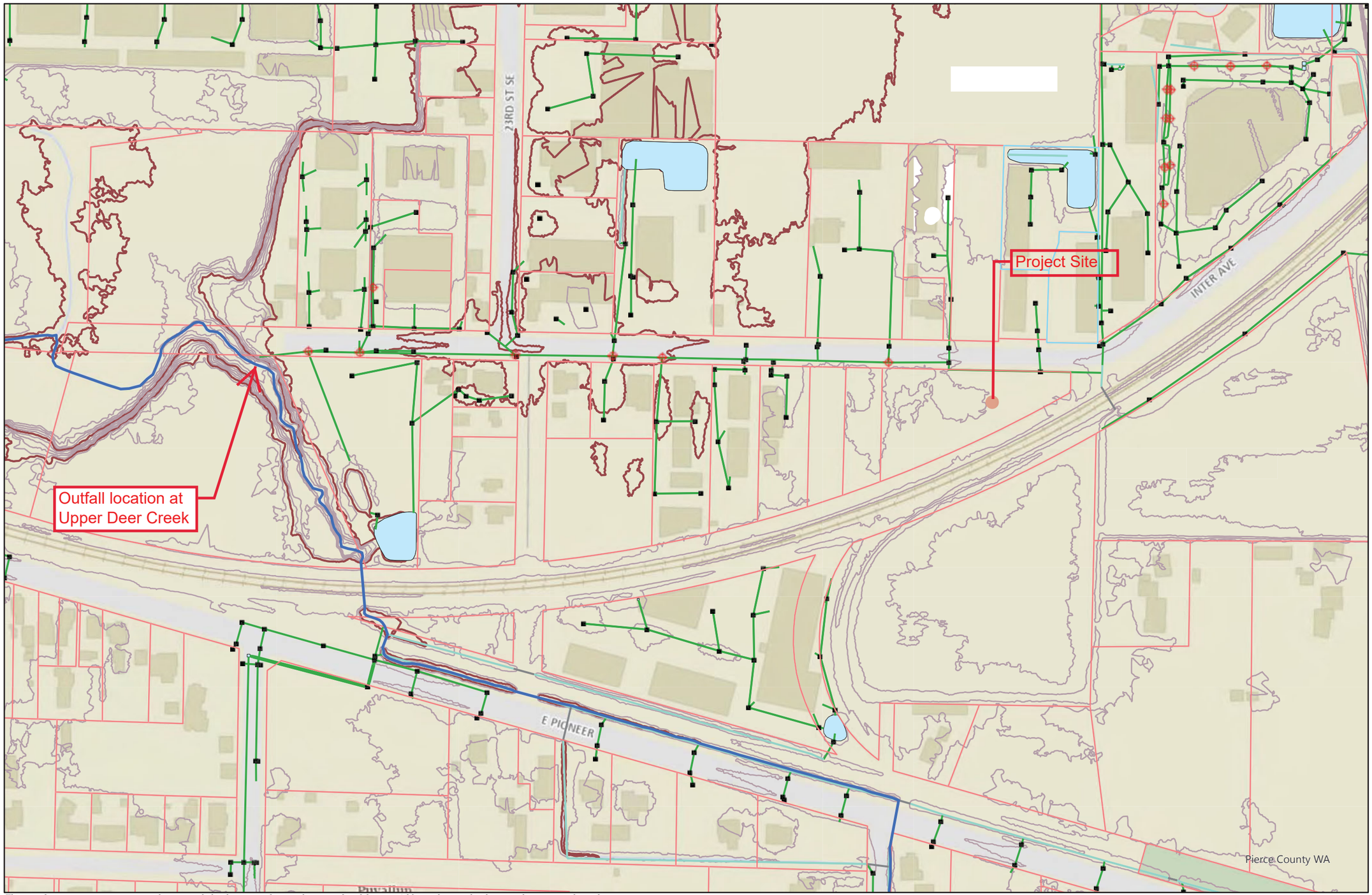
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 2/1/2021 at 1:21 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

Downstream Map



Legend

- Streams - Puyallup

Tax Parcels

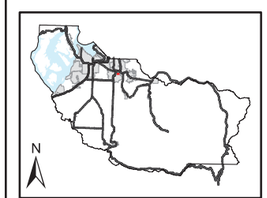
- Base Parcel
- Condominium
- Drainage - Manholes - Puyallup
- Drainage - Inlets - Puyallup
- Drainage - Culverts - Puyallup
- Drainage - Channels - Puyallup
- Drainage - Pipes - Puyallup
- Drainage - Stormwater Facilities - Puyallup

Contours - 2017

- 10' Contour Line
- 2' Contour Line

Hydro - Centerline Labels

- Hydro - Centerline Labels



0 45 90 180 Feet

CES • NW
INCORPORATED
CIVIL ENGINEERING & SURVEYING
429 29th St NE, Suite D - Puyallup, WA 98372
PH: 253.848.4282
www.cesnwinc.com

Date: 2/1/2021 12:34 PM

APPENDIX C

Computer Modelling Results

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 20083S

Site Name:	BPLC
Site Address:	
City:	Puyallup, WA
Report Date:	3/25/2024
Gage:	40 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

PreDev

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	1.987
Pervious Total	1.987
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.987

Mitigated Land Use

PostDev to Pond

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	0.494
Pervious Total	0.494

Impervious Land Use	acre
ROADS FLAT	0.066
PARKING FLAT	1.008
POND	0.24
Impervious Total	1.314
Basin Total	1.808

Bypass

Bypass:	Yes
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	0.074
Pervious Total	0.074

Impervious Land Use	acre
ROADS FLAT	0.105
Impervious Total	0.105
Basin Total	0.179

Routing Elements
Predeveloped Routing

Mitigated Routing

Combined Detention Pond

Bottom Length: 334.00 ft.
Bottom Width: 28.00 ft.
Depth: 4.5 ft.
Volume at riser head: 0.7908 acre-feet.
Side slope 1: 0 To 1
Side slope 2: 10 To 1
Side slope 3: 0 To 1
Side slope 4: 0 To 1
Discharge Structure
Riser Height: 3.5 ft.
Riser Diameter: 18 in.
Notch Type: Rectangular
Notch Width: 0.104 ft.
Notch Height: 0.360 ft.
Orifice 1 Diameter: 0.677 in. Elevation:0 ft.
Element Flows To:
Outlet 1 Outlet 2

Pond Hydraulic Table

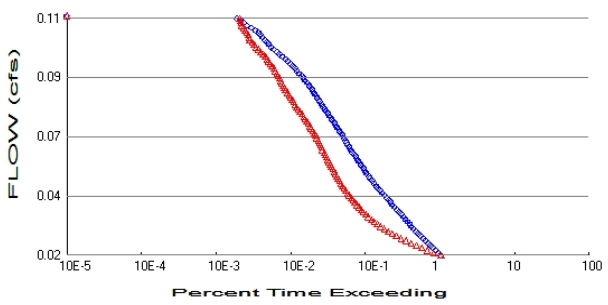
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.214	0.000	0.000	0.000
0.0500	0.215	0.010	0.002	0.000
0.1000	0.215	0.021	0.003	0.000
0.1500	0.215	0.032	0.004	0.000
0.2000	0.216	0.043	0.005	0.000
0.2500	0.216	0.053	0.006	0.000
0.3000	0.216	0.064	0.006	0.000
0.3500	0.216	0.075	0.007	0.000
0.4000	0.217	0.086	0.007	0.000
0.4500	0.217	0.097	0.008	0.000
0.5000	0.217	0.108	0.008	0.000
0.5500	0.218	0.119	0.009	0.000
0.6000	0.218	0.130	0.009	0.000
0.6500	0.218	0.140	0.010	0.000
0.7000	0.219	0.151	0.010	0.000
0.7500	0.219	0.162	0.010	0.000
0.8000	0.219	0.173	0.011	0.000
0.8500	0.220	0.184	0.011	0.000
0.9000	0.220	0.195	0.011	0.000
0.9500	0.220	0.206	0.012	0.000
1.0000	0.221	0.217	0.012	0.000
1.0500	0.221	0.229	0.012	0.000
1.1000	0.221	0.240	0.013	0.000
1.1500	0.222	0.251	0.013	0.000
1.2000	0.222	0.262	0.013	0.000
1.2500	0.222	0.273	0.013	0.000
1.3000	0.223	0.284	0.014	0.000
1.3500	0.223	0.295	0.014	0.000
1.4000	0.223	0.306	0.014	0.000
1.4500	0.224	0.318	0.015	0.000
1.5000	0.224	0.329	0.015	0.000
1.5500	0.224	0.340	0.015	0.000

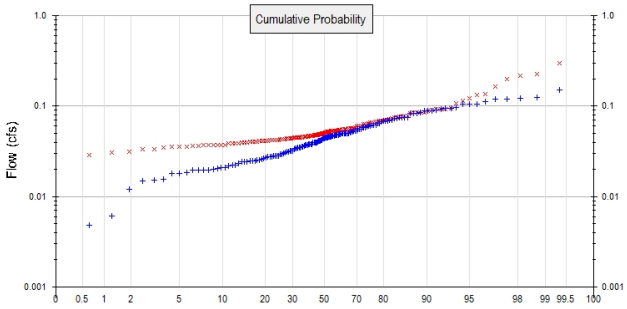
1.6000	0.225	0.351	0.015	0.000
1.6500	0.225	0.363	0.016	0.000
1.7000	0.225	0.374	0.016	0.000
1.7500	0.225	0.385	0.016	0.000
1.8000	0.226	0.396	0.016	0.000
1.8500	0.226	0.408	0.016	0.000
1.9000	0.226	0.419	0.017	0.000
1.9500	0.227	0.430	0.017	0.000
2.0000	0.227	0.442	0.017	0.000
2.0500	0.227	0.453	0.017	0.000
2.1000	0.228	0.465	0.018	0.000
2.1500	0.228	0.476	0.018	0.000
2.2000	0.228	0.487	0.018	0.000
2.2500	0.229	0.499	0.018	0.000
2.3000	0.229	0.510	0.018	0.000
2.3500	0.229	0.522	0.019	0.000
2.4000	0.230	0.533	0.019	0.000
2.4500	0.230	0.545	0.019	0.000
2.5000	0.230	0.556	0.019	0.000
2.5500	0.231	0.568	0.019	0.000
2.6000	0.231	0.579	0.020	0.000
2.6500	0.231	0.591	0.020	0.000
2.7000	0.232	0.603	0.020	0.000
2.7500	0.232	0.614	0.020	0.000
2.8000	0.232	0.626	0.020	0.000
2.8500	0.233	0.638	0.021	0.000
2.9000	0.233	0.649	0.021	0.000
2.9500	0.233	0.661	0.021	0.000
3.0000	0.234	0.673	0.021	0.000
3.0500	0.234	0.684	0.021	0.000
3.1000	0.234	0.696	0.021	0.000
3.1500	0.234	0.708	0.022	0.000
3.2000	0.235	0.719	0.027	0.000
3.2500	0.235	0.731	0.034	0.000
3.3000	0.235	0.743	0.044	0.000
3.3500	0.236	0.755	0.054	0.000
3.4000	0.236	0.767	0.066	0.000
3.4500	0.236	0.778	0.079	0.000
3.5000	0.237	0.790	0.092	0.000
3.5500	0.237	0.802	0.270	0.000
3.6000	0.237	0.814	0.595	0.000
3.6500	0.238	0.826	1.012	0.000
3.7000	0.238	0.838	1.497	0.000
3.7500	0.238	0.850	2.032	0.000
3.8000	0.239	0.862	2.595	0.000
3.8500	0.239	0.874	3.166	0.000
3.9000	0.239	0.886	3.726	0.000
3.9500	0.240	0.898	4.254	0.000
4.0000	0.240	0.910	4.733	0.000
4.0500	0.240	0.922	5.149	0.000
4.1000	0.241	0.934	5.495	0.000
4.1500	0.241	0.946	5.771	0.000
4.2000	0.241	0.958	5.987	0.000
4.2500	0.242	0.970	6.166	0.000
4.3000	0.242	0.982	6.433	0.000
4.3500	0.242	0.994	6.629	0.000
4.4000	0.243	1.006	6.818	0.000
4.4500	0.243	1.019	7.003	0.000

4.5000	0.243	1.031	7.182	0.000
4.5500	0.243	1.043	7.357	0.000

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.987
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.568
Total Impervious Area: 1.419

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.044895
5 year	0.069076
10 year	0.083053
25 year	0.098192
50 year	0.107931
100 year	0.116381

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.051334
5 year	0.073759
10 year	0.092765
25 year	0.122279
50 year	0.148818
100 year	0.179778

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.036	0.051
1903	0.028	0.057
1904	0.047	0.070
1905	0.023	0.043
1906	0.012	0.037
1907	0.070	0.055
1908	0.050	0.044
1909	0.049	0.045
1910	0.069	0.052
1911	0.045	0.052

1912	0.151	0.092
1913	0.070	0.039
1914	0.018	0.133
1915	0.029	0.041
1916	0.045	0.058
1917	0.015	0.031
1918	0.048	0.045
1919	0.037	0.036
1920	0.046	0.045
1921	0.050	0.047
1922	0.050	0.057
1923	0.040	0.045
1924	0.019	0.060
1925	0.025	0.035
1926	0.044	0.050
1927	0.032	0.044
1928	0.034	0.045
1929	0.069	0.064
1930	0.044	0.066
1931	0.042	0.044
1932	0.032	0.040
1933	0.036	0.046
1934	0.092	0.300
1935	0.042	0.038
1936	0.038	0.047
1937	0.061	0.057
1938	0.037	0.039
1939	0.003	0.043
1940	0.041	0.063
1941	0.025	0.069
1942	0.062	0.083
1943	0.031	0.054
1944	0.065	0.077
1945	0.050	0.054
1946	0.029	0.047
1947	0.021	0.036
1948	0.096	0.053
1949	0.083	0.067
1950	0.024	0.034
1951	0.031	0.052
1952	0.124	0.079
1953	0.112	0.076
1954	0.040	0.043
1955	0.035	0.037
1956	0.018	0.031
1957	0.059	0.042
1958	0.119	0.217
1959	0.075	0.166
1960	0.022	0.037
1961	0.075	0.093
1962	0.041	0.046
1963	0.020	0.034
1964	0.020	0.085
1965	0.084	0.199
1966	0.025	0.039
1967	0.038	0.053
1968	0.039	0.046
1969	0.037	0.045

