BARGHAUSEN

ALEX WHITE
STATE OF WASHINGTON
21036777
REGISTERED
PROFESSIONAL ENGINEER

01/12/2024

Stormwater Site Plan

ARCO Convenience Store and Fuel Station

PREPARED BY

Alex White, P.E.

PREPARED FOR	CLIENT ADDRESS
BP Fuels, NA c/o Accenture	P.O. Box 696049 San Antonio, Texas 78269-9931

SITE ADDRESS	JURISDICTION	DATE	PROJECT NO.
1402 South Meridian Puyallup, Washington 98371	City File No. PRCCP20231423	01/12/2023	21730

Stormwater Site Plan

Barghausen Consulting Engineers, Inc.

Convenience Store with Gas

Puyallup, Washington

Our Job No. 21730

TABLE OF CONTENTS

Tab 1.0

1.0 PROJECT OVERVIEW

The proposed redevelopment consists of an ARCO ampm convenience store, a fuel station canopy, underground storage tanks (USTs), required fuel system components, and an automatic car wash located at 1402 S. Meridian Street, Puyallup, Washington 98371. The development is located within Parcel Nos. 773000-028-1, 773000-028-8, 773000-003-1, and 773000-002-1. The parcels consist of a total area of 1.20 acres. Construction activities include site clearing, grading, paving, structures, utilities, drainage, road improvements, and landscaping.

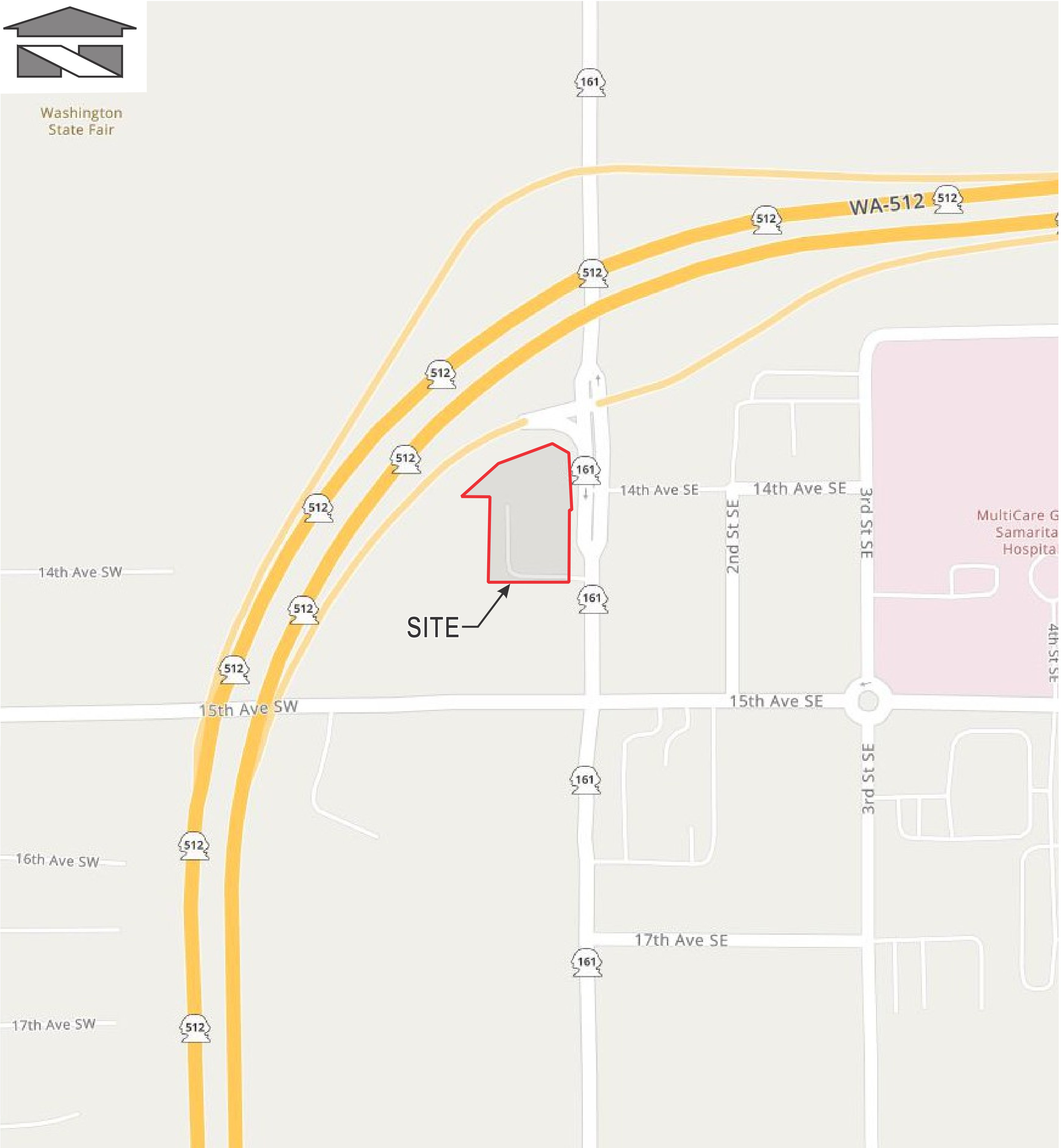
The existing site is primarily developed with a restaurant, asphalt pavement, parking stalls, an empty gravel truck parking area to the north, shrubs, trees, and other landscaping; all existing developments shall be demolished for the proposed development. The overall site topography varies; to the north of the site the slopes are between 0 percent to 3 percent and to the south of the site the slopes are between 2 percent and 14 percent. Per the geotechnical report by Krazan Associates, Inc., Appendix A in this report, stormwater infiltration is not feasible for this site. Additionally, groundwater was encountered at shallow depths.

The project proposes to add a new ARCO ampm convenience store, a fuel canopy with fuel dispensers, USTs, required fuel systems components, an automatic car wash, ADA parking, pavement, drainage, and associated utilities. Based on the Flow Chart for Determining Minimum Requirements for a Redevelopment found in the 2019 Washington State Department of Ecology Surface Water Management Manual for Western Washington (SWMMWW), Figure 1.6, this project is required to meet Minimum Requirements Nos. 1 through 9.

On-site drainage improvements include new catch basins, conveyance structures, proprietary runoff treatment facilities and a detention facility. The proposed detention facility has been designed to meet Flow Control requirements. A water quality facility and oil/water separator will be provided upstream of the detention vault to provide the enhanced treatment and oil control.

Provide a downstream drainage map showing City of Puyallup and WSDOT infrastructure for on-site and off-site flows. The initial qualitative analysis shall extend along the flow path from the project site to the receiving water, for a distance up to one mile. If the receiving water is within one-quarter mile from the project site, the analysis shall extend within the receiving water to one-quarter mile from the project site. The analysis shall extend one-quarter mile beyond any improvements proposed as mitigation. The analysis must extend upstream from the project site to a point where there are no backwater effects created by the project, and the designer can determine all areas contributing run-on to the project [drainage report, pg 6]

Figure 1.1
Vicinity Map



REFERENCE: MapQuest (2022)

Scale: *Horizontal:* ***N.T.S.*** *Vertical:* ***N/A***	*For:* ARCO ampm Puyallup, Washington	Job Number 21730
Barghausen Consulting Engineers, Inc. 18215 72nd Avenue South Kent, WA 98032 425.251.6222 **barghausen.com**	*Title:* VICINITY MAP	DATE: 05/10/22

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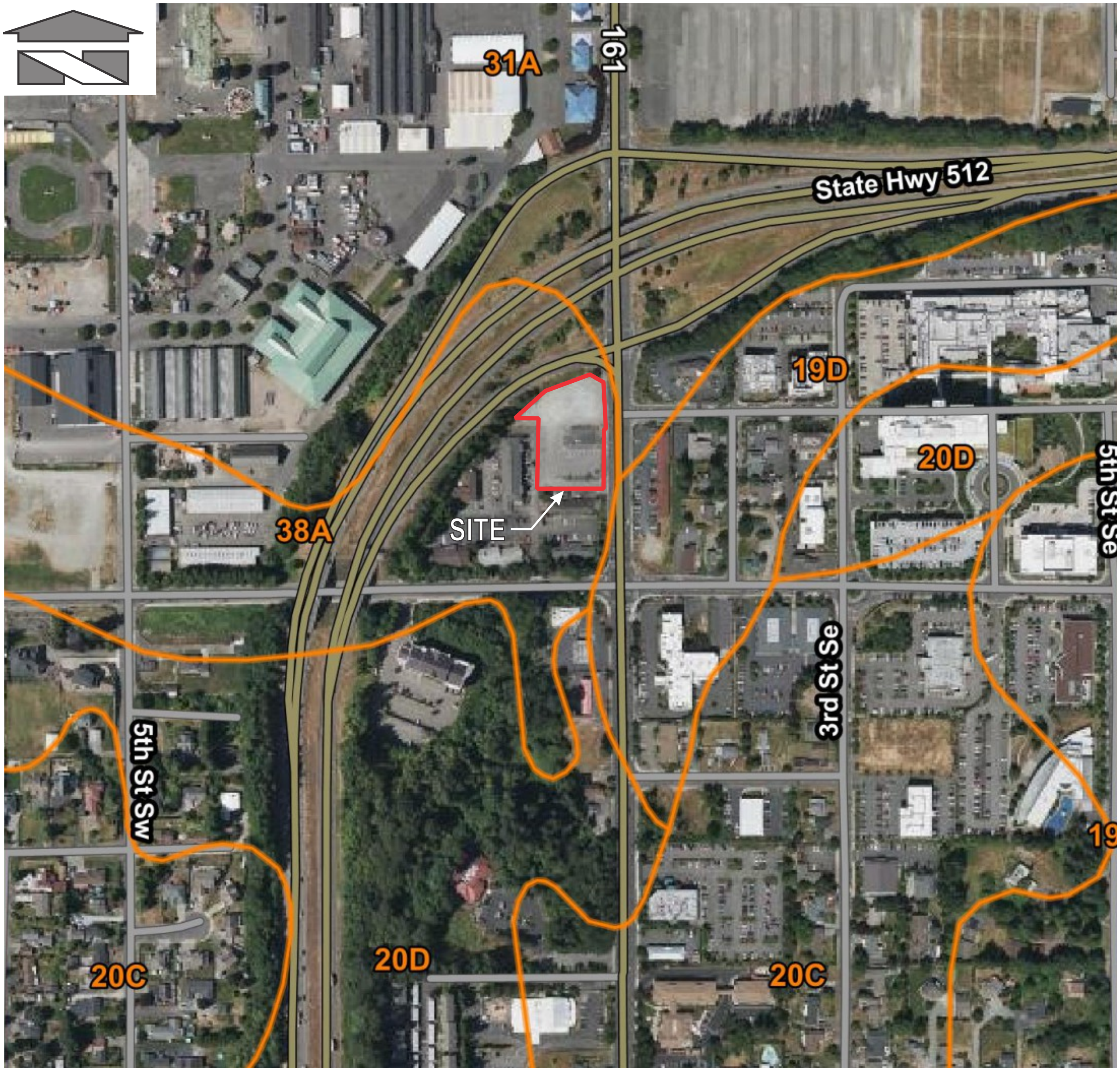
Figure 1.2
Soil Survey Map



REFERENCE: USDA, Natural Resources Conservation Service

LEGEND:	HSG
38A = Shalcar muck	D
31A = Puyallup fine sandy loam	A

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

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ARCO ampm
Puyallup, Washington

Title:
SOIL SURVEY MAP

Job Number
21730

DATE: 05/10/22

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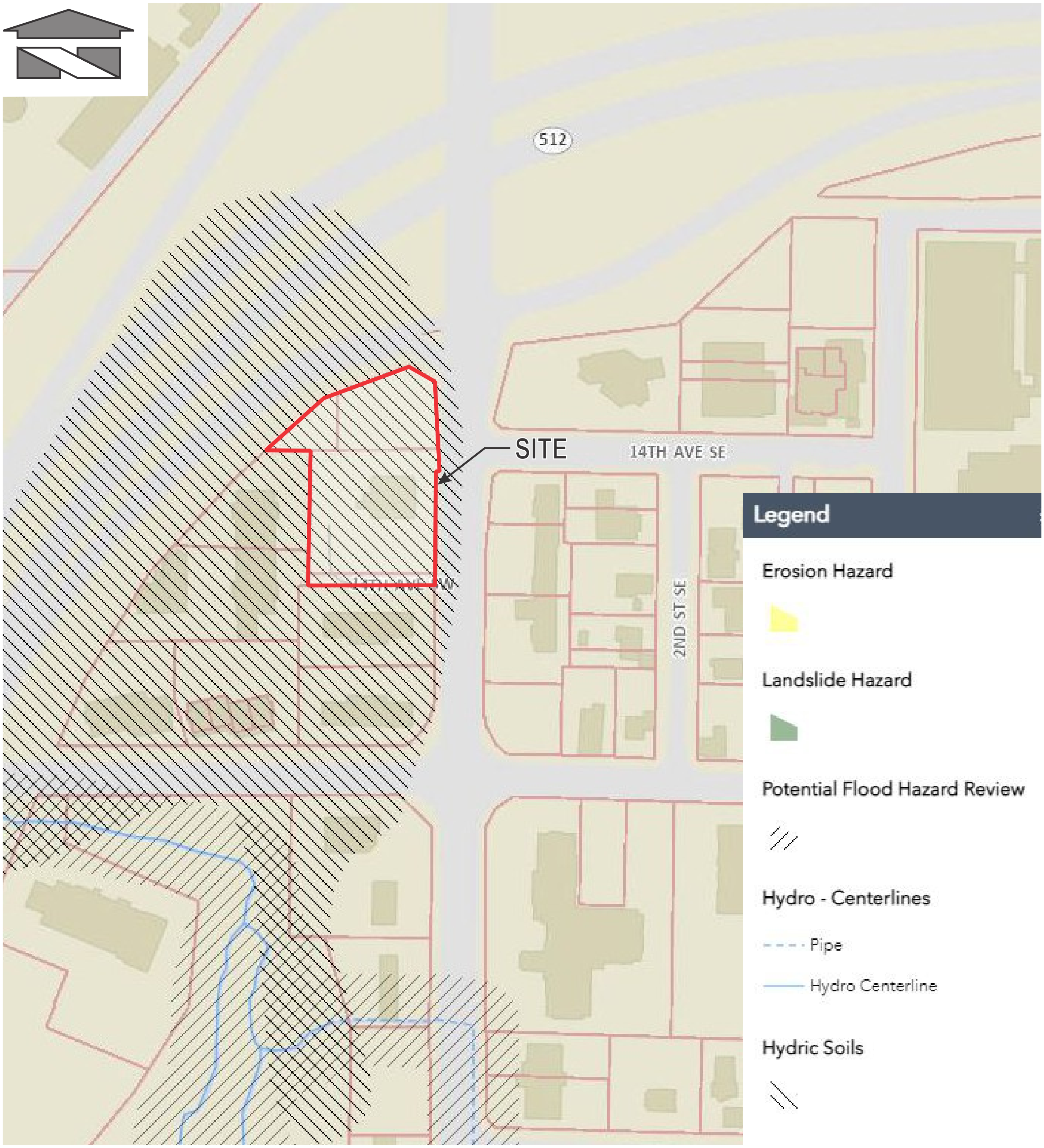
Figure 1.3
Sensitive Areas Map