1970	0.058	0.048
1971	0.088	0.057
1972	0.058	0.121
1973	0.075	0.076
1974	0.041	0.060
1975	0.094	0.095
1976	0.050	0.069
1977	0.022	0.033
1978	0.083	0.085
1979	0.024	0.051
1980	0.048	0.056
1981	0.044	0.049
1982	0.021	0.041
1983	0.075	0.060
1984	0.034	0.056
1985	0.054	0.061
1986	0.045	0.041
1987	0.086	0.060
1988	0.053	0.041
1989	0.049	0.037
1990	0.056	0.043
1991	0.045	0.056
1992	0.058	0.071
1993	0.060	0.055
1994	0.089	0.050
1995	0.020	0.042
1996	0.097	0.091
1997	0.040	0.045
1998	0.048	0.053
1999	0.005	0.048
2000	0.036	0.049
2001	0.019	0.035
2002	0.064	0.072
2003	0.055	0.047
2004	0.049	0.054
2005	0.089	0.092
2006	0.028	0.048
2007	0.030	0.057
2008	0.048	0.049
2009	0.032	0.039
2010	0.028	0.049
2011	0.025	0.041
2012	0.038	0.047
2013	0.028	0.042
2014	0.020	0.039
2015	0.038	0.065
2016	0.016	0.042
2017	0.068	0.069
2018	0.122	0.226
2019	0.120	0.114
2020	0.038	0.055
2021	0.062	0.053
2022	0.026	0.063
2023	0.052	0.079
2024	0.104	0.088
2025	0.047	0.041
2026	0.074	0.048
2027	0.028	0.054

2028	0.024	0.026
2029	0.050	0.046
2030	0.092	0.067
2031	0.030	0.029
2032	0.018	0.037
2033	0.028	0.044
2034	0.027	0.037
2035	0.105	0.107
2036	0.056	0.042
2037	0.015	0.050
2038	0.046	0.052
2039	0.006	0.085
2040	0.026	0.043
2041	0.035	0.048
2042	0.106	0.086
2043	0.051	0.054
2044	0.067	0.052
2045	0.045	0.039
2046	0.053	0.137
2047	0.039	0.044
2048	0.052	0.040
2049	0.046	0.053
2050	0.033	0.047
2051	0.047	0.067
2052	0.028	0.043
2053	0.050	0.074
2054	0.062	0.073
2055	0.026	0.045
2056	0.022	0.055
2057	0.035	0.037
2058	0.041	0.050
2059	0.073	0.065

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1510	0.2996
2	0.1237	0.2260
3	0.1218	0.2166
4	0.1204	0.1992
5	0.1194	0.1656
6	0.1123	0.1367
7	0.1059	0.1326
8	0.1048	0.1214
9	0.1043	0.1144
10	0.0968	0.1069
11	0.0956	0.0945
12	0.0939	0.0930
13	0.0920	0.0921
14	0.0915	0.0919
15	0.0889	0.0913
16	0.0886	0.0883
17	0.0884	0.0859
18	0.0855	0.0851
19	0.0839	0.0851
20	0.0831	0.0848
21	0.0825	0.0828
22	0.0753	0.0790

23	0.0748	0.0789
24	0.0748	0.0767
25	0.0747	0.0761
26	0.0741	0.0756
27	0.0731	0.0743
28	0.0703	0.0731
29	0.0696	0.0717
30	0.0695	0.0708
31	0.0694	0.0701
32	0.0681	0.0690
33	0.0675	0.0688
34	0.0645	0.0688
35	0.0640	0.0672
36	0.0621	0.0667
37	0.0619	0.0665
38	0.0618	0.0660
39	0.0607	0.0654
40	0.0603	0.0647
41	0.0595	0.0639
42	0.0585	0.0634
43	0.0581	0.0627
44	0.0577	0.0610
45	0.0561	0.0604
46	0.0558	0.0603
47	0.0551	0.0600
48	0.0535	0.0596
49	0.0534	0.0582
50	0.0529	0.0574
51	0.0520	0.0574
52	0.0519	0.0568
53	0.0507	0.0566
54	0.0503	0.0565
55	0.0502	0.0561
56	0.0502	0.0557
57	0.0501	0.0557
58	0.0498	0.0551
59	0.0497	0.0551
60	0.0496	0.0548
61	0.0492	0.0548
62	0.0490	0.0541
63	0.0487	0.0541
64	0.0481	0.0538
65	0.0478	0.0536
66	0.0478	0.0536
67	0.0478	0.0534
68	0.0474	0.0533
69	0.0474	0.0531
70	0.0465	0.0529
71	0.0463	0.0528
72	0.0461	0.0524
73	0.0457	0.0522
74	0.0455	0.0521
75	0.0451	0.0520
76	0.0450	0.0519
77	0.0448	0.0514
78	0.0446	0.0510
79	0.0445	0.0502
80	0.0439	0.0502

81	0.0436	0.0499
82	0.0423	0.0497
83	0.0422	0.0489
84	0.0415	0.0489
85	0.0415	0.0488
86	0.0411	0.0486
87	0.0405	0.0481
88	0.0399	0.0479
89	0.0398	0.0478
90	0.0397	0.0477
91	0.0395	0.0476
92	0.0392	0.0474
93	0.0382	0.0471
94	0.0380	0.0470
95	0.0380	0.0468
96	0.0376	0.0468
97	0.0376	0.0467
98	0.0374	0.0460
99	0.0373	0.0459
100	0.0373	0.0456
101	0.0364	0.0456
102	0.0358	0.0455
103	0.0357	0.0454
104	0.0351	0.0454
105	0.0349	0.0453
106	0.0348	0.0449
107	0.0343	0.0447
108	0.0339	0.0447
109	0.0331	0.0446
110	0.0323	0.0444
111	0.0319	0.0444
112	0.0317	0.0440
113	0.0313	0.0440
114	0.0313	0.0437
115	0.0304	0.0433
116	0.0299	0.0433
117	0.0294	0.0431
118	0.0294	0.0428
119	0.0283	0.0426
120	0.0282	0.0425
121	0.0282	0.0425
122	0.0281	0.0425
123	0.0277	0.0421
124	0.0277	0.0418
125	0.0276	0.0416
126	0.0270	0.0414
127	0.0263	0.0413
128	0.0256	0.0412
129	0.0256	0.0410
130	0.0251	0.0405
131	0.0250	0.0405
132	0.0245	0.0404
133	0.0245	0.0401
134	0.0243	0.0394
135	0.0242	0.0393
136	0.0241	0.0393
137	0.0230	0.0390
138	0.0224	0.0389

139	0.0222	0.0389
140	0.0220	0.0384
141	0.0210	0.0372
142	0.0207	0.0372
143	0.0205	0.0371
144	0.0202	0.0369
145	0.0198	0.0368
146	0.0196	0.0368
147	0.0195	0.0366
148	0.0194	0.0364
149	0.0184	0.0360
150	0.0180	0.0353
151	0.0179	0.0353
152	0.0156	0.0345
153	0.0153	0.0337
154	0.0149	0.0332
155	0.0120	0.0313
156	0.0061	0.0309
157	0.0049	0.0286
158	0.0031	0.0260

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0224	56896	57173	100	Pass
0.0233	52415	45395	86	Pass
0.0242	48376	37423	77	Pass
0.0250	44642	31468	70	Pass
0.0259	41213	26709	64	Pass
0.0268	38243	22764	59	Pass
0.0276	35501	19484	54	Pass
0.0285	32952	16714	50	Pass
0.0294	30526	14437	47	Pass
0.0302	28443	12654	44	Pass
0.0311	26493	11213	42	Pass
0.0319	24747	10000	40	Pass
0.0328	23141	8931	38	Pass
0.0337	21678	8022	37	Pass
0.0345	20332	7302	35	Pass
0.0354	19074	6643	34	Pass
0.0363	17856	6055	33	Pass
0.0371	16720	5618	33	Pass
0.0380	15617	5200	33	Pass
0.0389	14620	4870	33	Pass
0.0397	13723	4570	33	Pass
0.0406	12881	4280	33	Pass
0.0414	12099	4015	33	Pass
0.0423	11385	3790	33	Pass
0.0432	10654	3560	33	Pass
0.0440	9989	3366	33	Pass
0.0449	9357	3191	34	Pass
0.0458	8753	3022	34	Pass
0.0466	8199	2869	34	Pass
0.0475	7728	2723	35	Pass
0.0484	7241	2595	35	Pass
0.0492	6792	2493	36	Pass
0.0501	6421	2386	37	Pass
0.0509	6111	2287	37	Pass
0.0518	5828	2197	37	Pass
0.0527	5557	2117	38	Pass
0.0535	5265	2034	38	Pass
0.0544	5004	1951	38	Pass
0.0553	4785	1875	39	Pass
0.0561	4531	1803	39	Pass
0.0570	4339	1739	40	Pass
0.0578	4156	1678	40	Pass
0.0587	3937	1617	41	Pass
0.0596	3713	1554	41	Pass
0.0604	3536	1480	41	Pass
0.0613	3360	1434	42	Pass
0.0622	3227	1389	43	Pass
0.0630	3083	1340	43	Pass
0.0639	2964	1295	43	Pass
0.0648	2851	1245	43	Pass
0.0656	2738	1197	43	Pass
0.0665	2600	1147	44	Pass
0.0673	2477	1099	44	Pass

0.0682	2355	1044	44	Pass
0.0691	2264	997	44	Pass
0.0699	2159	951	44	Pass
0.0708	2056	909	44	Pass
0.0717	1947	861	44	Pass
0.0725	1837	826	44	Pass
0.0734	1748	785	44	Pass
0.0743	1659	733	44	Pass
0.0751	1578	695	44	Pass
0.0760	1510	662	43	Pass
0.0768	1442	628	43	Pass
0.0777	1367	604	44	Pass
0.0786	1296	577	44	Pass
0.0794	1241	550	44	Pass
0.0803	1182	531	44	Pass
0.0812	1128	502	44	Pass
0.0820	1079	473	43	Pass
0.0829	1026	454	44	Pass
0.0838	976	436	44	Pass
0.0846	922	421	45	Pass
0.0855	871	405	46	Pass
0.0863	819	391	47	Pass
0.0872	771	375	48	Pass
0.0881	717	362	50	Pass
0.0889	668	346	51	Pass
0.0898	629	331	52	Pass
0.0907	586	313	53	Pass
0.0915	549	294	53	Pass
0.0924	507	280	55	Pass
0.0933	471	264	56	Pass
0.0941	427	253	59	Pass
0.0950	392	235	59	Pass
0.0958	363	217	59	Pass
0.0967	329	204	62	Pass
0.0976	300	188	62	Pass
0.0984	281	179	63	Pass
0.0993	264	170	64	Pass
0.1002	249	157	63	Pass
0.1010	233	153	65	Pass
0.1019	219	149	68	Pass
0.1028	205	142	69	Pass
0.1036	186	136	73	Pass
0.1045	163	130	79	Pass
0.1053	144	123	85	Pass
0.1062	129	120	93	Pass
0.1071	118	117	99	Pass
0.1079	106	114	107	Pass

Model Default Modifications

Total of 0 changes have been made.

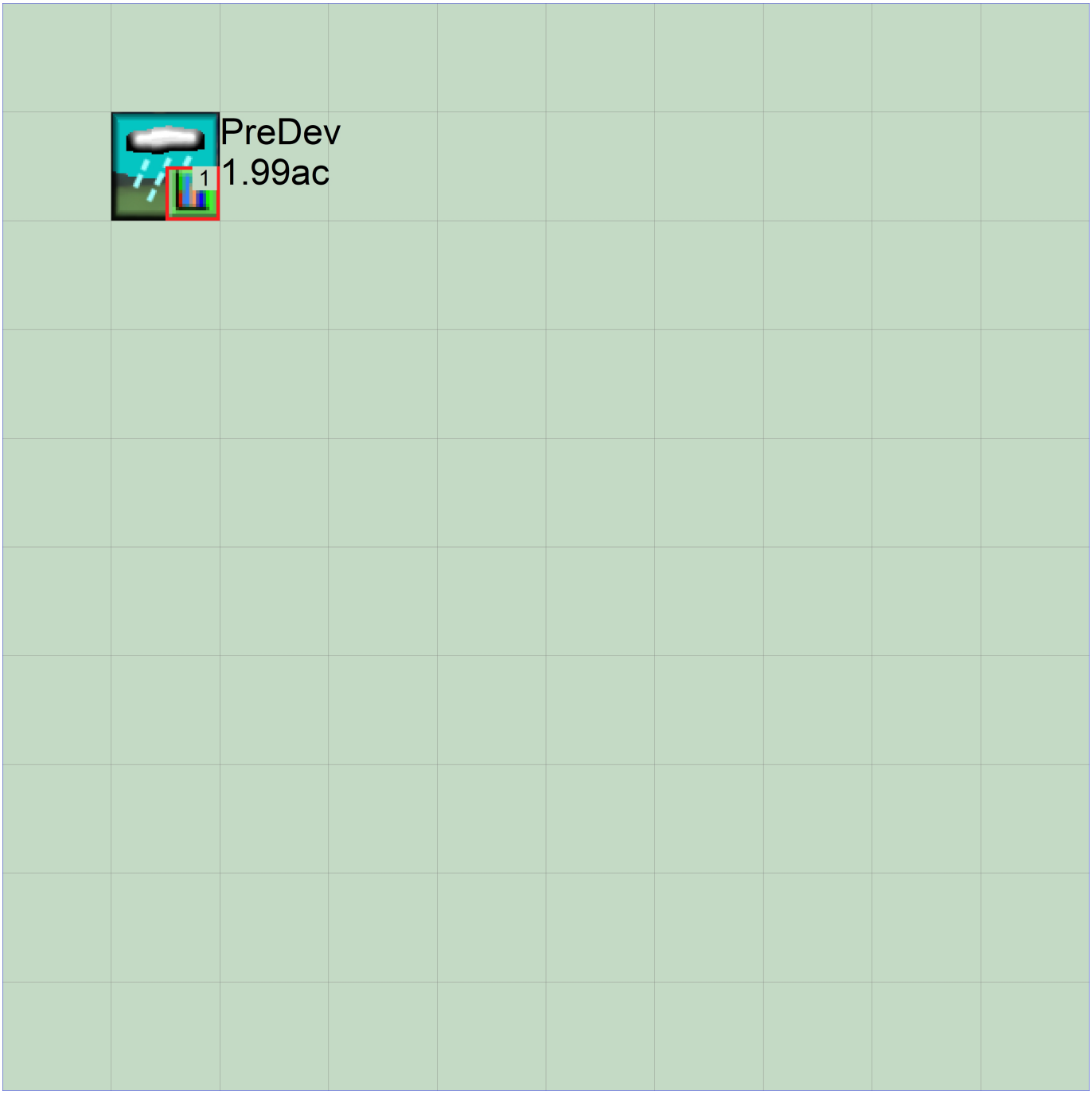
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1901 10 01        END    2059 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   20083S.wdm
MESSU       25   Pre20083S.MES
            27   Pre20083S.L61
            28   Pre20083S.L62
            30   POC20083S1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        PreDev                     MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                       in  out           ***
   10     C, Forest, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   10         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   10         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   10         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   10              0       4.5      0.08       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   10             0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10           0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   10             0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1
```

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
PreDev***
PERLND  10                       1.987     COPY   501     12
PERLND  10                       1.987     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                  ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *      *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------><--------> ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                     ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><---><---><---><---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
```

```
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1901 10 01        END    2059 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   20083S.wdm
MESSU       25   Mit20083S.MES
            27   Mit20083S.L61
            28   Mit20083S.L62
            30   POC20083S1.dat
END FILES

OPN SEQUENCE
    INGRP               INDELT 00:15
      PERLND      13
      IMPLND       1
      IMPLND      11
      IMPLND      14
      RCHRES       1
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Combined Detention Pond     MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  601         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out            ***
   13     C, Pasture, Flat        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   13         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   13         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   13         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   13              0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   13              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                  ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   13          0.15       0.4       0.3         6       0.5       0.4
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   13              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                     in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
   11      PARKING/FLAT           1    1    1   27    0
   14      POND                   1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
   11         0    0    1    0    0    0
   14         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    4    1    9
   11         0    0    4    0    0    0    1    9
   14         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
```

```
   11         0    0    0    0    0
   14         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
   11            400      0.01       0.1       0.1
   14            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
   11              0         0
   14              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
   11              0         0
   14              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
PostDev to Pond***
PERLND  13                       0.494     RCHRES   1      2
PERLND  13                       0.494     RCHRES   1      3
IMPLND   1                       0.066     RCHRES   1      5
IMPLND  11                       1.008     RCHRES   1      5
IMPLND  14                        0.24     RCHRES   1      5
Bypass***
PERLND  13                       0.074     COPY   501     12
PERLND  13                       0.074     COPY   601     12
PERLND  13                       0.074     COPY   501     13
PERLND  13                       0.074     COPY   601     13
IMPLND   1                       0.105     COPY   501     15
IMPLND   1                       0.105     COPY   601     15

******Routing******
PERLND  13                       0.494     COPY     1     12
IMPLND   1                       0.066     COPY     1     15
IMPLND  11                       1.008     COPY     1     15
IMPLND  14                        0.24     COPY     1     15
PERLND  13                       0.494     COPY     1     13
RCHRES   1                           1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
```

```
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***
    1     Combined Detenti-010    1    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1        0  1  0  0    4  0  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1              1      0.06       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1           0          4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.214692  0.000000  0.000000
  0.050000  0.215014  0.010743  0.002781
  0.100000  0.215335  0.021501  0.003933
  0.150000  0.215657  0.032276  0.004817
  0.200000  0.215978  0.043067  0.005562
  0.250000  0.216299  0.053874  0.006219
  0.300000  0.216621  0.064697  0.006812
  0.350000  0.216942  0.075536  0.007358
  0.400000  0.217264  0.086391  0.007866
  0.450000  0.217585  0.097262  0.008343
  0.500000  0.217906  0.108150  0.008795
  0.550000  0.218228  0.119053  0.009224
  0.600000  0.218549  0.129972  0.009634
  0.650000  0.218871  0.140908  0.010028
  0.700000  0.219192  0.151860  0.010406
  0.750000  0.219513  0.162827  0.010771
  0.800000  0.219835  0.173811  0.011125
  0.850000  0.220156  0.184811  0.011467
  0.900000  0.220478  0.195826  0.011799
  0.950000  0.220799  0.206858  0.012123
  1.000000  0.221120  0.217906  0.012438
  1.050000  0.221442  0.228970  0.012745
  1.100000  0.221763  0.240051  0.013045
```

```
  1.150000  0.222084  0.251147  0.013338
  1.200000  0.222406  0.262259  0.013625
  1.250000  0.222727  0.273387  0.013906
  1.300000  0.223049  0.284532  0.014181
  1.350000  0.223370  0.295692  0.014451
  1.400000  0.223691  0.306869  0.014716
  1.450000  0.224013  0.318061  0.014977
  1.500000  0.224334  0.329270  0.015233
  1.550000  0.224656  0.340495  0.015485
  1.600000  0.224977  0.351736  0.015732
  1.650000  0.225298  0.362992  0.015976
  1.700000  0.225620  0.374265  0.016217
  1.750000  0.225941  0.385554  0.016453
  1.800000  0.226263  0.396860  0.016687
  1.850000  0.226584  0.408181  0.016917
  1.900000  0.226905  0.419518  0.017144
  1.950000  0.227227  0.430871  0.017368
  2.000000  0.227548  0.442241  0.017589
  2.050000  0.227870  0.453626  0.017808
  2.100000  0.228191  0.465028  0.018024
  2.150000  0.228512  0.476445  0.018237
  2.200000  0.228834  0.487879  0.018448
  2.250000  0.229155  0.499329  0.018656
  2.300000  0.229477  0.510794  0.018863
  2.350000  0.229798  0.522276  0.019066
  2.400000  0.230119  0.533774  0.019268
  2.450000  0.230441  0.545288  0.019468
  2.500000  0.230762  0.556818  0.019666
  2.550000  0.231084  0.568364  0.019861
  2.600000  0.231405  0.579927  0.020055
  2.650000  0.231726  0.591505  0.020247
  2.700000  0.232048  0.603099  0.020437
  2.750000  0.232369  0.614710  0.020625
  2.800000  0.232691  0.626336  0.020812
  2.850000  0.233012  0.637979  0.020997
  2.900000  0.233333  0.649637  0.021180
  2.950000  0.233655  0.661312  0.021362
  3.000000  0.233976  0.673003  0.021543
  3.050000  0.234298  0.684710  0.021721
  3.100000  0.234619  0.696433  0.021899
  3.150000  0.234940  0.708171  0.022421
  3.200000  0.235262  0.719927  0.027286
  3.250000  0.235583  0.731698  0.034799
  3.300000  0.235904  0.743485  0.044084
  3.350000  0.236226  0.755288  0.054745
  3.400000  0.236547  0.767107  0.066531
  3.450000  0.236869  0.778943  0.079262
  3.500000  0.237190  0.790794  0.092801
  3.550000  0.237511  0.802662  0.270818
  3.600000  0.237833  0.814545  0.595309
  3.650000  0.238154  0.826445  1.012369
  3.700000  0.238476  0.838361  1.497921
  3.750000  0.238797  0.850293  2.032048
  3.800000  0.239118  0.862241  2.595039
  3.850000  0.239440  0.874205  3.166613
  3.900000  0.239761  0.886185  3.726296
  3.950000  0.240083  0.898181  4.254419
  4.000000  0.240404  0.910193  4.733500
  4.050000  0.240725  0.922221  5.149937
  4.100000  0.241047  0.934265  5.495937
  4.150000  0.241368  0.946326  5.771662
  4.200000  0.241690  0.958402  5.987556
  4.250000  0.242011  0.970495  6.166850
  4.300000  0.242332  0.982603  6.433832
  4.350000  0.242654  0.994728  6.629058
  4.400000  0.242975  1.006869  6.818625
  4.450000  0.243297  1.019025  7.002999
  4.500000  0.243618  1.031198  7.182584
  END FTABLE  1
END FTABLES
```

```
EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1             PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1             IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1             PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1             IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL      REPL
COPY   601 OUTPUT MEAN   1 1     48.4      WDM    901 FLOW     ENGL      REPL
RCHRES   1 HYDR   RO     1 1        1      WDM   1004 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1005 STAG     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13

  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15

  MASS-LINK       16
RCHRES     ROFLOW                          COPY           INPUT  MEAN
  END MASS-LINK   16


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 1913/ 7/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-2.527E-03     0.00000  0.0000E+00     0.00000  -6.136E-08

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
DATE/TIME: 1929/ 8/31 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-8.643E-02     0.00000  0.0000E+00     0.00000  -1.649E-09

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR  is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or
reach/reservior) at the end of the present interval.
STORS  is the storage of material in the pu at the start of the present
printout reporting period.
MATIN  is the total inflow of material to the pu during the present printout
reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the
present printout reporting period.
```

```
ERROR/WARNING ID:   238   1

The continuity error reported below is greater than 1 part in 1000 and is
therefore considered high.

Did you specify any "special actions"?  If so, they could account for it.

Relevant data are:
```

DATE/TIME: 1955/ 9/30 24: 0

RCHRES :   1

RELERR	STORS	STOR	MATIN	MATDIF
-5.486E-02	0.00000	0.0000E+00	0.00000	-2.692E-09

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238   1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1960/ 8/31 24: 0

RCHRES :   1

RELERR	STORS	STOR	MATIN	MATDIF
-4.260E-02	0.00000	0.0000E+00	0.00000	-3.526E-09

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.
REFVAL is the reference value (STORS+MATIN).
STOR   is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

ERROR/WARNING ID: 238   1

The continuity error reported below is greater than 1 part in 1000 and is therefore considered high.

Did you specify any "special actions"? If so, they could account for it.

Relevant data are:
DATE/TIME: 1974/ 8/31 24: 0

RCHRES :   1

RELERR	STORS	STOR	MATIN	MATDIF
-1.842E-03	0.00000	0.0000E+00	0.00000	-8.487E-08

Where:

RELERR is the relative error (ERROR/REFVAL).
ERROR is (STOR-STORS) - MATDIF.

REFVAL is the reference value (STORS+MATIN).
STOR is the storage of material in the processing unit (land-segment or reach/reservior) at the end of the present interval.
STORS is the storage of material in the pu at the start of the present printout reporting period.
MATIN is the total inflow of material to the pu during the present printout reporting period.
MATDIF is the net inflow (inflow-outflow) of material to the pu during the present printout reporting period.

The count for the WARNING printed above has reached its maximum.

If the condition is encountered again the message will not be repeated.

Disclaimer

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WWHM2012
PROJECT REPORT

Project Name: 20083S WQ
Site Name: BPLC
Site Address:
City : Puyallup, WA
Report Date: 3/25/2024
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2023/01/27
Version : 4.2.19

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : PreDev
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	1.808
Pervious Total	1.808

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.808

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : PostDev to Pond
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.494
Pervious Total	0.494

Impervious Land Use	acre
ROADS FLAT	0.066
PARKING FLAT	1.008
POND	0.24
Impervious Total	1.314
Basin Total	1.808

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.808
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.494
Total Impervious Area:1.314

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.040851
5 year	0.062853
10 year	0.075571
25 year	0.089347
50 year	0.098208
100 year	0.105896

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.477474
5 year	0.640524
10 year	0.758972
25 year	0.921021
50 year	1.051032

100 year 1.189262

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.1529 **acre-feet**
On-line facility target flow: 0.1979 **cfs.**
Adjusted for 15 min: 0.1979 **cfs.**
Off-line facility target flow: 0.1143 **cfs.**
Adjusted for 15 min: 0.1143 **cfs.**

Perlnd and Implnd Changes
No changes have been made.

WWHM2012
PROJECT REPORT

Project Name: 20083s Bypass Treatment
Site Name: BPLC
Site Address:
City : Puyallup, WA
Report Date: 3/25/2024
Gage : 40 IN EAST
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2023/01/27
Version : 4.2.19

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : PreDev Bypass
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	.179
Pervious Total	0.179

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.179

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Bypass
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.074
Pervious Total	0.074

Impervious Land Use	acre
ROADS FLAT	0.105
Impervious Total	0.105
Basin Total	0.179

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.179
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.074
Total Impervious Area:0.105

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.004044
5 year	0.006223
10 year	0.007482
25 year	0.008846
50 year	0.009723
100 year	0.010484

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.038604
5 year	0.051817
10 year	0.061421
25 year	0.074564
50 year	0.085113
100 year	0.096331

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.0129 **acre-feet**
On-line facility target flow: 0.0157 **cfs.**
Adjusted for 15 min: 0.0157 **cfs.**
Off-line facility target flow: 0.009 **cfs.**
Adjusted for 15 min: 0.009 **cfs.**

Perlnd and Implnd Changes

No changes have been made.