REFERENCE: Pierce County PublicGIS

Scale: *Horizontal:* ***N.T.S.*** *Vertical:* ***N/A***	*For:* ARCO ampm Puyallup, Washington		Job Number 21730
Barghausen Consulting Engineers, Inc. 18215 72nd Avenue South Kent, WA 98032 425.251.6222 **barghausen.com**	*Title:* SENSITIVE AREAS MAP		DATE: 05/10/22

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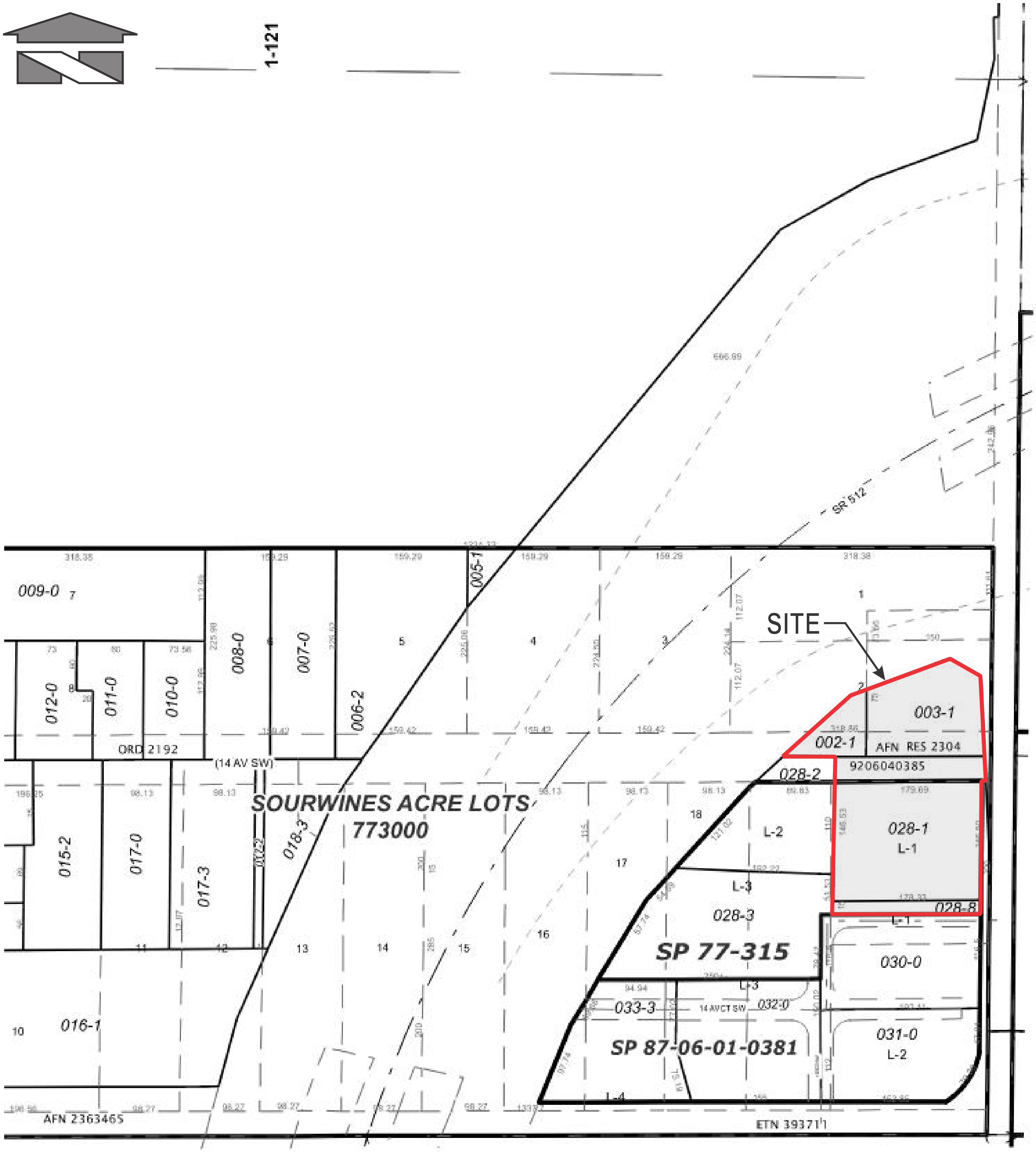
Figure 1.4
Assessor's Map



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

Scale: *Horizontal:* ***N.T.S.*** *Vertical:* ***N/A***	*For:* ARCO ampm Puyallup, Washington	Job Number 21730
Barghausen Consulting Engineers, Inc. 18215 72nd Avenue South Kent, WA 98032 425.251.6222 **barghausen.com**	*Title:* ASSESSOR MAP	DATE: 05/10/22

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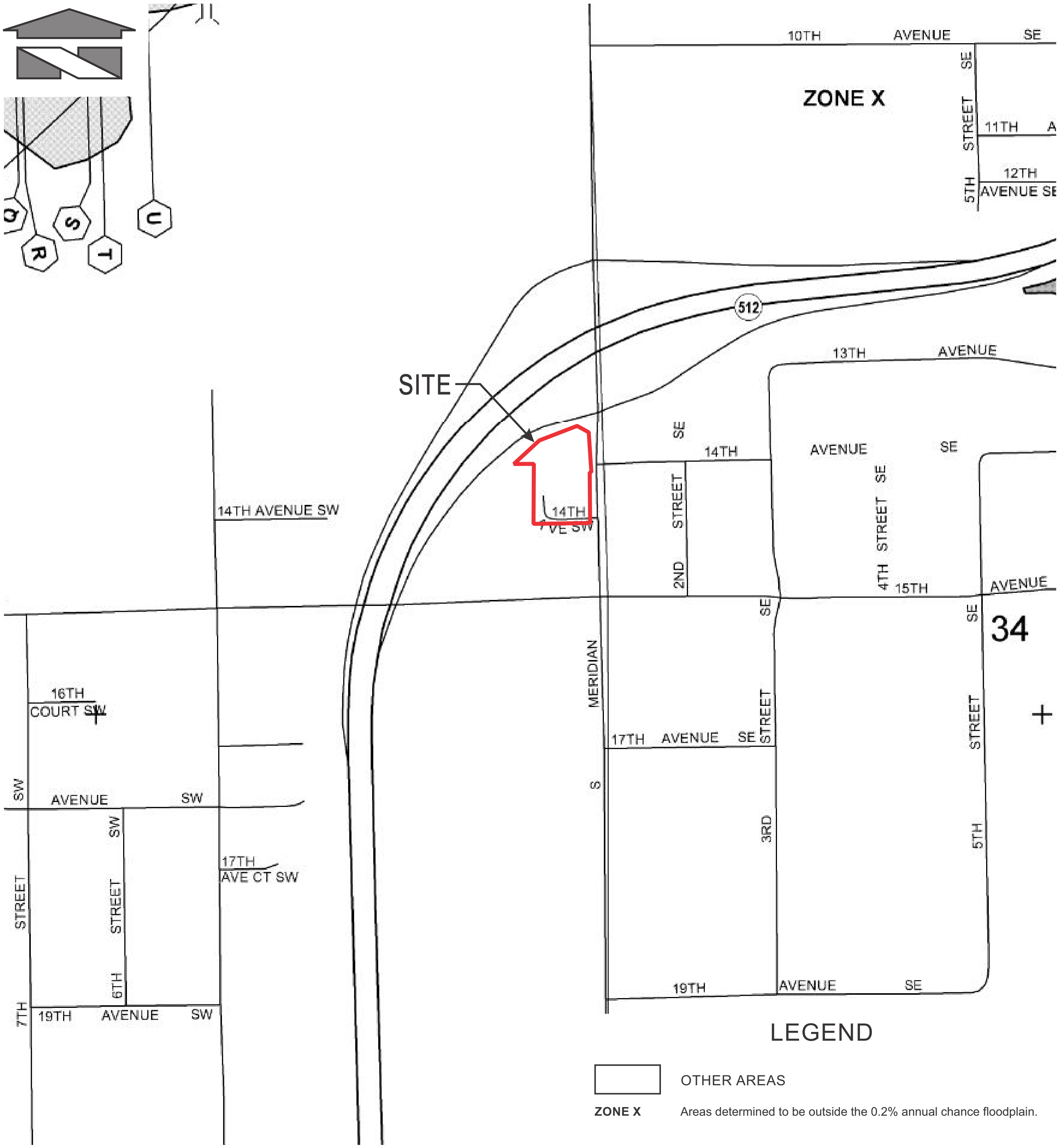
Figure 1.5
FEMA Map



LEGEND

ZONE X	OTHER AREAS Areas determined to be outside the 0.2% annual chance floodplain.

REFERENCE: Federal Emergency Management Agency (Portion of Map 53053C0341E, March 2017)

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

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For:
ARCO ampm
Puyallup, Washington

Title:
FEMA MAP

Job Number
21730

DATE: 05/10/22

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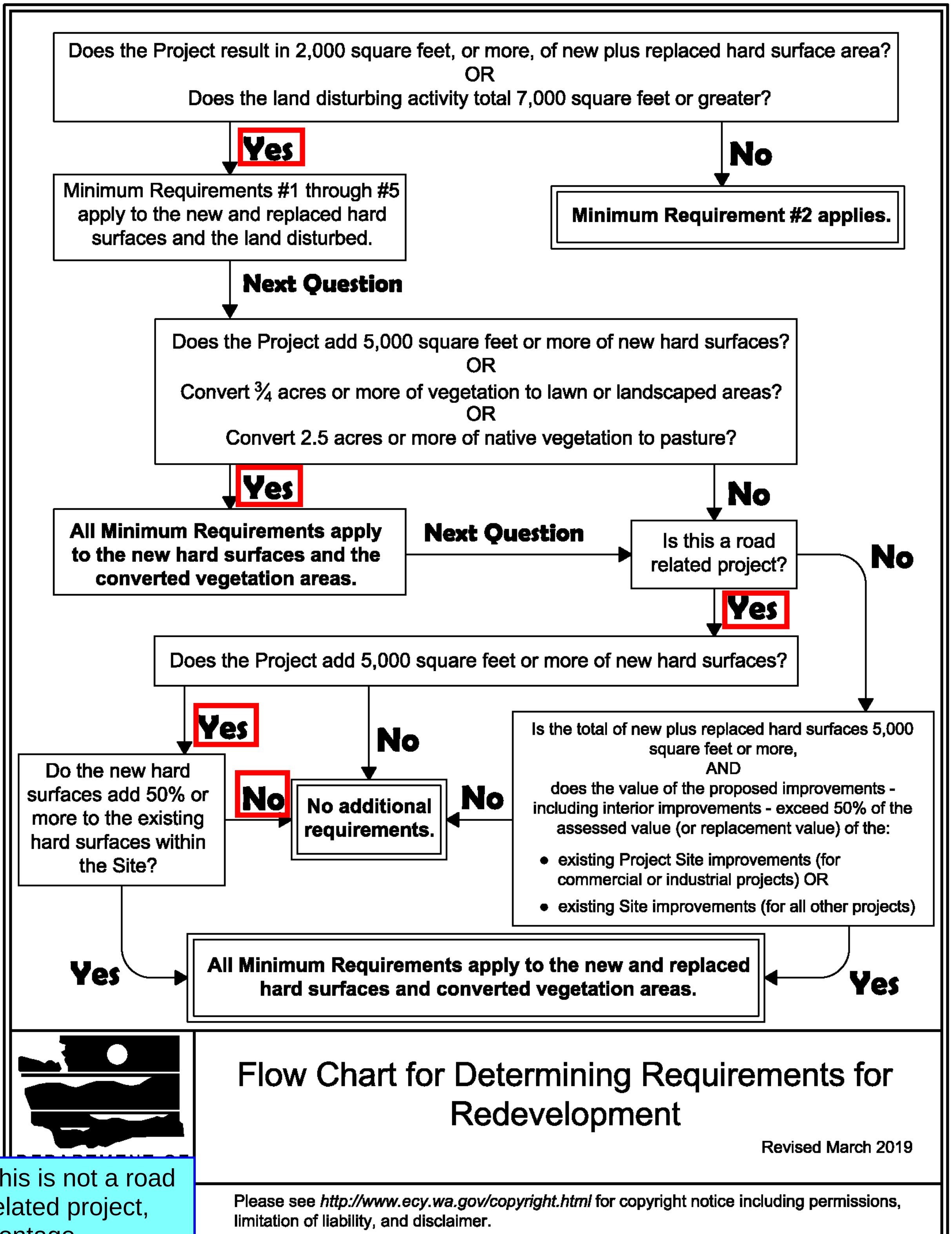
Figure 1.6 Minimum Requirements Flow Chart

Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment



This is not a road related project, frontage improvements are supplemental to the project scope, revise this flow chart. [drainage plans, sheet 18]

Tab 2.0

2.0 CONDITIONS AND REQUIREMENTS SUMMARY

This section contains the following information:

2.1 Analysis of the Minimum Requirements

2.1 Analysis of the Minimum Requirements

MINIMUM REQUIREMENTS	HOW THE PROJECT HAS ADDRESSED THE REQUIREMENT
No. 1: Preparation of the Stormwater Site Plans	This Minimum Requirement has been fulfilled by the preparation and completion of this Stormwater Site Plan.
No. 2: Construction Stormwater Pollution Prevention (SWPP)	A completed Construction Stormwater Pollution Prevention Plan (SWPPP) has been prepared under a separate cover and will be submitted together for the Construction Permit submittal. A Department of Ecology Construction Stormwater Permit will be obtained prior to construction.
No. 3: Source Control of Pollution	The proposed redevelopment will provide appropriate source control measures applicable to the project. The proposed design ensures that the fuel station canopy is hydraulically isolated and is routed to an oil/water separator with a stop valve prior to discharging into the sanitary sewer system. Additionally, water used for the proposed car wash will be collected and routed to a reclaim system prior to discharging into the sanitary sewer system. Solid waste will be stored in dumpsters that have leak proof lids and the enclosure will drain to the sanitary sewer.
No. 4: Preservation of Natural Drainage Systems and Outfalls	The proposed redevelopment will preserve the natural drainage system and discharges from the project site shall occur at the natural location. The proposed detention facility shall be designed so that stormwater discharge will not cause a significant adverse impact to downstream receiving waters and downgradient properties.
No. 5: On-site Stormwater Management	As required by the 2019 SWMMWW, On-Site Stormwater Management is required where is feasible based on on-site conditions. This project triggers Minimum Requirements Nos. 1 through 9 and is defined as a redevelopment on a parcel inside the UGA; therefore, this project must either apply the Low Impacted Development Performance Standard and BMP T5.13: Post Construction Soil Quality and Depth; or evaluate the feasibility of the BMPs in List No. 2. This project will choose to evaluate the feasibility of BMPs from List No. 2 and apply them to the maximum extent feasible; however, it appears that all on-site stormwater management BMPs for proposed impervious surfaces are infeasible for this site.
No. 6: Runoff Treatment	The proposed redevelopment will trigger enhanced Treatment requirements for all pollution-generating surfaces. See the Runoff Treatment Flow Chart, Figure 5.2.2, in this report for additional detail. Enhanced Treatment will be provided for the pollution-generating hard surfaces via a modular wetland unit. Additionally, this site is classified as a high-use site and will provide oil control. See Section 5.6 for further information.