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Mar 28 2024

Continuous Inflow Bio-filtration Swale WQ

Trapezoidal

Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 1.00
Slope (%)	= 1.50
N-Value	= 0.200

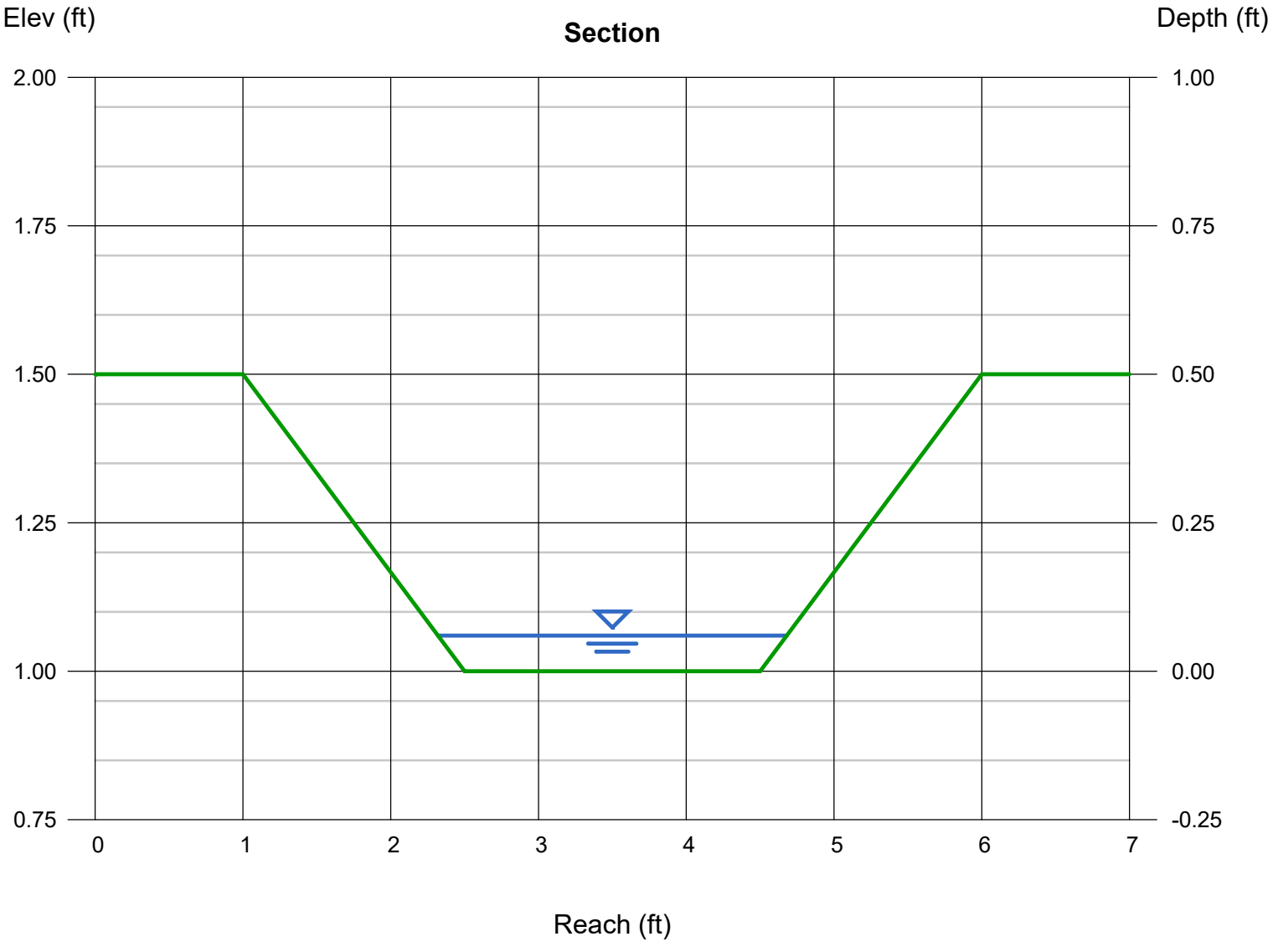
Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.02

Highlighted

Depth (ft)	= 0.06
Q (cfs)	= 0.016
Area (sqft)	= 0.13
Velocity (ft/s)	= 0.12
Wetted Perim (ft)	= 2.38
Crit Depth, Yc (ft)	= 0.02
Top Width (ft)	= 2.36
EGL (ft)	= 0.06

L = 18 min*60 sec/min*0.12-fps = 129.6-ft required 200-ft provided



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Mar 28 2024

Continuous Inflow Bio-filtration Swale 100-Year

Trapezoidal

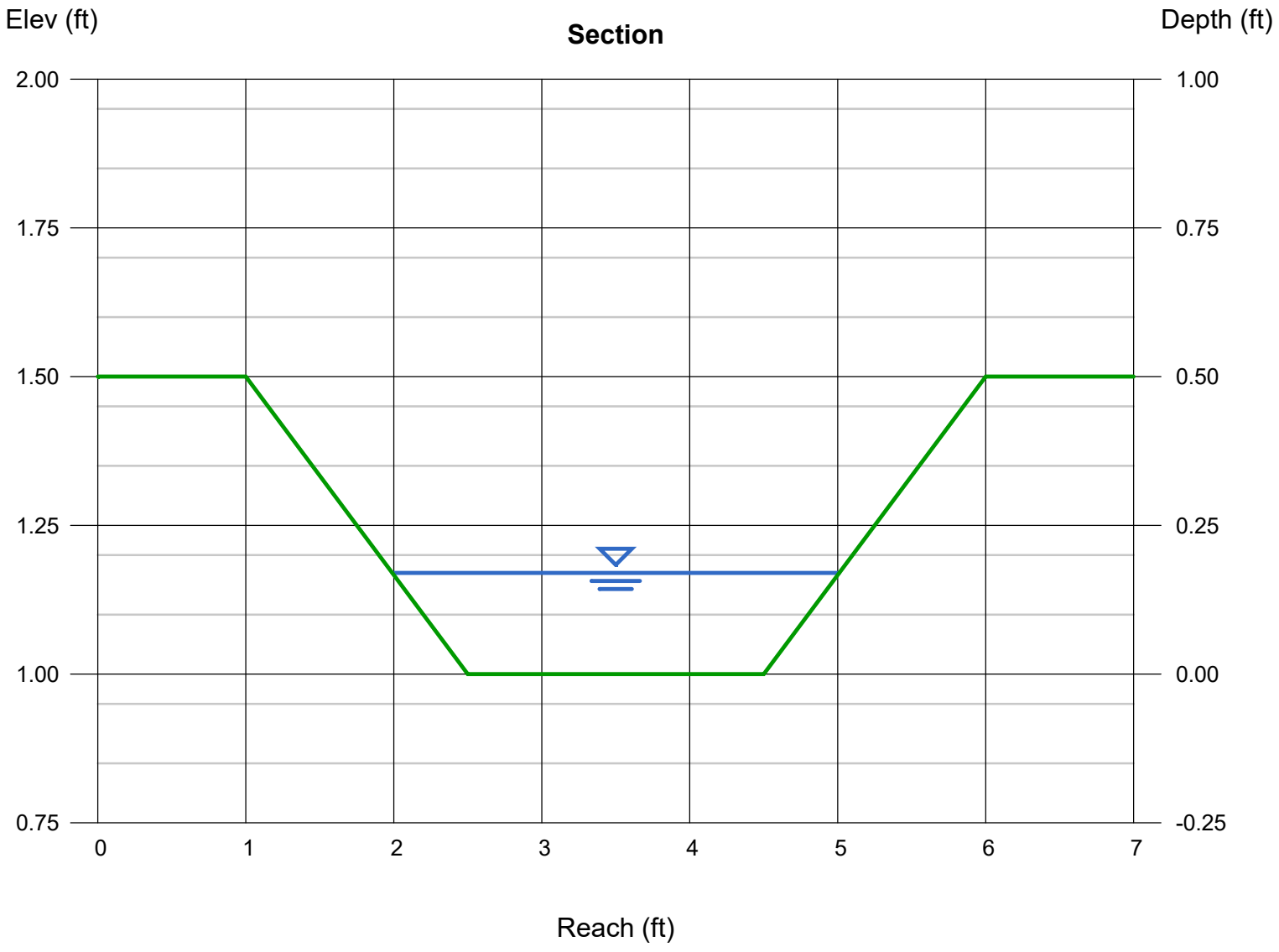
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 1.00
Slope (%)	= 1.50
N-Value	= 0.200

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.10

Highlighted

Depth (ft)	= 0.17
Q (cfs)	= 0.096
Area (sqft)	= 0.43
Velocity (ft/s)	= 0.22
Wetted Perim (ft)	= 3.08
Crit Depth, Yc (ft)	= 0.05
Top Width (ft)	= 3.02
EGL (ft)	= 0.17



PIPE FLOW CALCULATOR
using the Rational Method & Manning Formula
100 YEAR STORM

JOB NAME: Olson Parking Lot
JOB#: 20083
REVISED: 12/22/2023

NOTE: ENTER DEFAULTS AND STORM DATA BEFORE BEGINNING				
DEFAULTS	C=	0.9	n=	0.012
	d=	12	Tc=	6.3

A= Contributing Area (Ac)
C= Runoff Coefficient
Tc= Time of Concentration (min)
I= Intensity at Tc (in/hr)
d= Diameter of Pipe (in)
L= Length of Pipe (ft)
D= Water Depth at Qd (in)

Qd= Design Flow (cfs)
Qf= Full Capacity Flow (cfs)
Vd= Velocity at Design Flow (fps)
Vf= Velocity at Full Flow (fps)
s= Slope of pipe (%)
n= Manning Roughness Coefficient
Tt= Travel Time at Vd (min)

COEFFICIENTS FOR THE RATIONAL METHOD "Ir"-EQUATION

STORM	Ar	Br
2YR	1.58	0.58
10YR	2.44	0.64
25YR	2.66	0.65
50YR	2.75	0.65
100YR	2.61	0.63

PRECIP=	**4**
Ar=	**2.61**
Br=	**0.63**

Street Conveyance

FROM	TO	A	s	L	d	Tc	n	C	SUM A	A*C	SUM A*C	I	Qd	Qf	**Qd/Qf**	D/d	D	Vf	Vd	Tt
CB-4	CB-3	0.22	0.50	100	8	6.3	0.012	0.9	0.218	0.20	0.20	3.27	0.64	0.93	**0.694**	0.613	4.90	2.65	2.86	0.58
CB-5	CB-3	0.42	0.59	68	12	6.9	0.012	0.9	0.420	0.38	0.38	3.10	1.17	2.96	**0.395**	0.437	5.24	3.78	3.56	0.32
CB-3	CB-2	0.21	0.50	105	12	6.3	0.012	0.9	0.848	0.19	0.76	3.27	2.50	2.73	**0.916**	0.747	8.97	3.48	3.93	0.45
CB-2	Pond	0.24	0.50	75	14	6.7	0.012	0.9	1.088	0.22	0.98	3.14	3.07	4.12	**0.746**	0.644	9.01	3.85	4.23	0.50

APPENDIX D

Geotechnical Engineer's Report

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

February 12, 2019
ES-6481

Best Parking Lot Cleaning, Inc.
2412 Inter Avenue
Puyallup, Washington 98372

Attention: Mr. Rich Hamilton

Subject: Geotechnical Evaluation
Proposed Parking Lot Redevelopment
2512 Inter Avenue
Puyallup, Washington

Reference: Timothy J. Walsh
Geologic Map of the South Half of the Tacoma Quadrangle, Washington, 1987

CES NW, Inc.
Topographic Survey, dated May 30, 2018

United States Department of Agriculture
Natural Resources Conservation Service
Online Web Soil Survey (WSS) Resource

Dear Mr. Hamilton:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this geotechnical evaluation for the subject site. We performed our work in general accordance with the scope of services outlined in our proposal dated December 18, 2018 and authorized by you on January 2, 2019. A summary of our subsurface exploration and pertinent geotechnical considerations are provided in this letter.

Project Description

We understand the existing gravel parking lot, in the eastern portion of the site, will be improved. The feasibility of using shallow infiltration facilities to accommodate stormwater runoff from new impervious surfaces was the primary focus of our investigation. Infiltration facilities would likely be installed in the northeastern portion of the site, where feasible.

This letter has been prepared for the exclusive use of Best Parking Lot Cleaning, Inc. and their representatives. A warranty is neither expressed nor implied. The recommendations and conclusions provided in this letter are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. Variations in the soil and groundwater conditions encountered at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the contents of this letter if variations are encountered.

Surface Conditions

The subject site is located on the south side of Inter Avenue, about 450 feet east of the intersection with 23rd Street Southeast, in Puyallup, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map). The property is comprised of four tax parcels (Pierce County Parcel Nos. 210520-0320, -0350, -0340, and -0361) totaling approximately 2.79 acres. Two commercial buildings, asphalt parking, gravel parking, and related infrastructure improvements currently occupy the site. The site is surrounded to the north by Inter Avenue, to the south and east by BNSF railroad tracks, and to the west by a commercial development. Site topography is relateively level, with little discernible elevation change across the property. Vegetation primarily consists of scattered trees and grass.

Subsurface Conditions

An ESNW representative observed, logged, and sampled three test pits, excavated within accessible areas of the site, on January 30, 2019 using a trackhoe and operator provided by the client. The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the attached test pit logs for a more detailed description of subsurface conditions. Representative soil samples collected at the test pit locations were analyzed in accordance with both Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures.

Topsoil and Fill

Topsoil was not encountered at the test pit locations. Given the existing level of site development, we do no anticipate topsoil will be consequential during the proposed construction.

Fill was encountered at the test pit locations to depths of approximately one to two and one-half feet below the existing ground surface (bgs). The fill was characterized as crushed rock or silty gravel with sand (USCS: GM) and was encountered in a medium dense and moist condition. Where encountered during construction, ESNW can evaluate fill deposits, as necessary.

Native Soil

Underlying fill, native soils at depth were characterized primarily as loose to medium dense silty sand (USCS: SM). The upper two feet was predominately silt (USCS:ML) with various amounts of sand and gravel. The native soils were observed primarily in a moist to wet condition. The maximum exploration depth was approximately 10 feet bgs.

Geologic Setting

The referenced geologic map resource identifies alluvium (Qal) as the primary geologic unit underlying the subject site and surrounding areas. Alluvial deposits are dominant in the Puyallup Valley and typically consist of loose, stratified to massively bedded fluvial silt, sand, and gravel, and locally includes sandy to silty estuarine deposits.

The referenced WSS resource identifies Briscot loam (Map Unit Symbol: 6A) as the primary soil unit underlying the subject site. The Briscot series was formed in flood plains. Based on our field observations, native soils on the subject site are consistent with alluvium, as outlined in this section.

Groundwater

During our subsurface exploration completed on January 30, 2019, groundwater was encountered at the test pit locations between depths of roughly three to eight feet bgs. Our interpretation of field conditions is that groundwater seepage is present in the upper three to four feet bgs, and the groundwater table occurs at about seven to eight feet bgs. Even though our fieldwork occurred during the wet season, our observed groundwater elevations should not be considered representative of the seasonal high without confirmation by a seasonal groundwater monitoring program.

It is our opinion that the contractor should be prepared to manage groundwater during construction, especially within deeper site excavations. Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches, sumps, and dewatering pumps. It should be noted seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months.

Stormwater Facility Considerations

We understand shallow infiltration facilities are proposed to accommodate stormwater runoff from new impervious surfaces. As indicated in the *Subsurface* section of this letter, native soils encountered during our fieldwork were characterized primarily as loose to medium dense alluvial deposits. Given the relatively high fines content and presence of a shallow groundwater table, it is our opinion infiltration is not feasible from a geotechnical standpoint.

Alternatively, we understand detention may be utilized for stormwater management. At the time of this letter, specific detention plans were not available for review; however, based on our field observations, in general, it is our opinion construction of a detention facility is feasible from a geotechnical standpoint. Design and installation of a detention facility must consider seasonal groundwater elevations, which were estimated at about seven feet bgs (in the northern site area) at the time of our January 2019 fieldwork. Perched groundwater seepage should be anticipated within detention facility excavations. Final detention facility designs must incorporate adequate buffer space from property boundaries such that temporary construction excavations may be successfully completed. ESNW can provide additional recommendations and design parameters to aid with detention facility design, if needed, as project plans develop.

ESNW should have an opportunity to review final project plans with respect to the geotechnical recommendations provided in this letter. ESNW should also be retained to observe the construction of detention facilities on site to provide supplementary testing and recommendations, where necessary.

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

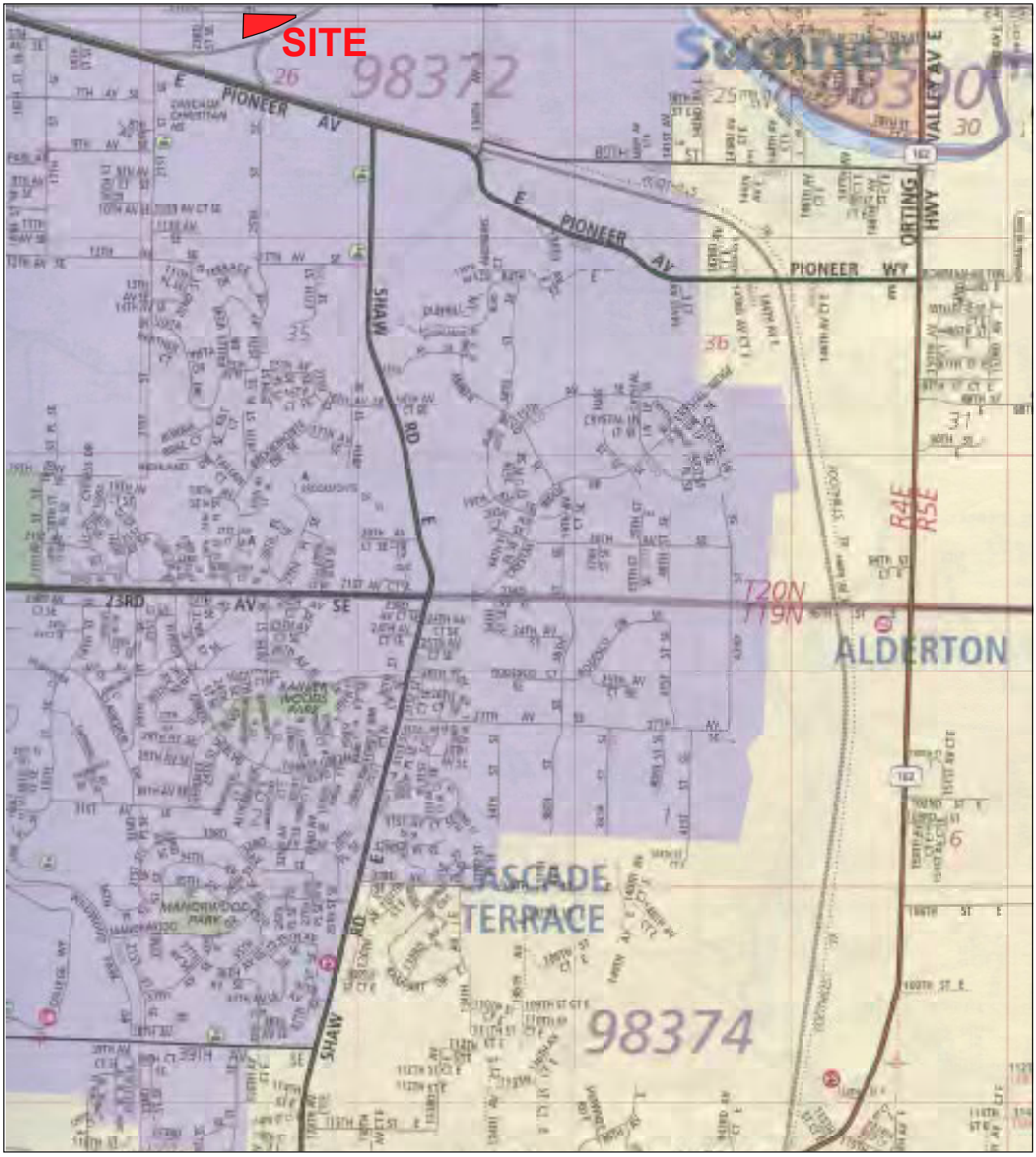
Sincerely,

EARTH SOLUTIONS NW, LLC

Terry J. Dunn
Staff Geologist

Keven D. Hoffmann, P.E.
Senior Project Manager

Attachments: Plate 1 – Vicinity Map
Plate 2 – Test Pit Location Plan
Test Pit Logs
Grain Size Distribution



Reference:
Pierce County, Washington
Map 835
By The Thomas Guide
Rand McNally
32nd Edition

NORTH

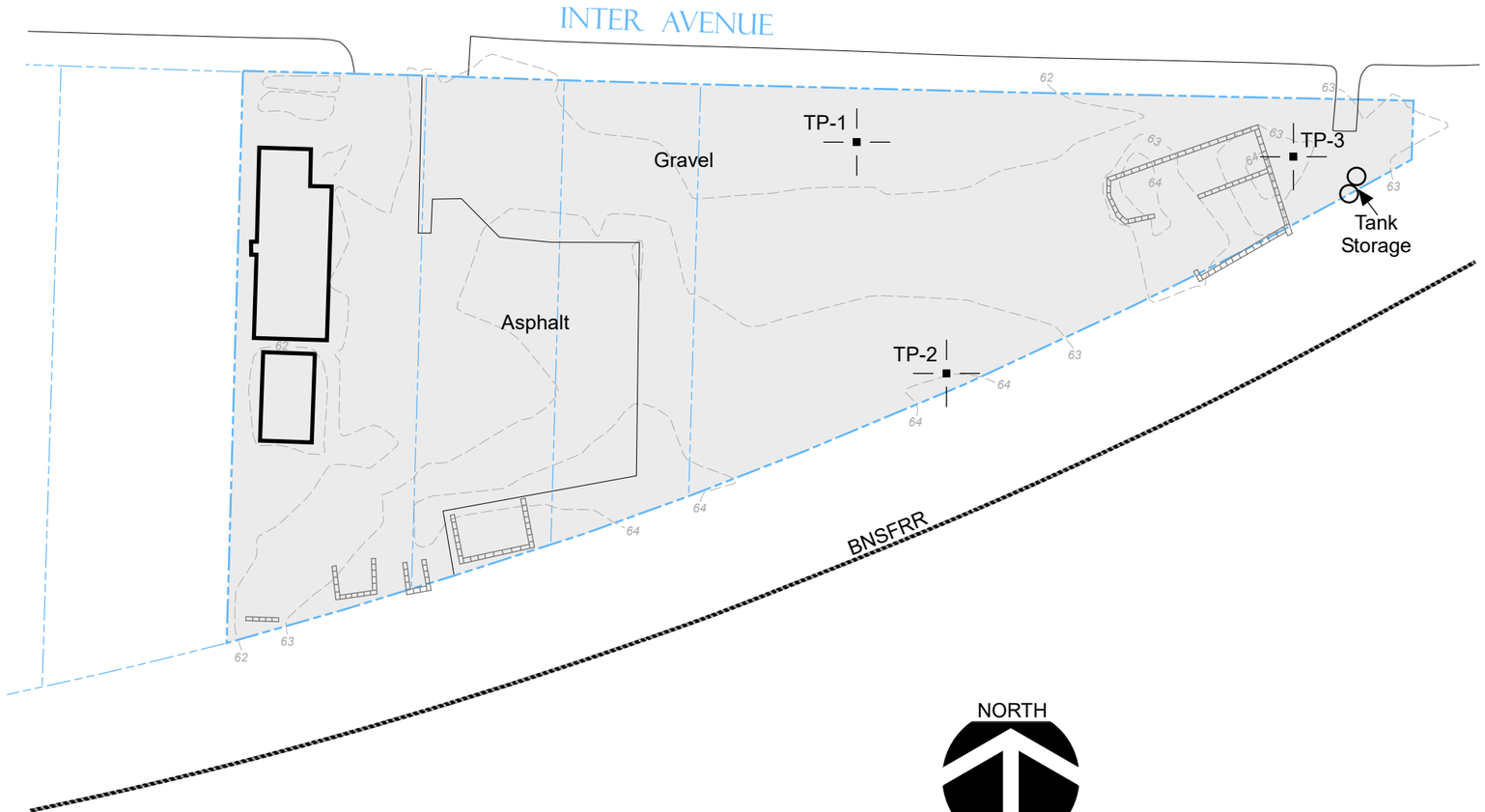
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Best Parking
Puyallup, Washington

Drwn. CAM	Date 02/06/2019	Proj. No. 6481
Checked TJD	Date Feb. 2019	Plate 1



LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-6481, Jan. 2019

Subject Site

Existing Building

Existing Concrete Block Wall

NORTH

1"=80' 0 40 80 160 Scale in Feet

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

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

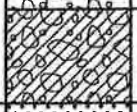
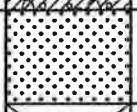
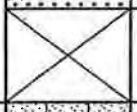
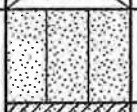
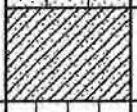
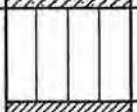
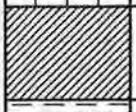
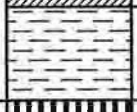
Test Pit Location Plan
Best Parking
Puyallup, Washington

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

Drwn. By	CAM
Checked By	TJD
Date	02/06/2019
Proj. No.	6481
Plate	2

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

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

DUAL SYMBOLS are used to indicate borderline soil classifications.

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

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

PROJECT NUMBER ES-6481 **PROJECT NAME** Best Parking

DATE STARTED 1/30/19 **COMPLETED** 1/30/19 **GROUND ELEVATION** 61 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD ▽ **AT TIME OF EXCAVATION** 8.0 ft / Elev 53.0 ft

LOGGED BY TJD **CHECKED BY** KDH **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 6": crushed rock minus **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			FILL		Crushed rock minus	
				0.5		60.5
			GM		Gray silty GRAVEL with sand, medium dense, moist (Fill)	
					-increased gravel content	
				2.0		59.0
		MC = 22.20% Fines = 66.70%	ML		Gray gravelly SILT, loose to medium dense, moist [USDA Classification: gravelly LOAM] -caving to 8'	
				4.0	-light groundwater seepage at 4'	57.0
5		MC = 28.80%	SM		Gray silty fine SAND, loose to medium dense, moist to wet -iron oxide staining -moderate to heavy groundwater seepage	
		MC = 25.90%			-increased sand content -becomes black, wet	
					▽ -groundwater table	
10		MC = 26.80% Fines = 12.60%		10.0	[USDA Classification: slightly gravelly SAND]	51.0
					Test pit terminated at 10.0 feet below existing grade. Groundwater table encountered at 8.0 feet and groundwater seepage encountered at 4.0 and 6.0 feet during excavation. Caving observed from 3.0 to 8.0 feet. Bottom of test pit at 10.0 feet.	

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

PROJECT NUMBER ES-6481 **PROJECT NAME** Best Parking

DATE STARTED 1/30/19 **COMPLETED** 1/30/19 **GROUND ELEVATION** 63 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD **AT TIME OF EXCAVATION** ---

LOGGED BY TJD **CHECKED BY** KDH **AT END OF EXCAVATION** —

NOTES Depth of Topsoil & Sod 4"-6": crushed rock minus **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			FILL		0.5 Crushed rock minus	62.5
			GM		Gray silty GRAVEL with sand, medium dense, damp to moist (Fill)	
					2.5	60.5
		MC = 31.70%	ML		Gray SILT with sand, loose to medium dense, moist to wet -iron oxide staining	
		MC = 29.40%			4.5 -light groundwater seepage	58.5
5			SM		Gray silty fine SAND, loose to medium dense, moist to wet -caving from 4.5' to 8'	
		MC = 28.80% Fines = 37.30%			-iron oxide staining [USDA Classification: very fine sandy LOAM] -moderate groundwater seepage -becomes black, wet	
10		MC = 32.50%			10.0	53.0
					Test pit terminated at 10.0 feet below existing grade. Groundwater seepage encountered at 4.0 and 8.0 feet during excavation. Caving observed from 4.5 to 8.0 feet. Bottom of test pit at 10.0 feet.	

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

PROJECT NUMBER ES-6481 **PROJECT NAME** Best Parking

DATE STARTED 1/30/19 **COMPLETED** 1/30/19 **GROUND ELEVATION** 63 ft **TEST PIT SIZE**

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD ▽ **AT TIME OF EXCAVATION** 7.0 ft / Elev 56.0 ft