No. 7: Flow Control	This project proposes more than 10,000 square feet of new and replaced hard surface and must provide flow control. A detention facility has been sized with WHHM2012 to match developed discharge durations to predeveloped durations for the range of predeveloped discharge rates from 50 percent of the two-year recurrence interval peak flow up to the full 50-year peak flow. The detention facility will discharge to the existing on-site stormwater main which ultimately drains to Clark's Creek. See Section 5.5 for further information.
No. 8: Wetlands Protection	There are no documented wetlands recorded on-site.
No. 9: Operation and Maintenance	The drainage facility for this project will be a private facility, owned and maintained by the property owner. An Operation and Maintenance Manual may be provided in Section 9.0 of this Stormwater Site Plan if requested by the City.

Provide an analysis discussing the potential of two threshold discharge areas. After further research, the on-site and off-site area's appear to have separate discharge areas. The on-site project discharges across SR 512 to the west, whereas Meridian is collected by WSDOT's stormwater infrastructure and traverses NE along SR 512. If the project has two threshold discharge areas, the areas within Meridian do not need to be included in the flow control WWHM model. [drainage report, pg 22]

Tab 3.0

3.0 EXISTING CONDITIONS SUMMARY

The site consists of four parcels, which together consist of a total area of 1.20 acres. Those four parcels are Parcel Nos. 773000-028-1, 773000-028-8, 773000-003-1, and 773000-002-1. Currently, the existing site is primarily developed with a restaurant, asphalt pavement, parking stalls, an empty gravel truck parking area to the north, shrubs, trees, and other landscaping.

See Figure 5.1.1 for the Existing Condition Map that is included in this report for additional detail.

The overall site topography varies, to the north of the site the slopes are between 0 percent to 3 percent and to the south of the site the slopes are between 2 percent and 14 percent. The site receives an incidental amount of drainage from adjacent properties. There are several existing storm drainage systems found on-site which collect and convey runoff from the roof and paved areas into the existing public stormwater infrastructure. Existing stormwater is collected by on-site catch basins and routed to the storm conveyance pipe that passes through the northern half of the site.

The project is not located within the 100-year floodplain and no wetlands are known on-site or nearby. The project site is within the Clark's Creek basin.

Per the geotechnical report by Krazan & Associates, Inc., the soils encountered on-site generally consisted of poorly graded sand (SP-SM) with silt at a depth of 0.0 to 2.0 feet below ground surface (bgs), bluish grey sand (SP-SM) with silt that was very loose at a depth of 2.0 to 2.5 feet bgs, organic silt (OH, Shalcar Muck) that was very soft at a depth of 2.5 to 4.0 feet bgs, and very loose to medium dense sand with varying silt content at a depth of 4.0 to 46.3 feet bgs. Shallow groundwater was encountered in the test pits.

Tab 4.0

4.0 OFF-SITE ANALYSIS REPORT

The immediate upstream basin of the site consists of properties to the south and west, and S. Meridian Street to the east. Runoff from these upstream properties collects into existing catch basins and conveyance systems found within each individual property. Runoff from S. Meridian Street appears to collect into existing conveyance systems within S. Meridian Street. It is not anticipated that runoff from the proposed development will contribute a negative impact on upstream properties.

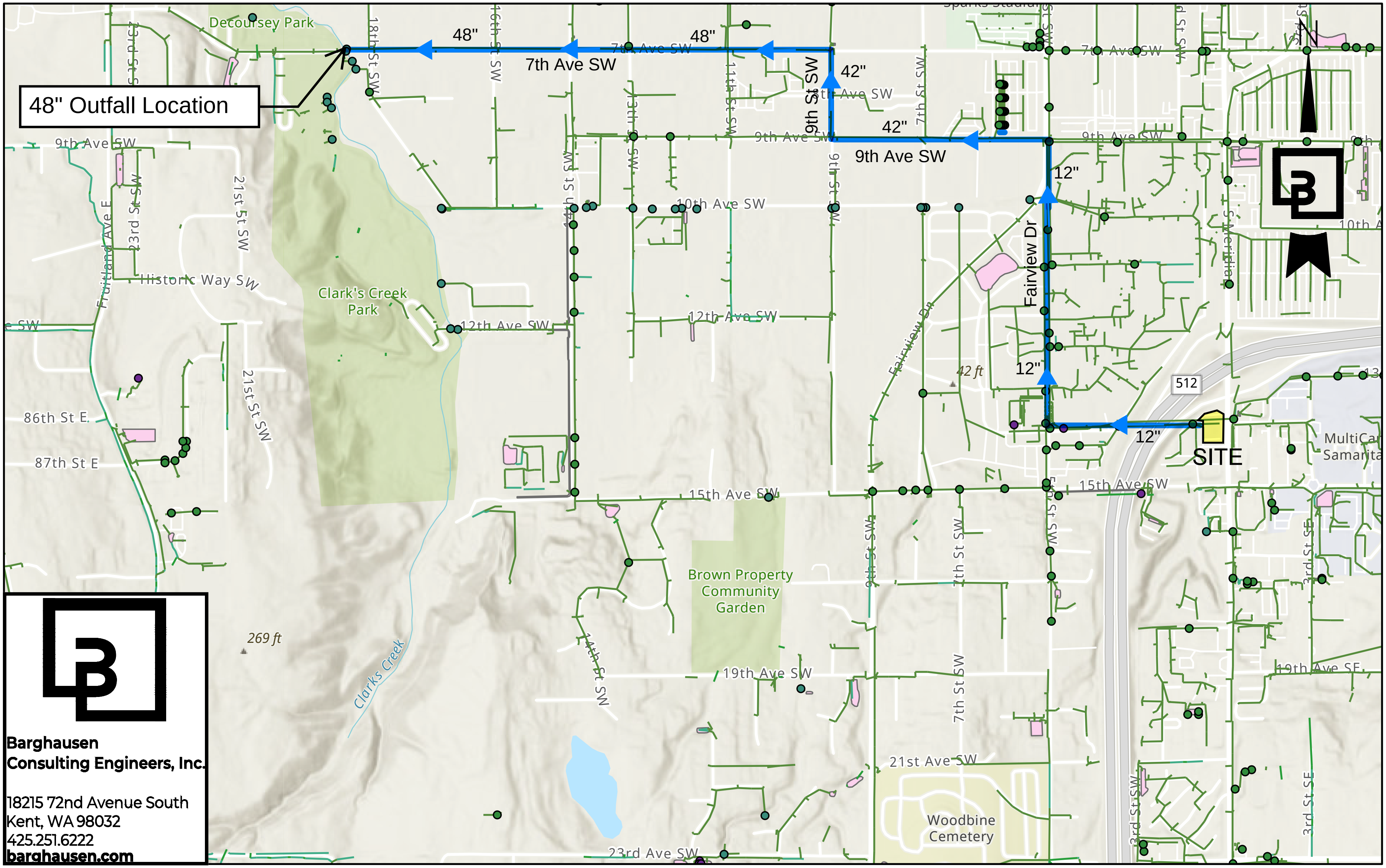
The immediate downstream basin of the site appears to be confined to S. Meridian Street and an existing ditch found just north of the site. Runoff from the existing ditch and S. Meridian Street shall be collected into catch basins and conveyed northwest. The stormwater within this conveyance system ultimately discharges to Clark's Creek. A downstream analysis map detailing the route between our site to Clark's Creek has been included as Figure 4.1.

This project will detain stormwater runoff to the maximum extent feasible to meet the flow control standards specified in MR No. 7. Additionally, this project will provide enhanced stormwater quality treatment; this project is not anticipated to create a negative impact on the downstream basin or receiving freshwater bodies.

Figure 4.1
Assessor Map

ARCO Puyallup Downstream Analysis

BCE #21730



10/4/2023

Outfalls
Control Structures
Pipes
Facilities
Manholes
Culverts
Channels
World Hillshade
12"- 48" Storm Pipe

1:18,056

0 0.1 0.2 0.4 mi

0 0.15 0.3 0.6 km

Esri, NASA, NGA, USGS, FEMA, Esri Community Maps Contributors, King County, WA State Parks GIS, Esri, HERE, Garmin, SafeGraph,

Image generated using City of Puyallup's ArcGIS Online Map
https://www.arcgis.com/home/item.html?id=7b66b03ac6ca459d9ec9c4672a6b8697 (Accessed 10/4/2023)

Tab 5.0

5.0 PERMANENT STORMWATER CONTROL PLAN

This section contains the following information:

5.1 Existing Site Hydrology

5.2 Developed Site Hydrology

5.3 Performance Standards and Goals

5.4 Low Impact Development Features

5.5 Flow Control System

5.6 Water Quality System

5.7 Conveyance System Analysis and Design

5.1 Existing Site Hydrology

Predeveloped Basins

See Figure 5.1.1 for the existing condition map and table with the predeveloped basin tributary areas and calculations.

The existing 1.20-acre site consists of soils that are classified as Shalcar muck according to the National Cooperative Soil Survey by the USDA Natural Resources Conservation Service. The overall site topography varies, to the north of the site the slopes are between 0 percent to 3 percent and to the south of the site the slopes are between 2 percent and 14 percent.

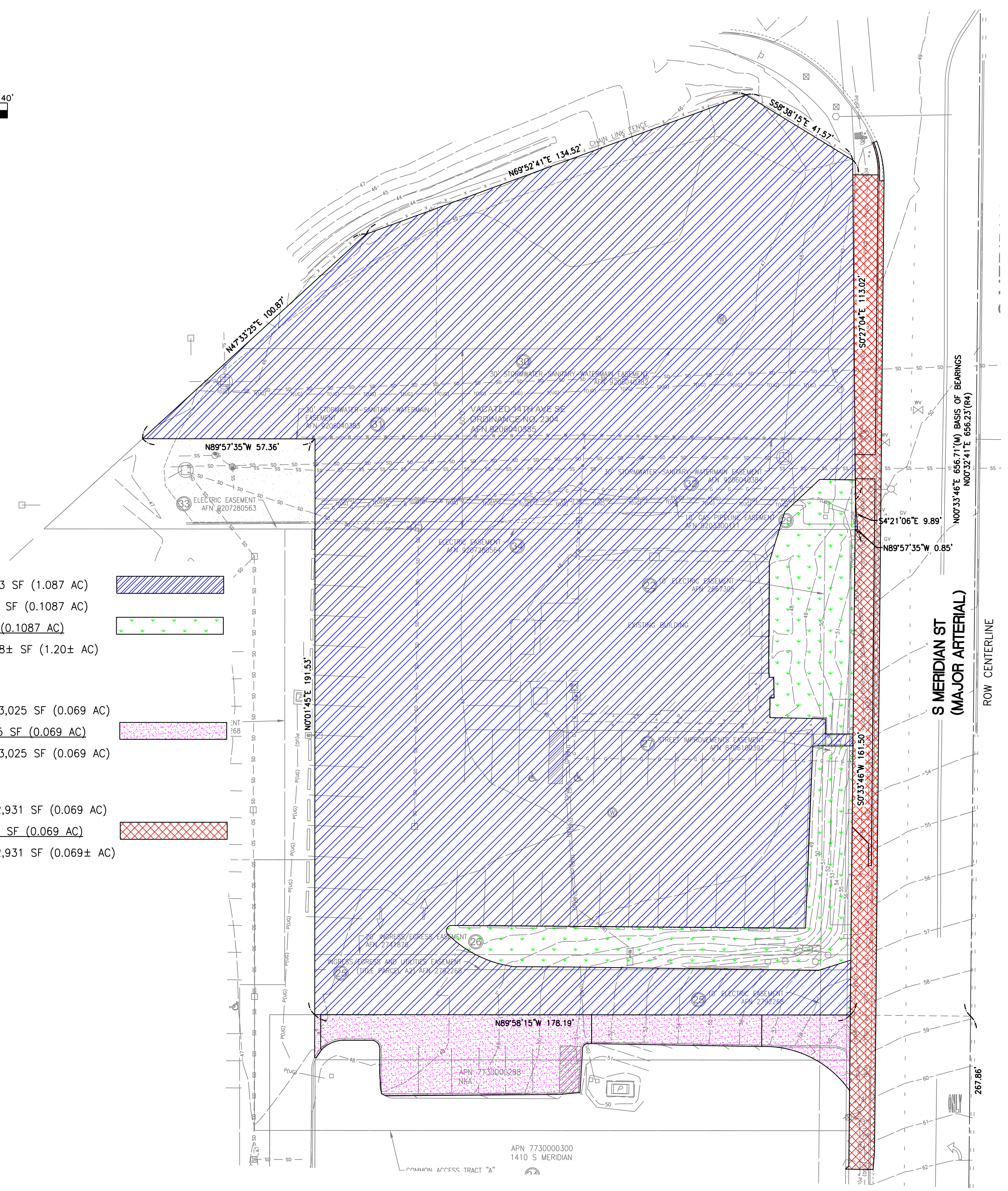
There are several existing storm drainage systems found on-site which collect and convey runoff from the roof and paved areas into the existing public stormwater infrastructure. Runoff from the north gravel area sheet flows north into an off-site ditch found within the right-of-way.

Figure 5.1.1 Existing Condition Map

EXISTING CONDITION MAP

N

0 10' 20' 40'
SCALE: 1"=20'



PROJECT GROUND COVER

ON-SITE

EXISTING IMPERVIOUS SURFACES	47,343 SF (1.087 AC)	
EXISTING PERVIOUS AREA	4,735 SF (0.1087 AC)	
EXISTING LANDSCAPING	4,735 SF (0.1087 AC)	
TOTAL AREA	52,078± SF (1.20± AC)	

OFFSITE (NOT RIGHT-OF-WAY)

EXISTING IMPERVIOUS SURFACES	3,025 SF (0.069 AC)	
ASPHALT DRIVEWAY SECTION	3,025 SF (0.069 AC)	
TOTAL AREA	3,025 SF (0.069 AC)	

RIGHT-OF-WAY

EXISTING IMPERVIOUS SURFACES	2,931 SF (0.069 AC)	
ROADWAY/SIDEWALK/CURB & GUTTER	2,931 SF (0.069 AC)	
TOTAL AREA	2,931 SF (0.069± AC)	

Preliminary Not For Construction

Know what's below. Call before you dig. Dial 811

CLIENT:

bp

ARCO

BP WEST COAST PRODUCTS, LLC

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

NO.	DATE	REVISION DESCRIPTION
1		
2		
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7		
8		
9		
10		
11		
12		

SEAL:

ALEX WHITE
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER

Not for Construction

DEVELOPMENT INFORMATION:

ARCO NTI
3400 am/pm
FUEL CANOPY w/ 8 MPD's

SITE ADDRESS:

SWC S MERIDIAN
@ HIGHWAY 512
PUYALLUP, WASHINGTON

FACILITY #TBD

DESIGNED BY:	ALLIANCE Z&OM:
CHECKED BY:	BP REPM:
DRAWN BY: AMJ	ALLIANCE PM:
VERSION: -	PROJECT NO: 21730

DRAWING TITLE:
EXISTING CONDITION MAP

SHEET NO:
1 OF 1

5.2 Developed Site Hydrology

Developed Basins

See Figure 5.2.1 for the developed basin map which contains a table with the developed basin tributary areas and calculations.

In the developed condition, the site will contain a new ARCO ampm convenience store, a fuel canopy with fuel dispensers, two USTs, required fuel systems components, an automatic car wash, ADA parking, pavement, a detention facility, drainage, and associated utilities. Catch basins and an underground pipe conveyance system will be installed to convey stormwater runoff from the developed site to the proposed on-site detention facility.

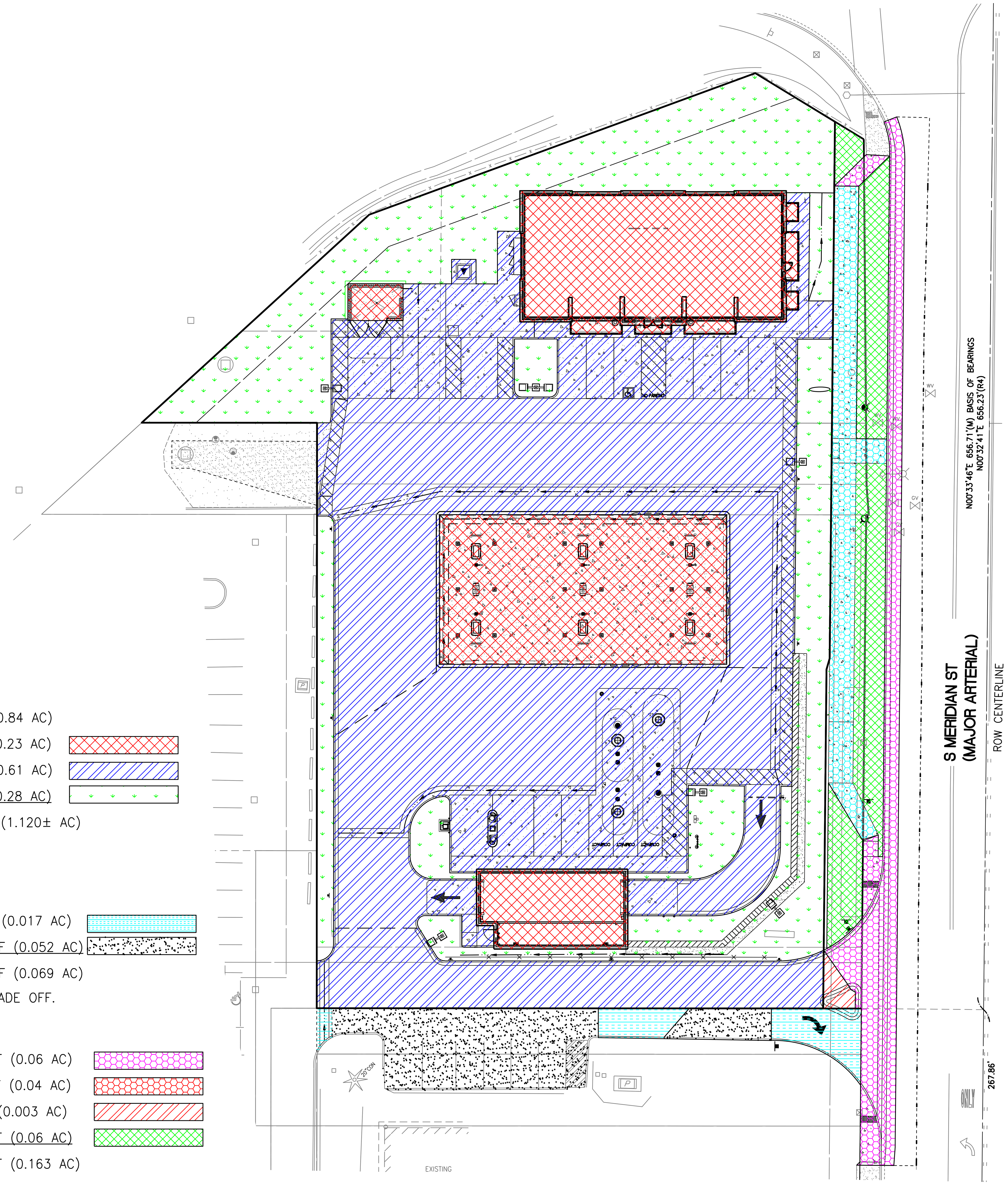
A detention facility has been sized with WWHM and will provide the required Flow Control requirements; see Section 5.5 of this report.

A modular wetland unit, sized using the water quality flow rates from WWHM, has been proposed upstream of the detention facility to provide treatment for the pollution-generating hard surfaces; see Section 5.6 of this report.

The proposed drainage design shall meet the required flow control and water quality per the 2019 SWMMWW.

Figure 5.2.1
Developed Basin Map

DEVELOPED BASIN MAP



N

SCALE: 1"=20'

It appears that S Meridian flows into WSDOT's storm system, whereas the on-site runoff crosses SR 512 to the west to Clark's creek. Provide a downstream basin map and determine if these are two separate discharge basins, if so a bypass basin and flow control trade would not be warranted. [drainage report, pg 36]

PROJECT GROUND COVER

ON-SITE (AFTER DEDICATION)

PROPOSED IMPERVIOUS SURFACES	36,774 SF (0.84 AC)	
ROOF CANOPY (COLLECTED)	10,106 SF (0.23 AC)	
CURBS/ASPHALT/CONCRETE (COLLECTED)	26,668 SF (0.61 AC)	
PROPOSED LANDSCAPING	12,002 SF (0.28 AC)	
TOTAL AREA	48,776± SF (1.120± AC)	

OFFSITE (ADJACENT PROPERTY)

REPLACED ASPHALT DRIVEWAY SECTION (COLLECTED)	741 SF (0.017 AC)
EXISTING IMPERVIOUS SURFACE (COLLECTED, BYPASS TRADE-OFF)	2,284 SF (0.052 AC)
TOTAL AREA	3,025 SF (0.069 AC)

NOTE: WWHM CALCS ONLY INCLUDE AREA REQUIRED TO PROVIDE BYPASS TRADE OFF.

RIGHT-OF-WAY (AFTER DEDICATION)

ROADWAY/SIDEWALK/CURB & GUTTER (BYPASS)	2,567 SF (0.06 AC)
REVERSE SLOPE SIDEWALK (COLLECTED)	1,768 SF (0.04 AC)
DRIVEWAY (COLLECTED)	123 SF (0.003 AC)
PROPOSED LANDSCAPE	2,624 SF (0.06 AC)
TOTAL AREA	7,082 SF (0.163 AC)

Preliminary Not For Construction

CLIENT: bp

ARCO
BP WEST COAST PRODUCTS, LLC

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

NO.	DATE	REVISION DESCRIPTION
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SEAL: ALEX WHITE, STATE OF WASHINGTON, REGISTERED PROFESSIONAL ENGINEER — Not for Construction

DEVELOPMENT INFORMATION:
ARCO NTI
3400 am/pm
FUEL CANOPY w/ 8 MPD's

SITE ADDRESS:
SWC S MERIDIAN
@ HIGHWAY 512
PUYALLUP, WASHINGTON

FACILITY #TBD

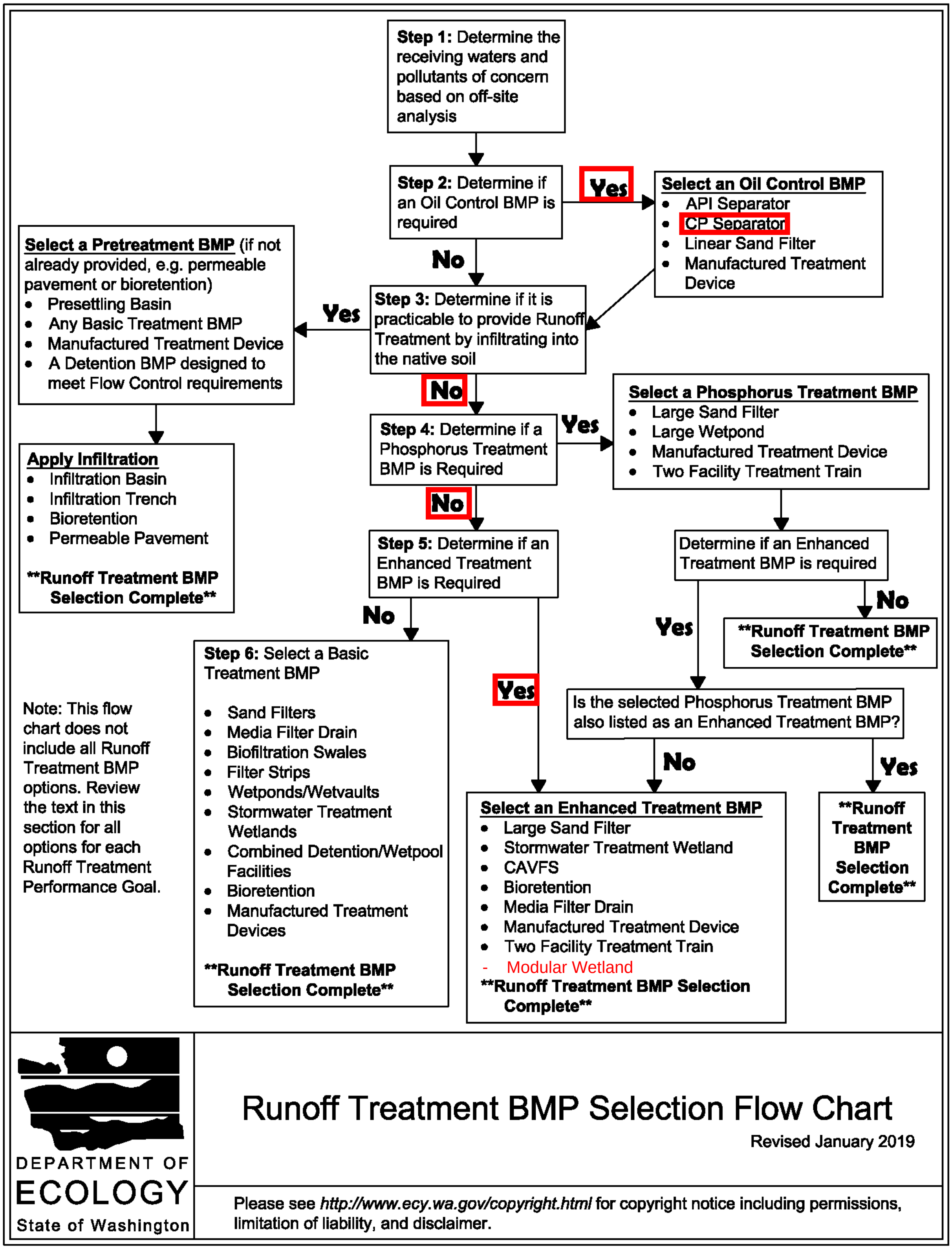
DESIGNED BY:	ALLIANCE Z&DM:
CHECKED BY:	BP REPM:
DRAWN BY: AMJ	ALLIANCE PM:
VERSION: -	PROJECT NO: 21730

DRAWING TITLE: DEVELOPED BASIN MAP

SHEET NO: 1 OF 2

Figure 5.2.2 Drainage Facility – Runoff Treatment Facility Selection Flow Chart

Figure III-1.1: Runoff Treatment BMP Selection Flow Chart



5.3 Performance Standards and Goals

This project is required to meet Flow Control and Water Quality Treatment Standards per the 2019 Stormwater Management Manual for Western Washington. The following is a full discussion of how this project intends to meet the required performance objectives.

5.4 Low Impact Development Features

Please see Figure 5.4.1; this project triggers Minimum Requirements Nos. 1 through 9 and must either use on-site stormwater management BMPs from List No. 2 or demonstrate compliance with the LID Performance Standard and BMP T5.13. This project will choose to evaluate the feasibility of on-site stormwater management BMPs from List No. 2.

Lawn and Landscaped Areas

1. Soil preservation and Amendment BMP in Volume III, Section 3.1.

   Feasible: Post Construction Soil Quality and Depth in accordance with BMP T5.13 in Chapter 5 Volume V of the SWMMWW will be applied to all proposed landscaping areas.

Roofs:

1. Full Dispersion in accordance with BMP T5.30 in Chapter 5 of Volume V of the SWMMWW, or Downspout Full Infiltration Systems in accordance with BMP T5.10A in Section 3.1.1 of Volume III of the SWMMWW.

   Infeasible: This project will not preserve 65 percent of the site area as forest or native vegetation. Additionally, infiltration is infeasible due to the infeasibility of on-site infiltration per the Geotechnical Investigation prepared by Krazan & Associates, Inc.

2. Bioretention (See Chapter 7 of Volume V of the SWMMWW) facilities that have a minimum horizontally projected surface area below the overflow, which is at least 5 percent of the total surface area draining to it.

   Infeasible: Bioretention is infeasible due to the infeasibility of on-site infiltration per the Geotechnical Investigation prepared by Krazan & Associates, Inc.

3. Downspout Dispersion Systems in accordance with BMP T5.10B in Section 3.1.2, Volume III, of the SWMMWW.

   Infeasible: Downspout dispersion systems are infeasible due to the lack of available vegetated area and flow path space.

4. Perforated Stub-out Connections in accordance with BMP T5.10C in Section 3.1.3, Volume III, of the SWMMWW.

   Infeasible: Perforated Stub-out Connections are infeasible. All rooftop runoff is proposed to be collected and discharged to a stormwater detention facility designed to meet Minimum Requirement No. 7 of Flow Control Requirements.

Other Hard Surfaces:

1. Full Dispersion in accordance with BMP T5.30 in Chapter, Volume V, of the SWMMWW.

   Infeasible: This project will not preserve 65 percent of the site area as forest or native vegetation.

2. Permeable Pavement No. 2 is in accordance with BMP T5.15 in Chapter 5, Volume V, of the SWMMWW.

Infeasible: This site is defined as high use, and, therefore, does not require the evaluation of permeable pavement. Additionally, on-site infiltration is infeasible per the Geotechnical Investigation prepared by Krazan & Associates, Inc.

3. Bioretention (See Chapter 7, Volume V of the SWMMWW) facilities that have a minimum horizontally projected surface area below the overflow which is at least 5 percent of the total surface area draining to it.