LOGGED BY TJD **CHECKED BY** KDH **AT END OF EXCAVATION** ---

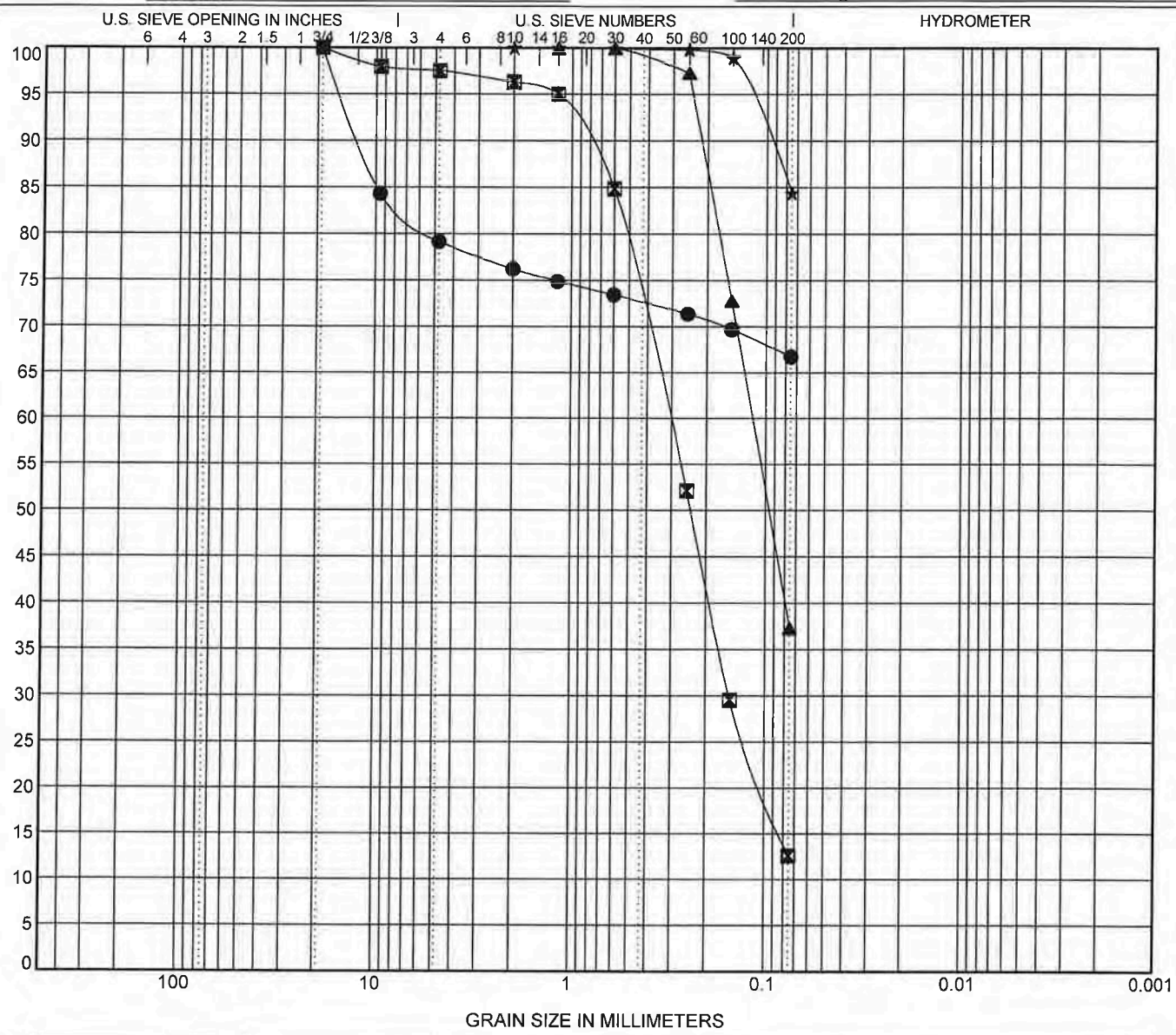
NOTES Depth of Topsoil & Sod 6"-10": 2"-4" quarry spalls **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			FILL		Quarry spalls Crushed rock minus
				0.9	62.1
		MC = 25.30%	ML		Gray SILT with sand, loose to medium dense, moist to wet
		MC = 33.00% Fines = 84.40%		3.0	-light groundwater seepage at 3', caving from 3' to 7'
					60.0
			SM		Gray fine silty SAND, loose to medium dense, wet [USDA Classification: LOAM]
5					-light groundwater seepage -iron oxide staining to 8'
		MC = 32.10%			-silt lens ▽ -groundwater table
		MC = 31.60%		9.5	
					53.5
					Test pit terminated at 9.5 feet below existing grade. Groundwater table encountered at 7.0 feet and groundwater seepage encountered at 3.0 and 5.0 feet during excavation. Caving observed from 3.0 to 7.0 feet. Bottom of test pit at 9.5 feet.

Earth Solutions NW, LLC
1805 - 136th PL N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-6481 **PROJECT NAME** Best Parking



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	Cc	Cu
● TP-01	2.50ft.	USDA: Gray Gravelly Loam. USCS: Gravelly ML.		
⊠ TP-01	10.00ft.	USDA: Black Slightly Gravelly Sand. USCS: SM.		
▲ TP-02	7.50ft.	USDA: Gray Very Fine Sandy Loam. USCS: SM.		
★ TP-03	3.00ft.	USDA: Gray Loam. USCS: ML with Sand.		

Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
● TP-01	2.5ft.	19							66.7	
⊠ TP-01	10.0ft.	19	0.309	0.152					12.6	
▲ TP-02	7.5ft.	1.18	0.117						37.3	
★ TP-03	3.0ft.	2							84.4	

GRAIN SIZE USDA ES-6481 BEST PARKING.GPJ GINT US LAB.GDT 1/31/19

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

April 27, 2021
ES-6481.01

BPLC Properties, LLC
10615 – 438th Street Court East
Eatonville, Washington 98328

Attention: Mr. Rich Hamilton

Subject: Groundwater Monitoring Program Summary
Best Parking Lot Cleaning Site Improvements
2412 Inter Avenue
Puyallup, Washington

Reference: Earth Solutions NW, LLC
Geotechnical Evaluation
Project No. ES-6481, dated February 19, 2019

City of Puyallup, Washington
E-20-0067 Civil Comments 1 Letter, dated March 16, 2020

Dear Mr. Hamilton:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this letter summarizing the results of our seasonal groundwater monitoring program on site.

The monitoring program consisted of installing three groundwater monitoring wells at the approximate locations depicted on Plate 2 (Subsurface Exploration Plan). Since the installation of the groundwater wells on June 8, 2020, daily groundwater levels have been recorded using dataloggers. ESNW personnel visited the site biweekly to download the collected data and perform manual measurements at each borehole using a depth-to-water meter. The table on page 2 summarizes the groundwater data collected during our monitoring program.

Borehole	Depth of Borehole (ft)	Ground Elevation* (ft)	Peak GWT Depth† (ft bgs)	Peak GWT Elevation* (ft)	Peak Date
B-1	21.5	56	0.9	55.1	01/13/2021
B-2	21.5	56	1.6	54.4	01/13/2021
B-3	21.5	54	2.0	52.0	01/13/2021

** Elevations are approximate, based on readily available topographic survey data; monitoring well locations have not been surveyed.*
† Depth measured from existing ground surface.

Monitoring charts are attached to letter, along with boring logs and laboratory analyses from the June 2020 fieldwork. The monitoring period extended before and after the minimum period requested by the City of Puyallup (December 21 to April 1), as outlined in the referenced comments letter. As anticipated, high groundwater readings corresponded with relatively high rainfall events. Based on the data collected during the monitoring period, it is our opinion the peak groundwater table depths listed in the table above are indicative of the seasonal high groundwater elevations.

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

Sincerely,

EARTH SOLUTIONS NW, LLC

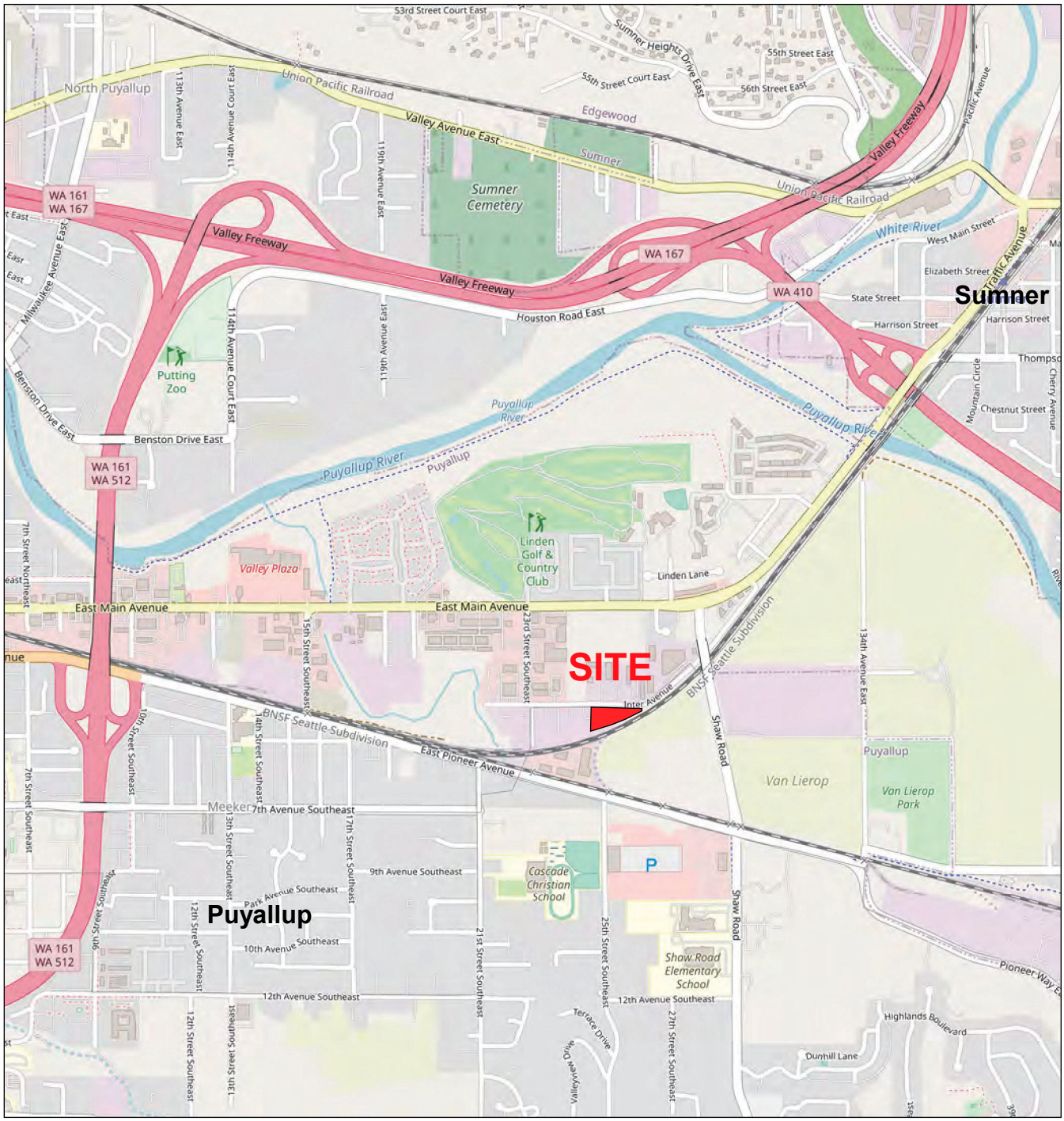
04/27/2021

Adam Z. Shier, L.G.
Project Geologist

Keven D. Hoffmann, P.E.
Geotechnical Engineering Services Manager

Attachments: Plate 1 – Vicinity Map
Plate 2 – Subsurface Exploration Plan
Boring Logs
Grain Size Distribution
Seasonal Groundwater Monitoring Charts

cc: Barghausen Consulting Engineers, Inc.
Attention: Mr. Jason Hubbell, P.E. (Email only)



Reference:
Pierce County, Washington
OpenStreetMap.org

NORTH

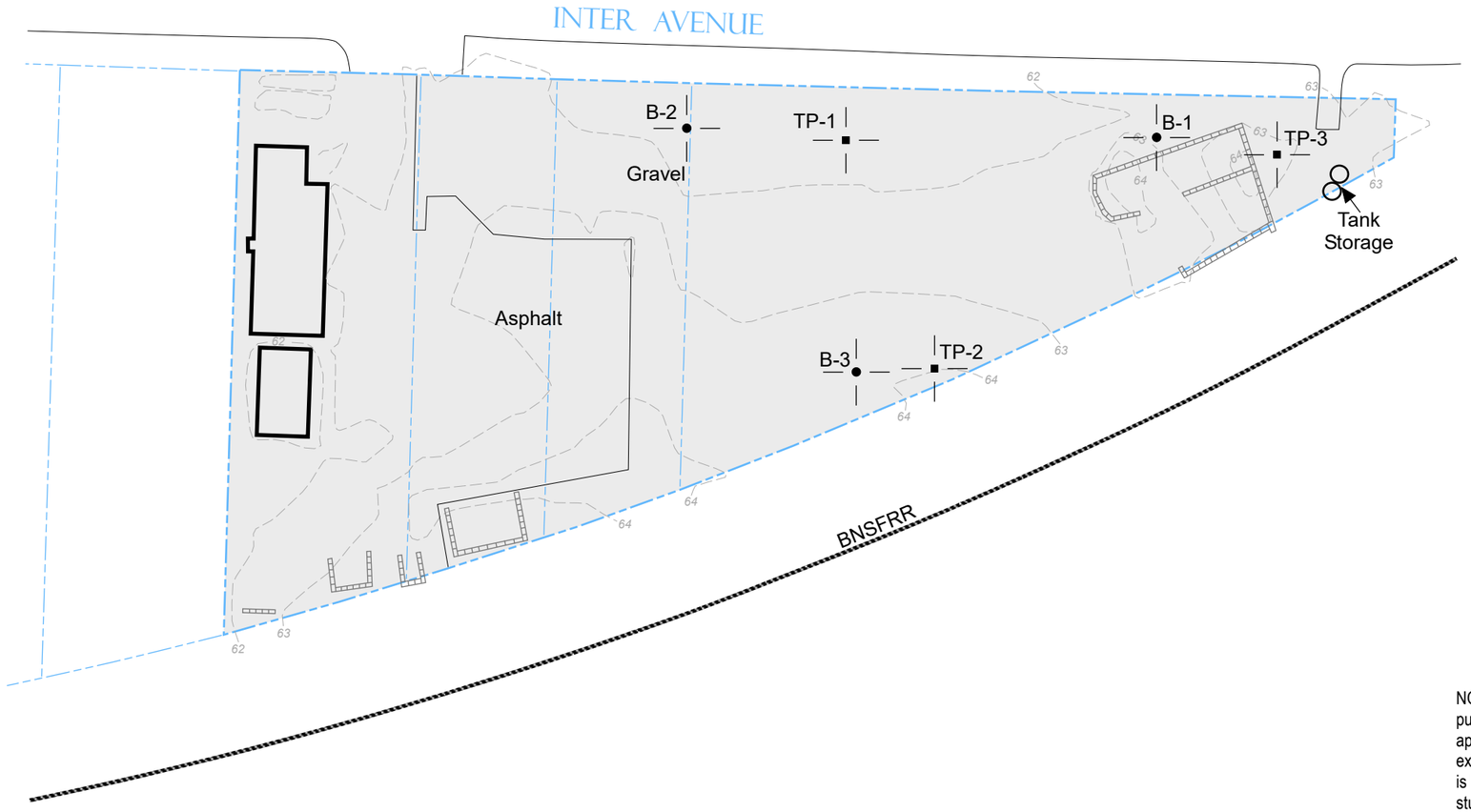
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Best Parking Lot Cleaning Site Improvements
Puyallup, Washington

Drwn. MRS	Date 06/30/2020	Proj. No. 6481.01
Checked KDH	Date June 2020	Plate 1



LEGEND

- B-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-6481.01, June 2020
- TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-6481, Jan. 2019
- Subject Site
- Existing Building
- Existing Concrete Block Wall

NORTH

1"=80' 0 40 80 160 Scale in Feet

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

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

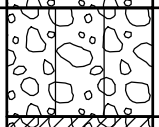
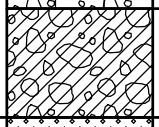
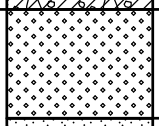
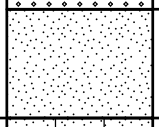
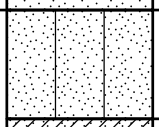
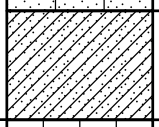
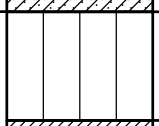
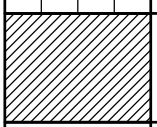
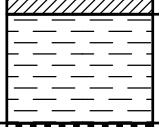
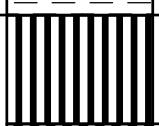
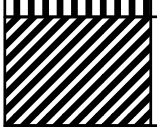
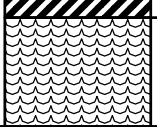
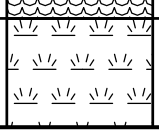
Subsurface Exploration Plan
Best Parking Lot Cleaning Site Improvements
Puyallup, Washington

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

Drwn. By	MRS
Checked By	KDH
Date	06/30/2020
Proj. No.	6481.01
Plate	2

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

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

DUAL SYMBOLS are used to indicate borderline soil classifications.