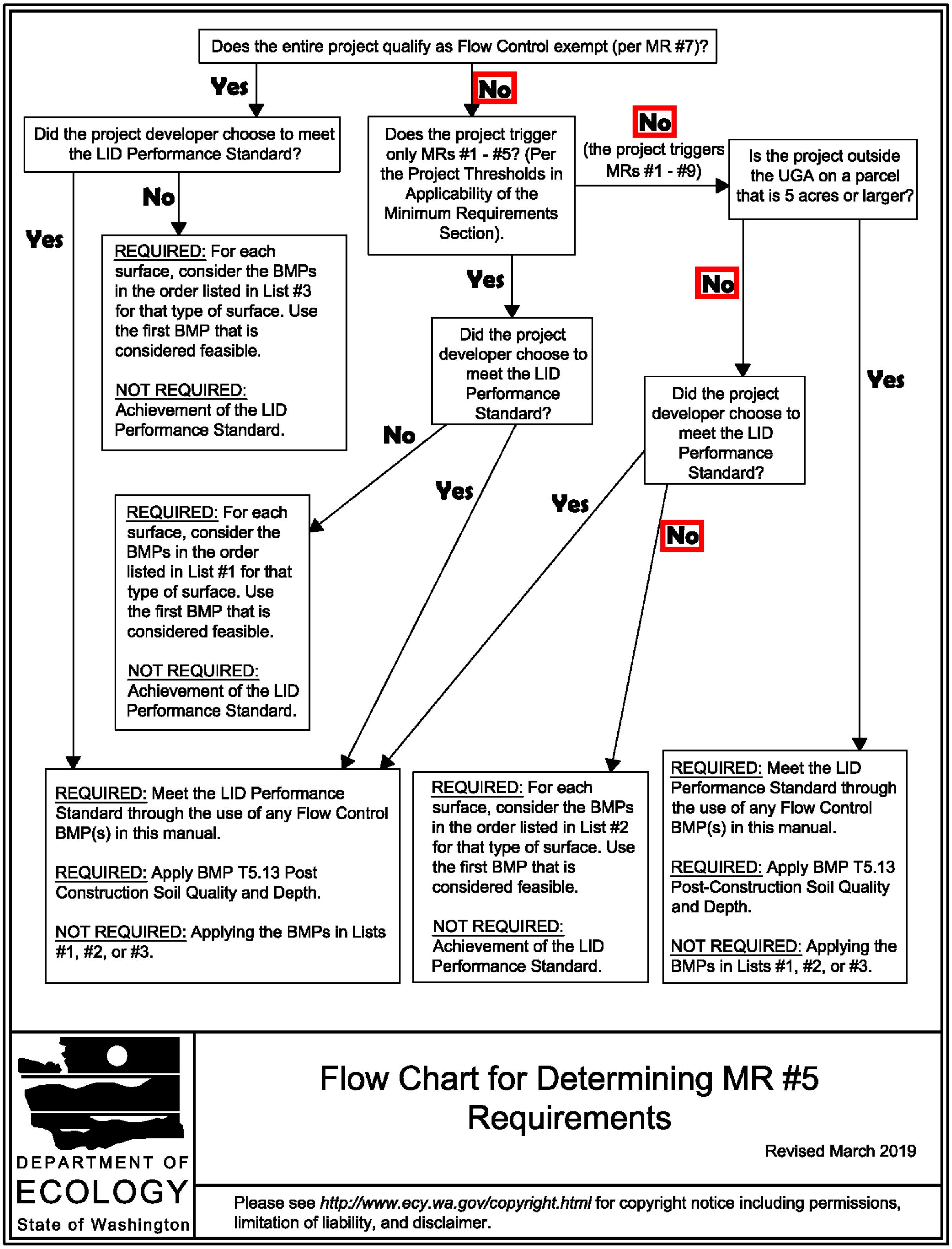
   Infeasible: Bioretention is infeasible due to the infeasibility of on-site infiltration per the Geotechnical Investigation prepared by Krazan & Associates, Inc.

4. Sheet Flow Dispersion in accordance with BMP T5.12, or Concentrated Flow Dispersion in accordance with BMP T5.11 in Chapter 5, Volume V, of the SWMMWW.

   Infeasible: The site lacks the available vegetated flow path space for sheet flow dispersion per BMP T5.12, or concentrated flow dispersion per BMP T5.11.

Figure 5.4.1 Flow Chart for Determining MR No. 5 Requirements

Figure I-3.3: Flow Chart for Determining MR #5 Requirements



5.5 Flow Control System

This project proposes greater than 10,000 square feet of new and replaced impervious surfaces; flow control must be provided so that post development stormwater discharge rates will match durations for the range of pre-developed discharge rates from 50 percent of the two-year recurrence interval peak flow up to the full 50-year peak flow. The pre-developed condition to be matched has been modeled as forested land cover.

This project proposes the use of a detention facility to provide flow control for the site. Per the 2019 DOE SWMMWW, the project proponent is allowed to provide Stormwater Management BMPs for an equivalent (flow and pollution characteristics) area. The project proposes to collect existing off-site non-replaced hard surfaces with an equivalent area to the replaced impervious bypass area that will not be collected. The collected existing off-site non-replaced impervious surfaces will have similar flow and pollution characteristics to the replaced impervious bypass area. The detention facility will collect runoff and shall detain and discharge runoff into the public stormwater infrastructure at rates that meet Flow Control standards. Please see Figures 5.2.1 and 5.5.1 for the WWHM Basin Map and the WWHM Model report, respectively. The proposed detention facility shall be routed to a catch basin prior to discharging via gravity into Clark's Creek.

Figure 5.5.1 WWHM Calculations and Detention Facility Sizing

WWHM2012

PROJECT REPORT

WWHM Modeling Report
for the Detention Facility

General Model Information

WWHM2012 Project Name: 21730-Flow Control-2024-1-12

Site Name:	ARCO
Site Address:	
City:	PUYALLUP
Report Date:	1/12/2024
Gage:	42 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/01/27
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

ON-SITE

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.84
Pervious Total	0.84
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.84

Per the current Figure I-3.2, all minimum requirements apply to the new hard surfaces and converted vegetation areas, this is not a road related project such that the flow chart must be re-evaluated. [drainage report, pg 48]

Flow Control Performance Standard

Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. The pre-developed condition to be matched shall be a forested land cover unless:

- Reasonable, historic information is provided that indicates the site was prairie prior to settlement (modeled as pasture in the approved continuous simulation model); or,
- The drainage area of the immediate stream and all subsequent downstream basins have had at least 40% total impervious area (TIA) since 1985. In this case, the pre-developed condition to be matched shall be the existing land cover condition. Figure I-3.4: Basins with 40% Total Impervious Area as of 1985 depicts those areas which meet this criterion. Where basin-specific studies determine a stream channel to be unstable, even though the above criterion is met, the pre-developed condition assumption shall be the "historic" land cover condition, or a land cover condition commensurate with achieving a target flow regime identified by an approved basin study.

The text in this box originates from one or more of the following Permits:
Appendix 1 of the Phase I / Phase II Municipal Stormwater Permits
Construction Stormwater General Permit

The existing impervious area shown within the existing conditions map is 1.087 acres rather than the shown 0.84 acres. Revise accordingly in combination with the other markup on this page. [drainage report, pg 48]

ROW

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.103
Pervious Total	0.103
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.103

The existing basin map states in the existing conditions there is 0.069 acres of land coverage, what is the 0.103 acres representing within the WWHM calculation? [drainage report, pg 49]

OFFSITE

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.017
Pervious Total	0.017
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.017

The existing basin map states in the existing conditions there is 0.069 acres of land coverage, what is the 0.017 acres representing within the WWHM calculation? [drainage report, pg 49]

Mitigated Land Use

ON-SITE

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.61
ROOF TOPS FLAT	0.23
Impervious Total	0.84
Basin Total	0.84

Include 0.28 acres of proposed landscaping. [drainage report, pg 51].

ROW-COLLECTED

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.043
Impervious Total	0.043
Basin Total	0.043

OFF-SITE-COLLECTED

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.069
Impervious Total	0.069
Basin Total	0.069

BY-PASS

Bypass:	Yes
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.008
Impervious Total	0.008
Basin Total	0.008

Routing Elements
Predeveloped Routing

Mitigated Routing

Vault 1

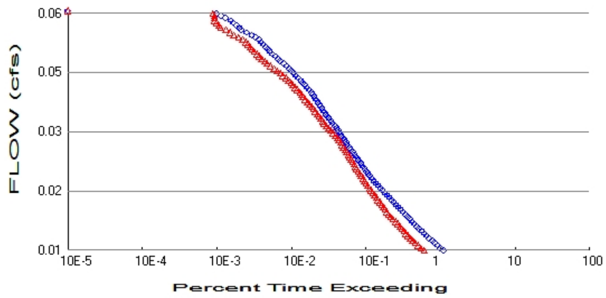
Width:	72 ft.
Length:	72 ft.
Depth:	5.6 ft.
Discharge Structure	
Riser Height:	5.1 ft.
Riser Diameter:	12 in.
Notch Type:	Rectangular
Notch Width:	0.010 ft.
Notch Height:	1.360 ft.
Orifice 1 Diameter:	0.446 in. Elevation:0 ft.
Element Flows To:	
Outlet 1	Outlet 2

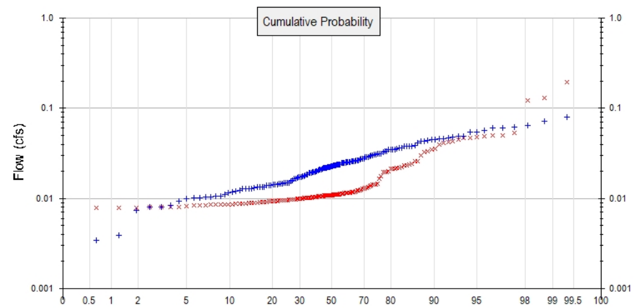
Vault Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.119	0.000	0.000	0.000
0.0622	0.119	0.007	0.001	0.000
0.1244	0.119	0.014	0.001	0.000
0.1867	0.119	0.022	0.002	0.000
0.2489	0.119	0.029	0.002	0.000
0.3111	0.119	0.037	0.003	0.000
0.3733	0.119	0.044	0.003	0.000
0.4356	0.119	0.051	0.003	0.000
0.4978	0.119	0.059	0.003	0.000
0.5600	0.119	0.066	0.004	0.000
0.6222	0.119	0.074	0.004	0.000
0.6844	0.119	0.081	0.004	0.000
0.7467	0.119	0.088	0.004	0.000
0.8089	0.119	0.096	0.004	0.000
0.8711	0.119	0.103	0.005	0.000
0.9333	0.119	0.111	0.005	0.000
0.9956	0.119	0.118	0.005	0.000
1.0578	0.119	0.125	0.005	0.000
1.1200	0.119	0.133	0.005	0.000
1.1822	0.119	0.140	0.005	0.000
1.2444	0.119	0.148	0.006	0.000
1.3067	0.119	0.155	0.006	0.000
1.3689	0.119	0.162	0.006	0.000
1.4311	0.119	0.170	0.006	0.000
1.4933	0.119	0.177	0.006	0.000
1.5556	0.119	0.185	0.006	0.000
1.6178	0.119	0.192	0.006	0.000
1.6800	0.119	0.199	0.007	0.000
1.7422	0.119	0.207	0.007	0.000
1.8044	0.119	0.214	0.007	0.000
1.8667	0.119	0.222	0.007	0.000
1.9289	0.119	0.229	0.007	0.000
1.9911	0.119	0.237	0.007	0.000
2.0533	0.119	0.244	0.007	0.000
2.1156	0.119	0.251	0.007	0.000
2.1778	0.119	0.259	0.008	0.000
2.2400	0.119	0.266	0.008	0.000

2.3022	0.119	0.274	0.008	0.000
2.3644	0.119	0.281	0.008	0.000
2.4267	0.119	0.288	0.008	0.000
2.4889	0.119	0.296	0.008	0.000
2.5511	0.119	0.303	0.008	0.000
2.6133	0.119	0.311	0.008	0.000
2.6756	0.119	0.318	0.008	0.000
2.7378	0.119	0.325	0.008	0.000
2.8000	0.119	0.333	0.009	0.000
2.8622	0.119	0.340	0.009	0.000
2.9244	0.119	0.348	0.009	0.000
2.9867	0.119	0.355	0.009	0.000
3.0489	0.119	0.362	0.009	0.000
3.1111	0.119	0.370	0.009	0.000
3.1733	0.119	0.377	0.009	0.000
3.2356	0.119	0.385	0.009	0.000
3.2978	0.119	0.392	0.009	0.000
3.3600	0.119	0.399	0.009	0.000
3.4222	0.119	0.407	0.010	0.000
3.4844	0.119	0.414	0.010	0.000
3.5467	0.119	0.422	0.010	0.000
3.6089	0.119	0.429	0.010	0.000
3.6711	0.119	0.436	0.010	0.000
3.7333	0.119	0.444	0.010	0.000
3.7956	0.119	0.451	0.011	0.000
3.8578	0.119	0.459	0.011	0.000
3.9200	0.119	0.466	0.013	0.000
3.9822	0.119	0.473	0.014	0.000
4.0444	0.119	0.481	0.016	0.000
4.1067	0.119	0.488	0.017	0.000
4.1689	0.119	0.496	0.019	0.000
4.2311	0.119	0.503	0.021	0.000
4.2933	0.119	0.510	0.023	0.000
4.3556	0.119	0.518	0.025	0.000
4.4178	0.119	0.525	0.027	0.000
4.4800	0.119	0.533	0.029	0.000
4.5422	0.119	0.540	0.031	0.000
4.6044	0.119	0.548	0.033	0.000
4.6667	0.119	0.555	0.036	0.000
4.7289	0.119	0.562	0.038	0.000
4.7911	0.119	0.570	0.040	0.000
4.8533	0.119	0.577	0.043	0.000
4.9156	0.119	0.585	0.046	0.000
4.9778	0.119	0.592	0.049	0.000
5.0400	0.119	0.599	0.052	0.000
5.1022	0.119	0.607	0.056	0.000
5.1644	0.119	0.614	0.228	0.000
5.2267	0.119	0.622	0.527	0.000
5.2889	0.119	0.629	0.894	0.000
5.3511	0.119	0.636	1.279	0.000
5.4133	0.119	0.644	1.636	0.000
5.4756	0.119	0.651	1.925	0.000
5.5378	0.119	0.659	2.127	0.000
5.6000	0.119	0.666	2.258	0.000
5.6622	0.119	0.673	2.417	0.000
5.7244	0.000	0.000	2.544	0.000

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.96
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.96

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.023119
5 year	0.035469
10 year	0.043055
25 year	0.05182
50 year	0.057757
100 year	0.063219

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.012283
5 year	0.021257
10 year	0.030259
25 year	0.046505
50 year	0.063265
100 year	0.085188

Annual Peaks
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.022	0.010
1903	0.014	0.008
1904	0.026	0.011
1905	0.012	0.012
1906	0.007	0.008
1907	0.036	0.011
1908	0.025	0.010
1909	0.025	0.011
1910	0.035	0.011
1911	0.023	0.009

1912	0.080	0.014
1913	0.036	0.030
1914	0.009	0.013
1915	0.016	0.017
1916	0.023	0.010
1917	0.008	0.009
1918	0.024	0.036
1919	0.020	0.010
1920	0.023	0.010
1921	0.026	0.013
1922	0.025	0.011
1923	0.020	0.011
1924	0.010	0.009
1925	0.013	0.009
1926	0.022	0.011
1927	0.018	0.010
1928	0.017	0.012
1929	0.035	0.021
1930	0.022	0.011
1931	0.022	0.011
1932	0.016	0.011
1933	0.019	0.011
1934	0.046	0.053
1935	0.022	0.023
1936	0.021	0.014
1937	0.031	0.011
1938	0.020	0.010
1939	0.002	0.009
1940	0.022	0.012
1941	0.014	0.009
1942	0.033	0.041
1943	0.015	0.010
1944	0.035	0.015
1945	0.026	0.011
1946	0.015	0.009
1947	0.012	0.009
1948	0.049	0.011
1949	0.043	0.021
1950	0.014	0.009
1951	0.018	0.010
1952	0.062	0.021
1953	0.057	0.050
1954	0.021	0.010
1955	0.018	0.009
1956	0.010	0.009
1957	0.030	0.020
1958	0.061	0.196
1959	0.038	0.051
1960	0.011	0.009
1961	0.038	0.043
1962	0.022	0.012
1963	0.010	0.008
1964	0.012	0.009
1965	0.043	0.045
1966	0.013	0.009
1967	0.019	0.010
1968	0.021	0.011
1969	0.020	0.011

1970	0.030	0.011
1971	0.045	0.026
1972	0.030	0.012
1973	0.039	0.023
1974	0.021	0.011
1975	0.047	0.131
1976	0.026	0.012
1977	0.013	0.008
1978	0.041	0.046
1979	0.013	0.009
1980	0.025	0.011
1981	0.024	0.010
1982	0.013	0.008
1983	0.038	0.012
1984	0.018	0.010
1985	0.029	0.010
1986	0.023	0.011
1987	0.044	0.032
1988	0.027	0.020
1989	0.025	0.010
1990	0.030	0.010
1991	0.024	0.012
1992	0.029	0.033
1993	0.031	0.011
1994	0.045	0.011
1995	0.011	0.010
1996	0.049	0.047
1997	0.022	0.010
1998	0.025	0.011
1999	0.003	0.009
2000	0.019	0.011
2001	0.010	0.008
2002	0.033	0.013
2003	0.029	0.012
2004	0.025	0.012
2005	0.048	0.013
2006	0.015	0.010
2007	0.017	0.010
2008	0.025	0.010
2009	0.017	0.009
2010	0.015	0.012
2011	0.013	0.010
2012	0.023	0.010
2013	0.015	0.008
2014	0.011	0.008
2015	0.020	0.010
2016	0.008	0.008
2017	0.033	0.014
2018	0.061	0.123
2019	0.064	0.049
2020	0.019	0.011
2021	0.032	0.026
2022	0.013	0.009
2023	0.027	0.013
2024	0.071	0.011
2025	0.024	0.011
2026	0.038	0.024
2027	0.015	0.009

2028	0.013	0.008
2029	0.025	0.022
2030	0.046	0.012
2031	0.015	0.009
2032	0.010	0.008
2033	0.014	0.008
2034	0.014	0.009
2035	0.054	0.048
2036	0.028	0.011
2037	0.008	0.009
2038	0.023	0.018
2039	0.004	0.010
2040	0.014	0.009
2041	0.017	0.009
2042	0.055	0.035
2043	0.026	0.022
2044	0.034	0.022
2045	0.023	0.014
2046	0.027	0.040
2047	0.020	0.014
2048	0.026	0.010
2049	0.024	0.011
2050	0.017	0.010
2051	0.027	0.012
2052	0.015	0.011
2053	0.026	0.043
2054	0.031	0.020
2055	0.013	0.009
2056	0.011	0.009
2057	0.018	0.011
2058	0.022	0.020
2059	0.037	0.024

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	**Predeveloped**	**Mitigated**
1	0.0796	0.1956
2	0.0714	0.1306
3	0.0644	0.1233
4	0.0621	0.0533
5	0.0610	0.0505
6	0.0605	0.0499
7	0.0574	0.0487
8	0.0547	0.0480
9	0.0543	0.0472
10	0.0492	0.0465
11	0.0486	0.0454
12	0.0476	0.0429
13	0.0471	0.0425
14	0.0464	0.0413
15	0.0460	0.0398
16	0.0452	0.0356
17	0.0450	0.0351
18	0.0441	0.0332
19	0.0433	0.0324
20	0.0432	0.0300
21	0.0413	0.0260
22	0.0387	0.0258

23	0.0383	0.0244
24	0.0381	0.0235
25	0.0378	0.0233
26	0.0377	0.0233
27	0.0366	0.0223
28	0.0361	0.0220
29	0.0356	0.0218
30	0.0352	0.0214
31	0.0350	0.0213
32	0.0349	0.0212
33	0.0345	0.0200
34	0.0333	0.0197
35	0.0332	0.0197
36	0.0328	0.0196
37	0.0315	0.0177
38	0.0312	0.0167
39	0.0310	0.0146
40	0.0308	0.0144
41	0.0305	0.0143
42	0.0302	0.0141
43	0.0298	0.0138
44	0.0297	0.0135
45	0.0290	0.0134
46	0.0289	0.0130
47	0.0285	0.0130
48	0.0279	0.0129
49	0.0275	0.0128
50	0.0274	0.0124
51	0.0267	0.0124
52	0.0265	0.0122
53	0.0265	0.0122
54	0.0265	0.0120
55	0.0261	0.0118
56	0.0261	0.0118
57	0.0259	0.0118
58	0.0257	0.0117
59	0.0255	0.0116
60	0.0254	0.0116
61	0.0253	0.0116
62	0.0252	0.0116
63	0.0251	0.0115
64	0.0250	0.0114
65	0.0250	0.0114
66	0.0249	0.0113
67	0.0247	0.0113
68	0.0247	0.0113
69	0.0238	0.0112
70	0.0238	0.0111
71	0.0237	0.0111
72	0.0236	0.0111
73	0.0235	0.0111
74	0.0235	0.0110
75	0.0234	0.0110
76	0.0234	0.0110
77	0.0231	0.0109
78	0.0229	0.0109
79	0.0229	0.0109
80	0.0228	0.0109

81	0.0225	0.0108
82	0.0222	0.0108
83	0.0221	0.0108
84	0.0221	0.0108
85	0.0220	0.0108
86	0.0219	0.0108
87	0.0216	0.0108
88	0.0216	0.0107
89	0.0216	0.0107
90	0.0213	0.0106
91	0.0210	0.0106
92	0.0209	0.0106
93	0.0209	0.0106
94	0.0205	0.0105
95	0.0203	0.0105
96	0.0200	0.0104
97	0.0200	0.0104
98	0.0198	0.0104
99	0.0197	0.0103
100	0.0195	0.0103
101	0.0194	0.0102
102	0.0193	0.0102
103	0.0190	0.0102
104	0.0183	0.0101
105	0.0183	0.0101
106	0.0178	0.0101
107	0.0177	0.0100
108	0.0176	0.0100
109	0.0174	0.0099
110	0.0172	0.0099
111	0.0171	0.0099
112	0.0167	0.0098
113	0.0165	0.0098
114	0.0164	0.0098
115	0.0158	0.0098
116	0.0155	0.0097
117	0.0150	0.0096
118	0.0150	0.0096
119	0.0150	0.0096
120	0.0149	0.0095
121	0.0147	0.0095
122	0.0147	0.0094
123	0.0147	0.0094
124	0.0142	0.0094
125	0.0142	0.0094
126	0.0141	0.0094
127	0.0141	0.0092
128	0.0140	0.0092
129	0.0138	0.0092
130	0.0135	0.0092
131	0.0134	0.0091
132	0.0133	0.0091
133	0.0132	0.0090
134	0.0130	0.0089
135	0.0129	0.0088
136	0.0129	0.0088
137	0.0127	0.0088
138	0.0127	0.0088

139	0.0124	0.0087
140	0.0121	0.0086
141	0.0117	0.0086
142	0.0115	0.0086
143	0.0111	0.0086
144	0.0106	0.0086
145	0.0105	0.0085
146	0.0104	0.0085
147	0.0103	0.0084
148	0.0101	0.0084
149	0.0101	0.0084
150	0.0098	0.0082
151	0.0092	0.0081
152	0.0083	0.0081
153	0.0081	0.0080
154	0.0080	0.0079
155	0.0073	0.0079
156	0.0039	0.0079
157	0.0035	0.0079
158	0.0022	0.0077

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0116	60220	33556	55	Pass
0.0120	55079	30071	54	Pass
0.0125	50381	27650	54	Pass
0.0130	46248	25385	54	Pass
0.0134	42376	23451	55	Pass
0.0139	38980	21712	55	Pass
0.0144	36038	20288	56	Pass
0.0148	33290	19069	57	Pass
0.0153	30697	17845	58	Pass
0.0158	28365	16825	59	Pass
0.0162	26343	15717	59	Pass
0.0167	24493	14670	59	Pass
0.0172	22803	13689	60	Pass
0.0176	21246	12720	59	Pass
0.0181	19833	11889	59	Pass
0.0186	18554	11113	59	Pass
0.0190	17224	10521	61	Pass
0.0195	16005	10005	62	Pass
0.0200	14930	9496	63	Pass
0.0204	13906	8997	64	Pass
0.0209	12980	8526	65	Pass
0.0214	12144	8044	66	Pass
0.0218	11324	7618	67	Pass
0.0223	10587	7202	68	Pass
0.0228	9861	6853	69	Pass
0.0232	9174	6482	70	Pass
0.0237	8537	6138	71	Pass
0.0242	7978	5828	73	Pass
0.0246	7435	5511	74	Pass
0.0251	6947	5274	75	Pass
0.0256	6559	5027	76	Pass
0.0260	6199	4794	77	Pass
0.0265	5895	4572	77	Pass
0.0270	5584	4363	78	Pass
0.0274	5275	4150	78	Pass
0.0279	5009	3966	79	Pass
0.0284	4768	3823	80	Pass
0.0288	4528	3664	80	Pass
0.0293	4288	3508	81	Pass
0.0298	4074	3350	82	Pass
0.0302	3861	3188	82	Pass
0.0307	3653	3043	83	Pass
0.0312	3444	2913	84	Pass
0.0316	3283	2758	84	Pass
0.0321	3124	2631	84	Pass
0.0326	2978	2520	84	Pass
0.0330	2829	2391	84	Pass
0.0335	2682	2271	84	Pass
0.0340	2576	2153	83	Pass
0.0344	2452	1985	80	Pass
0.0349	2357	1857	78	Pass
0.0354	2239	1730	77	Pass
0.0358	2140	1623	75	Pass

0.0363	1990	1525	76	Pass
0.0368	1869	1437	76	Pass
0.0372	1757	1375	78	Pass
0.0377	1672	1304	77	Pass
0.0382	1583	1228	77	Pass
0.0386	1506	1155	76	Pass
0.0391	1429	1092	76	Pass
0.0396	1354	1026	75	Pass
0.0400	1295	963	74	Pass
0.0405	1234	910	73	Pass
0.0410	1182	847	71	Pass
0.0414	1119	796	71	Pass
0.0419	1072	759	70	Pass
0.0424	1026	718	69	Pass
0.0428	966	662	68	Pass
0.0433	895	618	69	Pass
0.0438	834	574	68	Pass
0.0442	781	545	69	Pass
0.0447	735	503	68	Pass
0.0452	678	464	68	Pass
0.0456	630	426	67	Pass
0.0461	589	391	66	Pass
0.0466	555	354	63	Pass
0.0470	510	324	63	Pass
0.0475	475	286	60	Pass
0.0480	432	259	59	Pass
0.0484	389	241	61	Pass
0.0489	367	220	59	Pass
0.0494	340	207	60	Pass
0.0498	304	192	63	Pass
0.0503	280	176	62	Pass
0.0508	265	164	61	Pass
0.0512	247	154	62	Pass
0.0517	233	144	61	Pass
0.0522	218	134	61	Pass
0.0526	204	123	60	Pass
0.0531	182	108	59	Pass
0.0536	161	93	57	Pass
0.0540	139	83	59	Pass
0.0545	117	73	62	Pass
0.0550	110	62	56	Pass
0.0554	101	59	58	Pass
0.0559	92	55	59	Pass
0.0564	85	51	60	Pass
0.0568	72	51	70	Pass
0.0573	62	51	82	Pass
0.0578	54	49	90	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0353 acre-feet
On-line facility target flow:	0.0196 cfs.
Adjusted for 15 min:	0.0196 cfs.
Off-line facility target flow:	0.0108 cfs.
Adjusted for 15 min:	0.0108 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Vault 1 POC	☐	392.34			☐	0.00			
Total Volume Infiltrated		392.34	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