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

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

BORING NUMBER B-1

PROJECT NUMBER ES-6481.01 **PROJECT NAME** Best Parking Lot Cleaning Site Improvements

DATE STARTED 6/8/20 **COMPLETED** 6/8/20 **GROUND ELEVATION** 63 ft **HOLE SIZE**

DRILLING CONTRACTOR Holocene Drilling **GROUND WATER LEVELS:**

DRILLING METHOD HSA ▽ **AT TIME OF DRILLING** 7.0 ft

LOGGED BY AZS **CHECKED BY** KDH **AT END OF DRILLING** ---

NOTES Surface Conditions: exposed soil **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					SW-SM		Gray well-graded SAND with silt, medium dense, moist
	SS	11	7-8-7 (15)	MC = 10.6%			
5							
	SS	17	1-4-4 (8)	MC = 8.1% Fines = 11.1%			[USDA Classification: gravelly coarse SAND] -becomes loose
							▽ -groundwater table, becomes water bearing
	SS	50	4-2-5 (7)	MC = 40.5%			8.0
10							Gray SILT, medium dense, water bearing
	SS	100	7-8-10 (18)	MC = 29.8%	ML		
15							
	SS	67	3-5-6 (11)	MC = 34.5%			
20							20.0 55.0 43.0

(Continued Next Page)

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BORING NUMBER B-1

PROJECT NUMBER ES-6481.01 **PROJECT NAME** Best Parking Lot Cleaning Site Improvements

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
20							
	SS	67	2-3-5 (8)	MC = 31.1%	ML		Gray SILT, loose, water bearing
21.5							41.5

Boring terminated at 21.5 feet below existing grade. Groundwater table encountered at 7.0 feet during drilling. 2" PVC standpipe installed to bottom of boring. Lower 10.0 feet slotted. Well ID: BNF287. Boring backfilled with bentonite/sand.

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

BORING NUMBER B-2

PROJECT NUMBER ES-6481.01 **PROJECT NAME** Best Parking Lot Cleaning Site Improvements

DATE STARTED 6/8/20 **COMPLETED** 6/8/20 **GROUND ELEVATION** 62 ft **HOLE SIZE**

DRILLING CONTRACTOR Holocene Drilling **GROUND WATER LEVELS:**

DRILLING METHOD HSA ▽ **AT TIME OF DRILLING** 6.0 ft

LOGGED BY AZS **CHECKED BY** KDH **AT END OF DRILLING** ---

NOTES Surface Conditions: gravel driveway **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					GM		Gray silty GRAVEL with sand, loose, moist (Fill)
	SS	6	1-2-5 (7)	MC = 22.3%			3.0 59.0
					SP		Gray poorly graded SAND, loose, moist
							4.0 58.0
5					ML		Brown SILT with sand, loose, wet
	SS	67	1-1-2 (3)	MC = 43.5% Fines = 77.1%			[USDA Classification: slightly gravelly LOAM]
							▽ -iron oxide staining
							-groundwater table, becomes water bearing
	SS	100	2-6-7 (13)	MC = 42.8%			8.5 53.5
10					SM		Gray silty fine SAND, medium dense, water bearing
	SS	100	3-11-16 (27)	MC = 31.3%			-4" wood debris
15							
	SS	67	6-6-6 (12)	MC = 29.5%			
20							20.0 42.0

(Continued Next Page)

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

BORING NUMBER B-2

PROJECT NUMBER ES-6481.01 **PROJECT NAME** Best Parking Lot Cleaning Site Improvements

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
20							
	SS	100	2-4-8 (12)	MC = 33.5%	SP		Gray poorly graded SAND, medium dense, water bearing 21.0 41.0
					ML		21.5 Gray SILT, medium dense, water bearing -wood debris 40.5

Boring terminated at 21.5 feet below existing grade. Groundwater table encountered at 6.0 feet during drilling. 2" PVC standpipe installed to bottom of boring. Lower 10.0 feet slotted. Well ID: BNF288. Boring backfilled with bentonite/sand.

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

BORING NUMBER B-3

PROJECT NUMBER ES-6481.01 **PROJECT NAME** Best Parking Lot Cleaning Site Improvements
DATE STARTED 6/8/20 **COMPLETED** 6/8/20 **GROUND ELEVATION** 64 ft **HOLE SIZE**
DRILLING CONTRACTOR Holocene Drilling **GROUND WATER LEVELS:**
DRILLING METHOD HSA ▽ **AT TIME OF DRILLING** 10.0 ft
LOGGED BY AZS **CHECKED BY** KDH **AT END OF DRILLING** ---
NOTES Surface Conditions: gravel driveway **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0					GM		Gray silty GRAVEL with sand, loose, moist (Fill)	
								2.5 61.5
	SS	67	4-3-4 (7)	MC = 34.5% Fines = 98.3%	ML		Gray SILT, loose, moist [USDA Classification: slightly gravelly LOAM] -iron oxide staining	
5							-becomes sandy silt	
	SS	11	4-4-5 (9)	MC = 25.2% Fines = 60.4%			[USDA Classification: slightly gravelly LOAM]	
								7.5 56.5
	SS	33	3-4-6 (10)	MC = 21.8%	SM		Gray silty fine SAND with gravel, medium dense, moist to wet	
10							▽ -groundwater table, becomes water bearing, no recovery	
	SS		4-4-6 (10)					
15								15.5 48.5
	SS	67	2-4-7 (11)	MC = 28.6%	SP		Gray poorly graded SAND, medium dense, water bearing	
20								20.0 44.0

(Continued Next Page)

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

BORING NUMBER B-3

PROJECT NUMBER ES-6481.01 **PROJECT NAME** Best Parking Lot Cleaning Site Improvements

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
20							
	SS	67	4-4-3 (7)	MC = 22.6%	SP		Gray poorly graded SAND, loose, water bearing
21.5							42.5

Boring terminated at 21.5 feet below existing grade. Groundwater table encountered at 10.0 feet during drilling. 2" PVC standpipe installed to bottom of boring. Lower 10.0 feet slotted. Well ID: BNF289. Boring backfilled with bentonite/sand.

Earth Solutions NW, LLC
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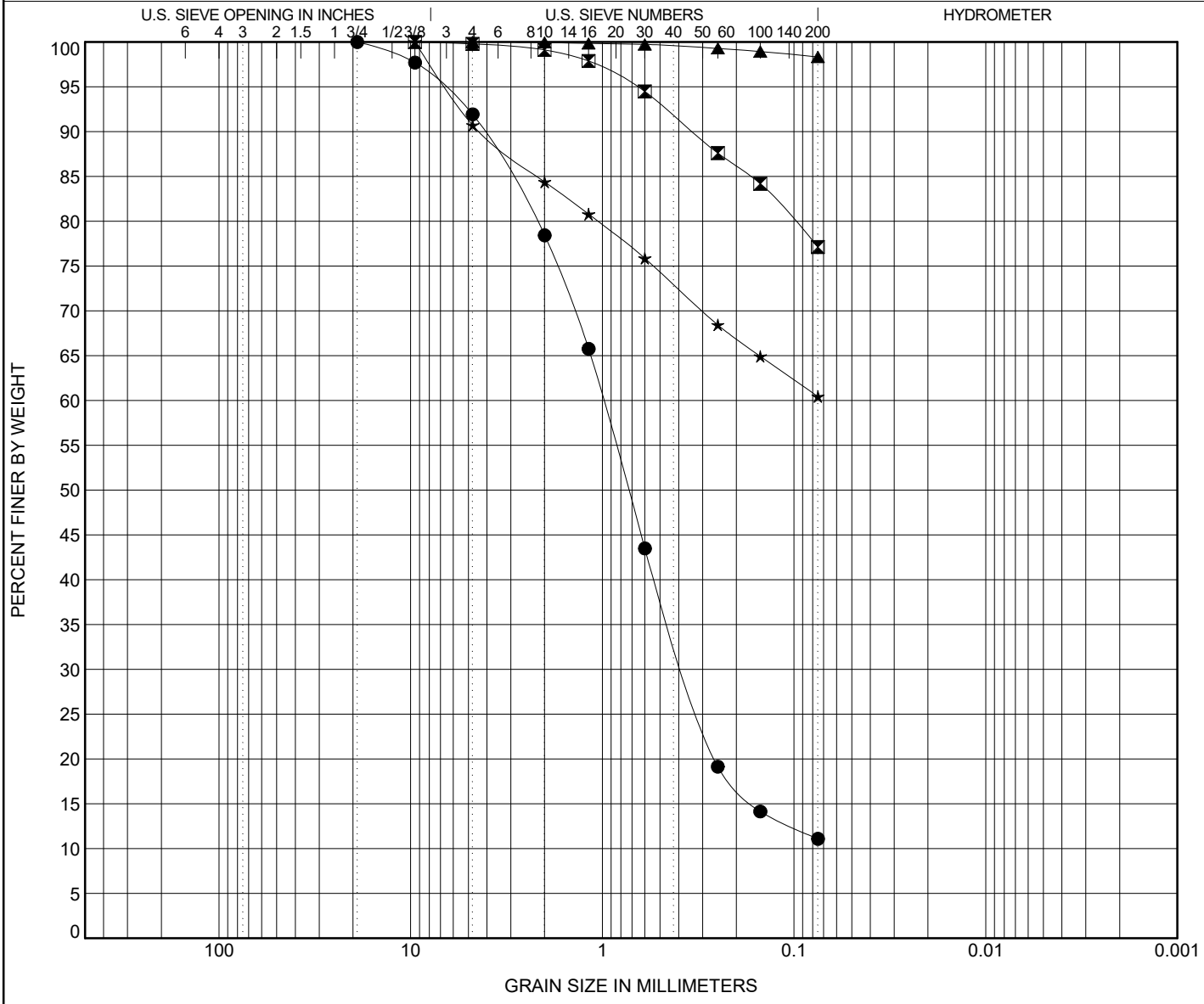
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

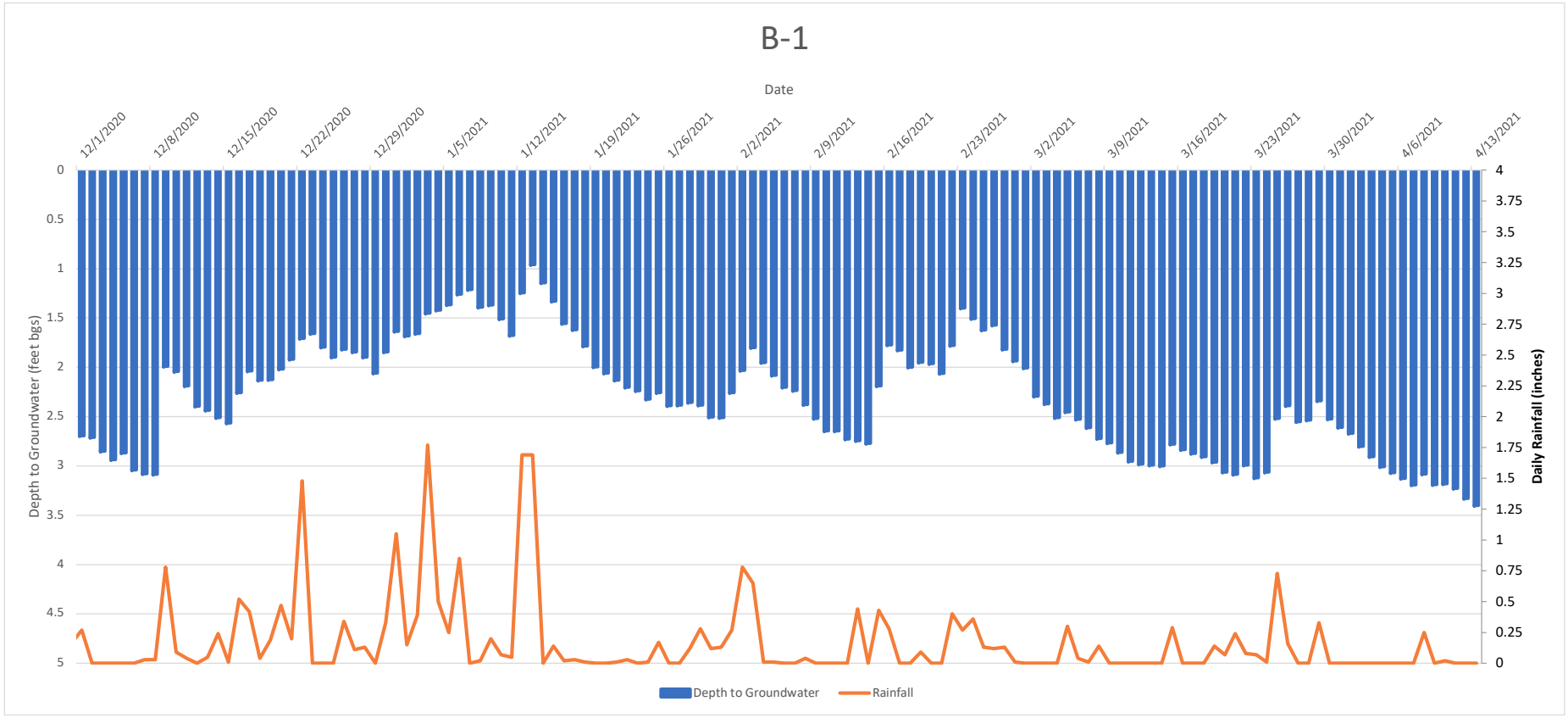
PROJECT NUMBER ES-6481.01 **PROJECT NAME** Best Parking Lot Cleaning Site Improvements