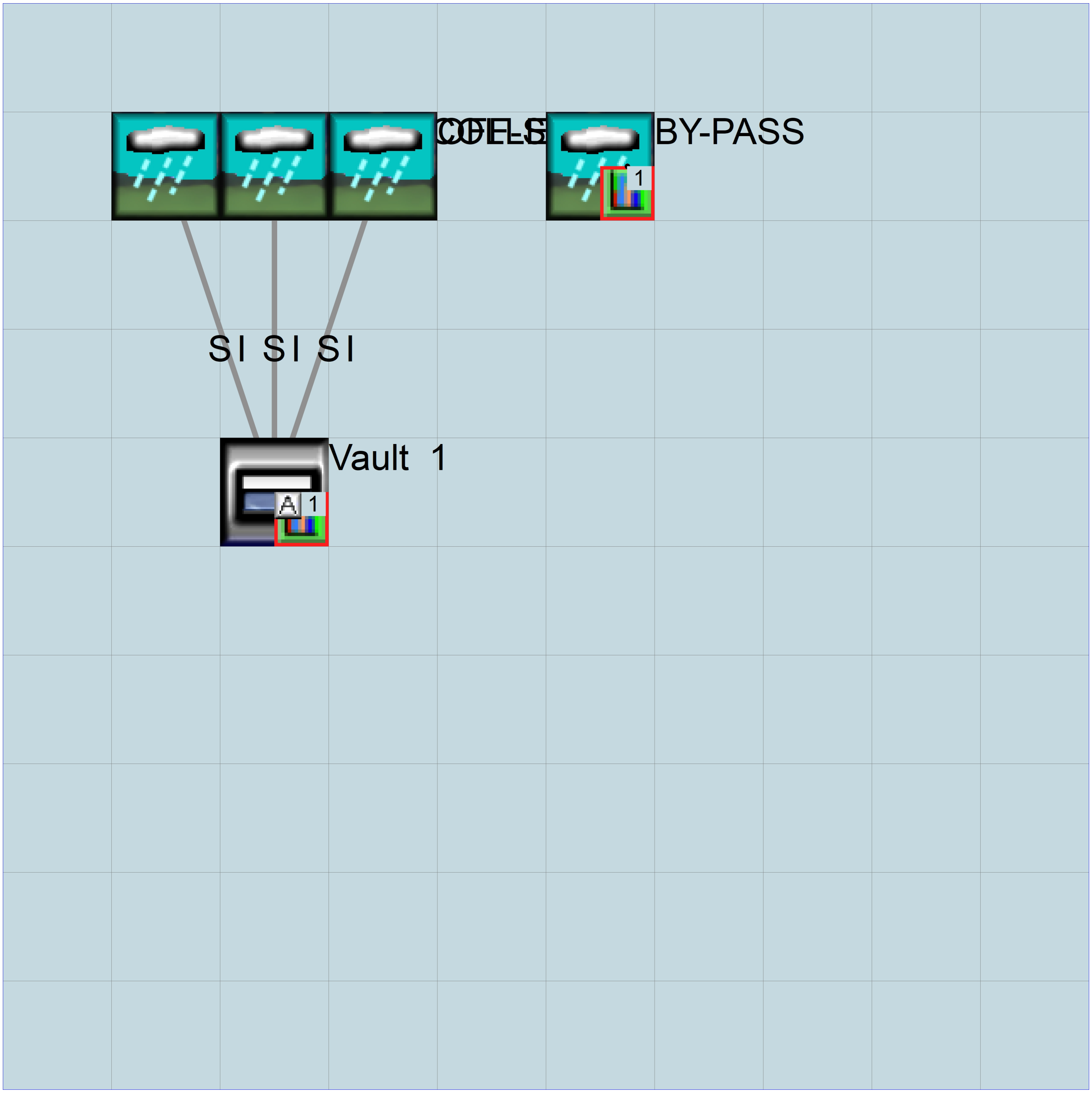
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic



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   21730-Flow Control-2024-1-12.wdm
MESSU      25   Pre21730-Flow Control-2024-1-12.MES
           27   Pre21730-Flow Control-2024-1-12.L61
           28   Pre21730-Flow Control-2024-1-12.L62
           30   POC21730-Flow Control-2024-1-121.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        ON-SITE                    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#   ***
ON-SITE***
PERLND  10                        0.84     COPY   501     12
PERLND  10                        0.84     COPY   501     13
ROW***
PERLND  10                       0.103     COPY   501     12
PERLND  10                       0.103     COPY   501     13
OFFSITE***
PERLND  10                       0.017     COPY   501     12
PERLND  10                       0.017     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   21730-Flow Control-2024-1-12.wdm
MESSU      25   Mit21730-Flow Control-2024-1-12.MES
           27   Mit21730-Flow Control-2024-1-12.L61
           28   Mit21730-Flow Control-2024-1-12.L62
           30   POC21730-Flow Control-2024-1-121.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       1
      IMPLND       4
      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        Vault  1                    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            ***
  END GEN-INFO
  *** Section PWATER***

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

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

```
  END PRINT-INFO

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

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  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
    4      ROOF TOPS/FLAT         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
    4         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
    4         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
    4         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
    4            400      0.01       0.1       0.1
  END IWAT-PARM2

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

```
    1              0         0
    4              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    4              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
ON-SITE***
IMPLND   1                        0.61     RCHRES   1      5
IMPLND   4                        0.23     RCHRES   1      5
ROW-COLLECTED***
IMPLND   1                       0.043     RCHRES   1      5
OFF-SITE-COLLECTED***
IMPLND   1                       0.069     RCHRES   1      5
BY-PASS***
IMPLND   1                       0.008     COPY   501     15
IMPLND   1                       0.008     COPY   601     15

******Routing******
IMPLND   1                        0.61     COPY     1     15
IMPLND   4                        0.23     COPY     1     15
IMPLND   1                       0.043     COPY     1     15
IMPLND   1                       0.069     COPY     1     15
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     Vault  1               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      0.01       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
   92    4
     Depth      Area    Volume  Outflow1 Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.119008  0.000000  0.000000
  0.062222  0.119008  0.007405  0.001346
  0.124444  0.119008  0.014810  0.001904
  0.186667  0.119008  0.022215  0.002332
  0.248889  0.119008  0.029620  0.002693
  0.311111  0.119008  0.037025  0.003011
  0.373333  0.119008  0.044430  0.003298
  0.435556  0.119008  0.051835  0.003562
  0.497778  0.119008  0.059240  0.003808
  0.560000  0.119008  0.066645  0.004039
  0.622222  0.119008  0.074050  0.004258
  0.684444  0.119008  0.081455  0.004466
  0.746667  0.119008  0.088860  0.004664
  0.808889  0.119008  0.096264  0.004855
  0.871111  0.119008  0.103669  0.005038
  0.933333  0.119008  0.111074  0.005215
  0.995556  0.119008  0.118479  0.005386
  1.057778  0.119008  0.125884  0.005552
  1.120000  0.119008  0.133289  0.005713
  1.182222  0.119008  0.140694  0.005869
  1.244444  0.119008  0.148099  0.006022
  1.306667  0.119008  0.155504  0.006170
  1.368889  0.119008  0.162909  0.006316
  1.431111  0.119008  0.170314  0.006458
  1.493333  0.119008  0.177719  0.006596
  1.555556  0.119008  0.185124  0.006732
  1.617778  0.119008  0.192529  0.006866
  1.680000  0.119008  0.199934  0.006997
  1.742222  0.119008  0.207339  0.007125
  1.804444  0.119008  0.214744  0.007251
  1.866667  0.119008  0.222149  0.007375
  1.928889  0.119008  0.229554  0.007497
  1.991111  0.119008  0.236959  0.007617
  2.053333  0.119008  0.244364  0.007735
  2.115556  0.119008  0.251769  0.007851
  2.177778  0.119008  0.259174  0.007966
  2.240000  0.119008  0.266579  0.008079
  2.302222  0.119008  0.273983  0.008190
  2.364444  0.119008  0.281388  0.008300
  2.426667  0.119008  0.288793  0.008409
  2.488889  0.119008  0.296198  0.008516
  2.551111  0.119008  0.303603  0.008622
  2.613333  0.119008  0.311008  0.008726
  2.675556  0.119008  0.318413  0.008829
```

```
  2.737778  0.119008  0.325818  0.008932
  2.800000  0.119008  0.333223  0.009032
  2.862222  0.119008  0.340628  0.009132
  2.924444  0.119008  0.348033  0.009231
  2.986667  0.119008  0.355438  0.009329
  3.048889  0.119008  0.362843  0.009425
  3.111111  0.119008  0.370248  0.009521
  3.173333  0.119008  0.377653  0.009616
  3.235556  0.119008  0.385058  0.009710
  3.297778  0.119008  0.392463  0.009803
  3.360000  0.119008  0.399868  0.009895
  3.422222  0.119008  0.407273  0.009986
  3.484444  0.119008  0.414678  0.010076
  3.546667  0.119008  0.422083  0.010166
  3.608889  0.119008  0.429488  0.010255
  3.671111  0.119008  0.436893  0.010343
  3.733333  0.119008  0.444298  0.010430
  3.795556  0.119008  0.451702  0.010952
  3.857778  0.119008  0.459107  0.011930
  3.920000  0.119008  0.466512  0.013163
  3.982222  0.119008  0.473917  0.014587
  4.044444  0.119008  0.481322  0.016161
  4.106667  0.119008  0.488727  0.017859
  4.168889  0.119008  0.496132  0.019658
  4.231111  0.119008  0.503537  0.021542
  4.293333  0.119008  0.510942  0.023496
  4.355556  0.119008  0.518347  0.025509
  4.417778  0.119008  0.525752  0.027569
  4.480000  0.119008  0.533157  0.029666
  4.542222  0.119008  0.540562  0.031793
  4.604444  0.119008  0.547967  0.033941
  4.666667  0.119008  0.555372  0.036103
  4.728889  0.119008  0.562777  0.038271
  4.791111  0.119008  0.570182  0.040811
  4.853333  0.119008  0.577587  0.043500
  4.915556  0.119008  0.584992  0.046262
  4.977778  0.119008  0.592397  0.049096
  5.040000  0.119008  0.599802  0.052000
  5.102222  0.119008  0.607207  0.055980
  5.164444  0.119008  0.614612  0.228167
  5.226667  0.119008  0.622017  0.527812
  5.288889  0.119008  0.629421  0.893969
  5.351111  0.119008  0.636826  1.279490
  5.413333  0.119008  0.644231  1.636874
  5.475556  0.119008  0.651636  1.925859
  5.537778  0.119008  0.659041  2.126973
  5.600000  0.119008  0.666446  2.258783
  5.662222  0.119008  0.673851  2.417158
  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***
RCHRES   1 HYDR   RO     1 1        1      WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1001 STAG     ENGL      REPL
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
END EXT TARGETS
```

```
MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
  END MASS-LINK    5

  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: 1955/ 9/30 24: 0

RCHRES :    1

RELERR       STORS        STOR       MATIN      MATDIF
-1.169E-03     0.00000  0.0000E+00     0.00000  -2.757E-07

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
-3.409E-03     0.00000  0.0000E+00     0.00000  -9.405E-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: 1964/ 9/30 24: 0

RCHRES : 1

```
RELERR       STORS        STOR       MATIN      MATDIF
-1.766E-01     0.00000  0.0000E+00     0.00000  -1.492E-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: 1966/ 8/31 24: 0

RCHRES : 1

```
RELERR       STORS        STOR       MATIN      MATDIF
-6.654E-02     0.00000  0.0000E+00     0.00000  -4.487E-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: 1989/ 8/31 24: 0