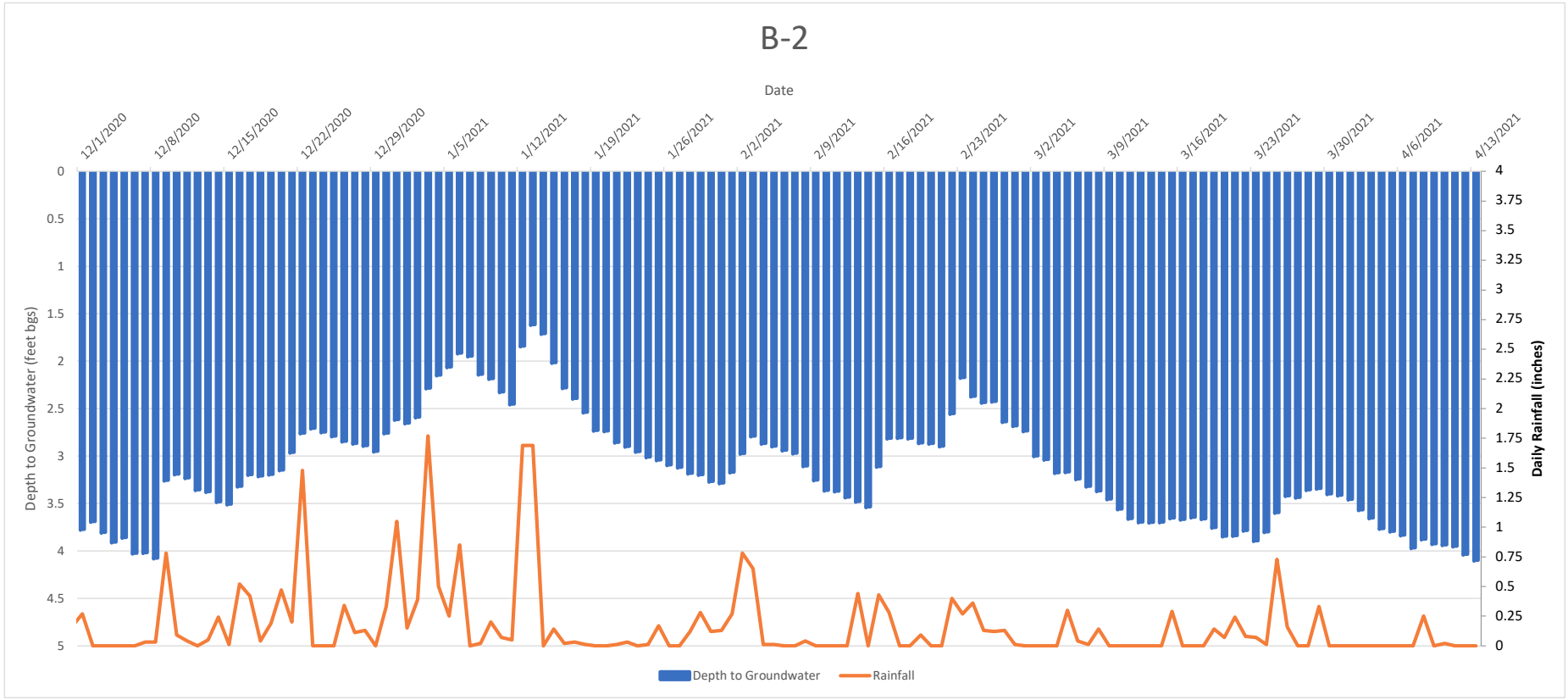


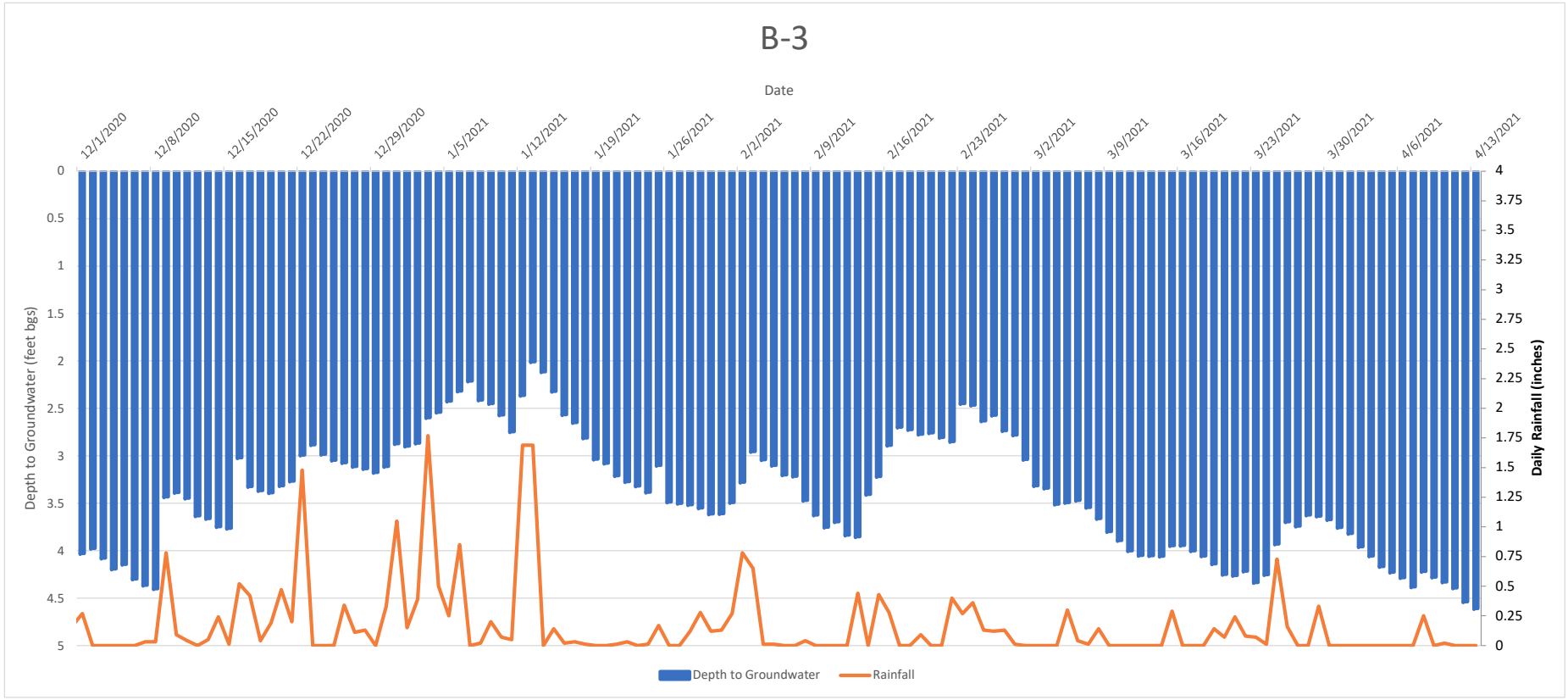
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	**B-01**	**5.00ft.**	**USDA: Gray Gravelly Coarse Sand. USCS: SW-SM.**	**2.35**	**16.92**
⊠	**B-02**	**5.00ft.**	**USDA: Brown Slightly Gravelly Loam. USCS: ML with Sand.**		
▲	**B-03**	**2.50ft.**	**USDA: Gray Slightly Gravelly Loam. USCS: ML.**		
★	**B-03**	**5.00ft.**	**USDA: Gray Slightly Gravelly Loam. USCS: Sandy ML.**		

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	**B-01**	**5.0ft.**	**19**	**0.991**	**0.369**					**11.1**	
⊠	**B-02**	**5.0ft.**	**9.5**							**77.1**	
▲	**B-03**	**2.5ft.**	**4.75**							**98.3**	
★	**B-03**	**5.0ft.**	**9.5**							**60.4**	


B-1
Date
12/1/2020
12/8/2020
12/15/2020
12/22/2020
12/29/2020
1/5/2021
1/12/2021
1/19/2021
1/26/2021
2/2/2021
2/9/2021
2/16/2021
2/23/2021
3/2/2021
3/9/2021
3/16/2021
3/23/2021
3/30/2021
4/6/2021
4/13/2021
Depth to Groundwater (feet bgs)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Daily Rainfall (inches)
4
3.75
3.5
3.25
3
2.75
2.5
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
Depth to Groundwater
Rainfall


B-2
Date
12/1/2020
12/8/2020
12/15/2020
12/22/2020
12/29/2020
1/5/2021
1/12/2021
1/19/2021
1/26/2021
2/2/2021
2/9/2021
2/16/2021
2/23/2021
3/2/2021
3/9/2021
3/16/2021
3/23/2021
3/30/2021
4/6/2021
4/13/2021
Depth to Groundwater (feet bgs)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Daily Rainfall (inches)
4
3.75
3.5
3.25
3
2.75
2.5
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
Depth to Groundwater
Rainfall


B-3
Date
12/1/2020
12/8/2020
12/15/2020
12/22/2020
12/29/2020
1/5/2021
1/12/2021
1/19/2021
1/26/2021
2/2/2021
2/9/2021
2/16/2021
2/23/2021
3/2/2021
3/9/2021
3/16/2021
3/23/2021
3/30/2021
4/6/2021
4/13/2021
Depth to Groundwater (feet bgs)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Daily Rainfall (inches)
4
3.75
3.5
3.25
3
2.75
2.5
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
Depth to Groundwater
Rainfall

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

August 3, 2021
ES-6481.01

BPLC Properties, LLC
10615 – 438th Street Court East
Eatonville, Washington 98328

Attention: Mr. Rich Hamilton

Subject: Detention Pond Liner & Pavement Section Recommendations
Best Parking Lot Cleaning Site Improvements
2512 Inter Avenue
Puyallup, Washington

Reference: Earth Solutions NW, LLC
Geotechnical Evaluation
Project No. ES-6481, dated February 19, 2019

Earth Solutions NW, LLC
Groundwater Monitoring Program Summary
Project No. ES-6481.01, dated April 27, 2021

Barghausen Consulting Engineers, Inc.
Civil Plans, dated February 2020

Greetings, Mr. Hamilton:

As requested by Barghausen Consulting Engineers, Inc., Earth Solutions NW, LLC (ESNW) has prepared this letter for the subject project. Recommendations provided herein concern lining the proposed detention pond and a pavement section for the heavier (truck) traffic anticipated on the new asphalt.

Detention Pond Liner

Per the referenced civil plans, a detention pond is proposed within the northeast site area. Because the detention pond will be constructed below the seasonal high groundwater table (GWT), a liner will be installed to resist hydrostatic uplift. Based on the pond sections depicted in the referenced plans as well as the results of our groundwater monitoring program through the 2020–2021 wet season (as summarized in the referenced letter), the following is a summary of the design parameters for the detention pond

- Top of pond elevation 64.5 feet
- Maximum water surface elevation 63.5 feet
- Static water surface elevation 57.5 feet
- Bottom of pond elevation 57.0 feet
- Seasonal high GWT elevation 62.2 feet

The seasonal high GWT elevation was based on the monitoring completed at boring B-1, which was installed within the detention pond area. It is noted that the seasonal high GWT elevation obtained at B-1 was the shallowest groundwater level obtained across the site; readings at B-2 and B-3 were 0.7 feet and 1.1 feet deeper, respectively.

The design parameters outlined in this section were incorporated into an equation to determine the required liner thickness to resist hydrostatic uplift. A calculation sheet is attached to this letter. Based on the computation results, the following recommendations are offered for the detention pond liner:

- A 40-mil PVC or HDPE liner should be placed continuously over the pond bottom.
- Atop the liner, at least four-and-one-half feet of ballast should be placed. If desired and/or required, the upper 12 inches of the ballast may be substituted as amended soil.
- An ESNW representative should be contacted to observe and document installation of the pond liner. Supplementary recommendations may be provided at the time of construction, where necessary.

The above recommendations incorporate a safety factor of about 1.1 with respect to hydrostatic uplift resistance. In our opinion, this safety factor is appropriate for the pond liner design from a geotechnical standpoint.

Pavement Section Recommendations

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas of unsuitable or yielding subgrade conditions may require remedial measures, such as overexcavation and replacement with structural fill or thicker crushed rock sections, prior to pavement.

In our opinion, the following pavement sections for heavier traffic (occasional truck traffic) areas may be considered:

- Three inches of hot-mix asphalt (HMA) placed over six inches of crushed rock base (CRB).
- Three inches of HMA placed over four-and-one-half inches of asphalt-treated base (ATB).

The HMA, ATB, and CRB materials should conform to WSDOT and/or City of Puyallup specifications, where applicable. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557. Road standards utilized by the City of Puyallup may supersede the recommendations provided in this section.

We trust this letter meets your current needs. Please call if you have any questions about this letter or if we can be of further assistance.

Sincerely,

EARTH SOLUTIONS NW, LLC

08/03/2021
Keven D. Hoffmann, P.E.
Geotechnical Engineering Services Manager

Attachment: Calculation Sheet

cc: Barghausen Consulting Engineers, Inc.
Attention: Mr. Jason Hubbell, P.E. (Email only)

Earth Solutions NW LLC
CALCULATION SHEET

Name: KDH
Date: 07/27/2021
Project Number: 6481.01
Project Name: BPLC Improvements (Puyallup)

Detention Pond Liner Evaluation:
Req'd Amended Soil Thickness to resist Uplift

Assumptions / Design Parameters

(ref. Barghausen Consulting Engr., Storm Drainage Plan/Sections, Feb. 2020)

Top of pond = El. 64.5

Max. W.S. = El. 63.5

Static W.S. = El. 57.5

Bottom of pond = El. 57.0

Seasonal high GWE = El. 62.2

*NEED: Liner thickness/elevation req'd to resist uplift * ("x")

NOTE: Pond liner assumed as ballast + amended soil, $\gamma = 135$ pcf

Solve the imbalance equation, need to resist uplift

$$\text{Imbalance} = [(\text{Seasonal high GWE}) - (\text{Liner elevation})](\text{Unit wt. } H_2O)$$

$$\text{Resistance to uplift} = \text{Dead Storage}$$
$$= [(\text{Static W.S.}) - (\text{Bottom of pond})](\text{Unit wt. } H_2O) +$$
$$(\text{Liner thickness})(\text{Unit wt. liner})$$

Where Imbalance = Resistance to uplift, FOS = 1.0. Solve equation...

$$(62.2 - 57.0 + x)(62.4) = (57.5 - 57.0)(62.4) + (x)(135)$$

$\Rightarrow x = 4.04'$, so 4.04' liner req'd for resistance.

Use min. FOS = 1.1 for design and round up: $4.04(1.1) = 4.44 \triangleq$ **4.5'**

→ **Use 4.5' Liner thickness** ←