RCHRES : 1

```
RELERR       STORS        STOR       MATIN      MATDIF
-4.344E-03     0.00000  0.0000E+00     0.00000  -7.342E-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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Figure 5.6.1
WWHM
Calculations WQ
Flowrate

WWHM2012

PROJECT REPORT

Overall Water Quality Flow Rate

General Model Information

Project Name:	21730-WQ-2023-10-4
Site Name:	ARCO
Site Address:	
City:	PUYALLUP
Report Date:	10/4/2023
Gage:	42 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

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

WQ Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.82
Pervious Total	0.82
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.82

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

WQ Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.82
Impervious Total	0.82
Basin Total	0.82

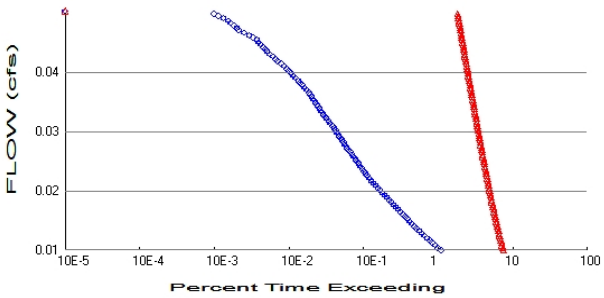
Element Flows To:

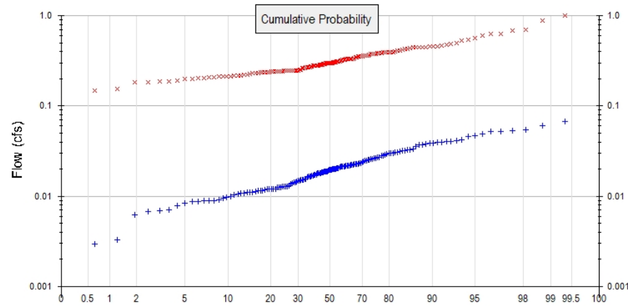
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.82
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 0.82

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.019747
5 year	0.030297
10 year	0.036776
25 year	0.044263
50 year	0.049334
100 year	0.053999

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.300303
5 year	0.402074
10 year	0.475896
25 year	0.576772
50 year	0.657617
100 year	0.743502

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.019	0.356
1903	0.012	0.392
1904	0.022	0.445
1905	0.011	0.200
1906	0.006	0.220
1907	0.031	0.298
1908	0.022	0.246
1909	0.021	0.304
1910	0.030	0.289
1911	0.020	0.325

1912	0.068	0.537
1913	0.030	0.236
1914	0.008	0.998
1915	0.014	0.204
1916	0.020	0.377
1917	0.007	0.153
1918	0.020	0.302
1919	0.017	0.189
1920	0.020	0.249
1921	0.022	0.213
1922	0.021	0.331
1923	0.017	0.230
1924	0.009	0.430
1925	0.011	0.184
1926	0.019	0.351
1927	0.016	0.299
1928	0.015	0.215
1929	0.030	0.429
1930	0.019	0.444
1931	0.019	0.220
1932	0.014	0.234
1933	0.016	0.232
1934	0.039	0.376
1935	0.018	0.206
1936	0.018	0.282
1937	0.027	0.376
1938	0.017	0.205
1939	0.002	0.246
1940	0.018	0.452
1941	0.012	0.455
1942	0.028	0.334
1943	0.013	0.331
1944	0.030	0.478
1945	0.022	0.360
1946	0.013	0.281
1947	0.010	0.219
1948	0.041	0.302
1949	0.037	0.464
1950	0.012	0.271
1951	0.015	0.401
1952	0.053	0.444
1953	0.049	0.410
1954	0.018	0.244
1955	0.016	0.234
1956	0.009	0.212
1957	0.026	0.243
1958	0.052	0.303
1959	0.032	0.300
1960	0.009	0.243
1961	0.033	0.679
1962	0.018	0.290
1963	0.009	0.215
1964	0.010	0.629
1965	0.037	0.283
1966	0.011	0.236
1967	0.017	0.333
1968	0.018	0.278
1969	0.017	0.251

1970	0.026	0.283
1971	0.039	0.276
1972	0.025	0.889
1973	0.033	0.534
1974	0.018	0.388
1975	0.040	0.397
1976	0.022	0.424
1977	0.011	0.183
1978	0.035	0.306
1979	0.011	0.327
1980	0.021	0.320
1981	0.020	0.310
1982	0.011	0.245
1983	0.033	0.330
1984	0.015	0.329
1985	0.024	0.374
1986	0.020	0.189
1987	0.038	0.342
1988	0.023	0.199
1989	0.022	0.214
1990	0.025	0.243
1991	0.020	0.348
1992	0.025	0.349
1993	0.026	0.390
1994	0.038	0.265
1995	0.009	0.209
1996	0.042	0.278
1997	0.019	0.249
1998	0.021	0.297
1999	0.003	0.330
2000	0.016	0.281
2001	0.008	0.238
2002	0.028	0.414
2003	0.025	0.240
2004	0.021	0.360
2005	0.041	0.703
2006	0.013	0.324
2007	0.014	0.363
2008	0.021	0.300
2009	0.015	0.227
2010	0.013	0.292
2011	0.012	0.288
2012	0.020	0.285
2013	0.013	0.266
2014	0.009	0.266
2015	0.017	0.444
2016	0.007	0.254
2017	0.028	0.439
2018	0.052	0.261
2019	0.055	0.390
2020	0.017	0.320
2021	0.027	0.268
2022	0.011	0.453
2023	0.023	0.567
2024	0.061	0.600
2025	0.020	0.296
2026	0.032	0.382
2027	0.013	0.357

2028	0.011	0.143
2029	0.022	0.230
2030	0.040	0.490
2031	0.013	0.147
2032	0.009	0.246
2033	0.012	0.309
2034	0.012	0.242
2035	0.046	0.297
2036	0.024	0.244
2037	0.007	0.326
2038	0.020	0.309
2039	0.003	0.630
2040	0.012	0.244
2041	0.014	0.309
2042	0.047	0.356
2043	0.023	0.395
2044	0.029	0.270
2045	0.019	0.218
2046	0.023	0.243
2047	0.017	0.299
2048	0.023	0.246
2049	0.020	0.365
2050	0.015	0.271
2051	0.023	0.383
2052	0.013	0.293
2053	0.022	0.246
2054	0.027	0.493
2055	0.011	0.288
2056	0.010	0.394
2057	0.015	0.193
2058	0.019	0.372
2059	0.031	0.454

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0680	0.9977
2	0.0610	0.8886
3	0.0550	0.7034
4	0.0530	0.6794
5	0.0521	0.6297
6	0.0517	0.6293
7	0.0490	0.6002
8	0.0468	0.5667
9	0.0464	0.5366
10	0.0420	0.5338
11	0.0415	0.4931
12	0.0407	0.4896
13	0.0402	0.4779
14	0.0396	0.4639
15	0.0393	0.4554
16	0.0386	0.4540
17	0.0384	0.4530
18	0.0377	0.4515
19	0.0370	0.4450
20	0.0369	0.4440
21	0.0353	0.4438
22	0.0331	0.4438

23	0.0327	0.4386
24	0.0326	0.4297
25	0.0323	0.4286
26	0.0322	0.4237
27	0.0312	0.4142
28	0.0308	0.4101
29	0.0305	0.4011
30	0.0300	0.3970
31	0.0299	0.3946
32	0.0299	0.3937
33	0.0295	0.3924
34	0.0285	0.3901
35	0.0284	0.3899
36	0.0280	0.3880
37	0.0269	0.3825
38	0.0267	0.3820
39	0.0265	0.3769
40	0.0263	0.3763
41	0.0260	0.3762
42	0.0258	0.3743
43	0.0254	0.3721
44	0.0254	0.3652
45	0.0248	0.3628
46	0.0247	0.3605
47	0.0244	0.3601
48	0.0238	0.3573
49	0.0235	0.3560
50	0.0234	0.3556
51	0.0228	0.3505
52	0.0226	0.3486
53	0.0226	0.3477
54	0.0226	0.3419
55	0.0223	0.3344
56	0.0223	0.3325
57	0.0221	0.3308
58	0.0219	0.3307
59	0.0218	0.3304
60	0.0217	0.3298
61	0.0216	0.3291
62	0.0215	0.3274
63	0.0214	0.3261
64	0.0214	0.3255
65	0.0214	0.3241
66	0.0213	0.3204
67	0.0211	0.3197
68	0.0211	0.3095
69	0.0203	0.3092
70	0.0203	0.3089
71	0.0203	0.3088
72	0.0202	0.3062
73	0.0201	0.3035
74	0.0200	0.3028
75	0.0200	0.3022
76	0.0200	0.3016
77	0.0197	0.3005
78	0.0196	0.3003
79	0.0195	0.2994
80	0.0194	0.2989

81	0.0192	0.2985
82	0.0189	0.2972
83	0.0189	0.2968
84	0.0188	0.2959
85	0.0188	0.2926
86	0.0187	0.2918
87	0.0185	0.2903
88	0.0185	0.2893
89	0.0185	0.2884
90	0.0182	0.2879
91	0.0180	0.2855
92	0.0179	0.2832
93	0.0178	0.2828
94	0.0175	0.2817
95	0.0173	0.2814
96	0.0171	0.2807
97	0.0171	0.2776
98	0.0169	0.2776
99	0.0168	0.2764
100	0.0166	0.2715
101	0.0165	0.2708
102	0.0165	0.2700
103	0.0162	0.2682
104	0.0156	0.2663
105	0.0156	0.2657
106	0.0152	0.2654
107	0.0152	0.2615
108	0.0150	0.2540
109	0.0149	0.2513
110	0.0147	0.2487
111	0.0146	0.2486
112	0.0143	0.2464
113	0.0141	0.2464
114	0.0140	0.2462
115	0.0135	0.2458
116	0.0132	0.2457
117	0.0128	0.2447
118	0.0128	0.2443
119	0.0128	0.2441
120	0.0127	0.2438
121	0.0126	0.2431
122	0.0125	0.2428
123	0.0125	0.2427
124	0.0121	0.2426
125	0.0121	0.2422
126	0.0121	0.2395
127	0.0120	0.2377
128	0.0120	0.2363
129	0.0118	0.2363
130	0.0115	0.2344
131	0.0115	0.2341
132	0.0114	0.2320
133	0.0113	0.2302
134	0.0111	0.2302
135	0.0110	0.2270
136	0.0110	0.2198
137	0.0109	0.2198
138	0.0109	0.2191

139	0.0105	0.2181
140	0.0103	0.2149
141	0.0100	0.2147
142	0.0098	0.2139
143	0.0094	0.2130
144	0.0090	0.2119
145	0.0090	0.2088
146	0.0089	0.2061
147	0.0088	0.2053
148	0.0087	0.2039
149	0.0087	0.2005
150	0.0084	0.1987
151	0.0079	0.1931
152	0.0071	0.1887
153	0.0069	0.1885
154	0.0068	0.1840
155	0.0063	0.1825
156	0.0033	0.1533
157	0.0030	0.1469
158	0.0019	0.1425

Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0099	60110	414120	688	Fail
0.0103	55052	405976	737	Fail
0.0107	50365	398054	790	Fail
0.0111	46260	390519	844	Fail
0.0115	42398	383151	903	Fail
0.0119	39008	376060	964	Fail
0.0123	36021	369190	1024	Fail
0.0127	33285	362542	1089	Fail
0.0131	30697	356060	1159	Fail
0.0135	28315	349855	1235	Fail
0.0139	26371	344093	1304	Fail
0.0143	24520	338221	1379	Fail
0.0147	22797	332570	1458	Fail
0.0151	21246	327030	1539	Fail
0.0155	19839	321490	1620	Fail
0.0159	18532	316227	1706	Fail
0.0163	17207	311019	1807	Fail
0.0166	16033	306255	1910	Fail
0.0170	14930	301379	2018	Fail
0.0174	13911	296670	2132	Fail
0.0178	12986	292072	2249	Fail
0.0182	12133	287585	2370	Fail
0.0186	11318	283208	2502	Fail
0.0190	10587	278887	2634	Fail
0.0194	9867	274898	2786	Fail
0.0198	9185	270854	2948	Fail
0.0202	8543	266920	3124	Fail
0.0206	7978	263042	3297	Fail
0.0210	7435	259275	3487	Fail
0.0214	6947	255508	3677	Fail
0.0218	6554	251796	3841	Fail
0.0222	6210	248250	3997	Fail
0.0226	5900	244649	4146	Fail
0.0230	5584	241325	4321	Fail
0.0234	5277	237946	4509	Fail
0.0238	5010	234511	4680	Fail
0.0242	4761	231187	4855	Fail
0.0246	4527	228029	5037	Fail
0.0250	4297	224927	5234	Fail
0.0254	4074	221769	5443	Fail
0.0258	3862	218722	5663	Fail
0.0262	3656	215619	5897	Fail
0.0266	3442	212683	6179	Fail
0.0270	3281	209802	6394	Fail
0.0274	3124	206921	6623	Fail
0.0278	2972	204096	6867	Fail
0.0282	2829	201381	7118	Fail
0.0286	2684	198722	7403	Fail
0.0290	2575	196007	7611	Fail
0.0294	2452	193404	7887	Fail
0.0298	2357	190911	8099	Fail
0.0302	2239	188307	8410	Fail
0.0306	2140	185814	8682	Fail
0.0310	1993	183432	9203	Fail

0.0314	1869	180994	9684	Fail
0.0318	1757	178556	10162	Fail
0.0322	1673	176229	10533	Fail
0.0326	1583	173958	10989	Fail
0.0330	1506	171687	11400	Fail
0.0334	1429	169526	11863	Fail
0.0338	1355	167310	12347	Fail
0.0342	1296	165149	12742	Fail
0.0346	1234	162989	13208	Fail
0.0350	1182	160883	13611	Fail
0.0354	1119	158723	14184	Fail
0.0358	1072	156673	14615	Fail
0.0362	1025	154623	15085	Fail
0.0366	968	152684	15773	Fail
0.0370	896	150634	16811	Fail
0.0374	834	148695	17829	Fail
0.0378	781	146756	18790	Fail
0.0382	735	144873	19710	Fail
0.0386	678	142989	21089	Fail
0.0390	630	141161	22406	Fail
0.0394	589	139333	23655	Fail
0.0398	555	137504	24775	Fail
0.0402	510	135732	26614	Fail
0.0406	475	134014	28213	Fail
0.0410	431	132241	30682	Fail
0.0414	389	130524	33553	Fail
0.0418	367	128862	35112	Fail
0.0422	341	127255	37318	Fail
0.0426	305	125649	41196	Fail
0.0430	280	124042	44300	Fail
0.0434	265	122435	46201	Fail
0.0438	247	120940	48963	Fail
0.0442	233	119388	51239	Fail
0.0446	218	117893	54079	Fail
0.0449	205	116397	56779	Fail
0.0453	183	114901	62787	Fail
0.0457	161	113350	70403	Fail
0.0461	139	111909	80510	Fail
0.0465	117	110469	94417	Fail
0.0469	110	109084	99167	Fail
0.0473	101	107699	106632	Fail
0.0477	92	106369	115618	Fail
0.0481	85	105040	123576	Fail
0.0485	73	103710	142068	Fail
0.0489	63	102436	162596	Fail
0.0493	54	101106	187233	Fail

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0911 acre-feet
On-line facility target flow:	0.1282 cfs.
Adjusted for 15 min:	0.1282 cfs.
Off-line facility target flow:	0.0747 cfs.
Adjusted for 15 min:	0.0747 cfs.

Water Quality Flow Rate

LID Report

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

Model Default Modifications

Total of 0 changes have been made.

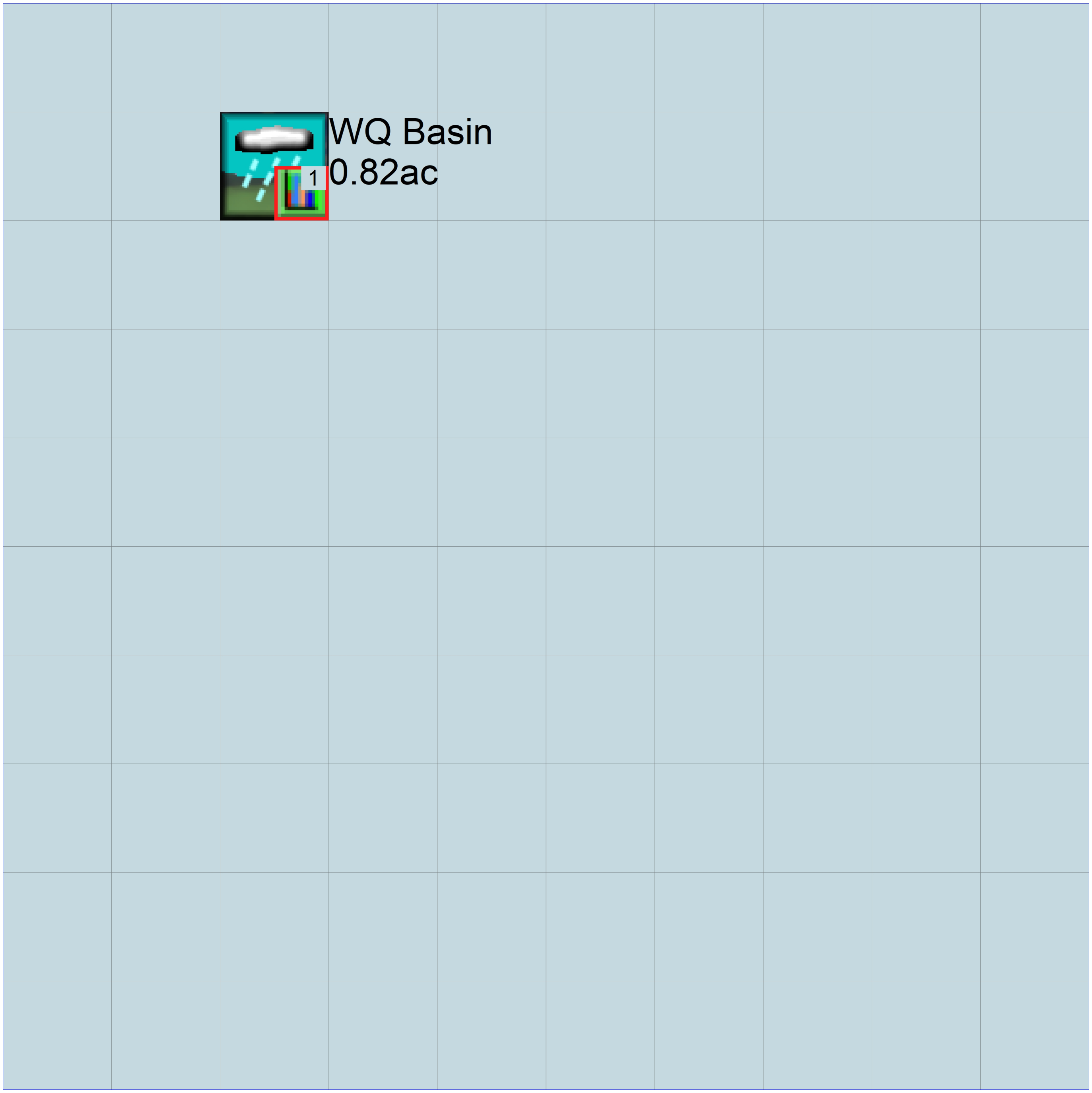
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

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   21730-WQ-2023-10-4.wdm
MESSU      25   Pre21730-WQ-2023-10-4.MES
           27   Pre21730-WQ-2023-10-4.L61
           28   Pre21730-WQ-2023-10-4.L62
           30   POC21730-WQ-2023-10-41.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        WQ Basin                    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#   ***
WQ Basin***
PERLND  10                        0.82     COPY   501     12
PERLND  10                        0.82     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   21730-WQ-2023-10-4.wdm
MESSU      25   Mit21730-WQ-2023-10-4.MES
           27   Mit21730-WQ-2023-10-4.L61
           28   Mit21730-WQ-2023-10-4.L62
           30   POC21730-WQ-2023-10-41.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        WQ Basin                    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           ***
  END GEN-INFO
  *** Section PWATER***

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

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

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

```
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  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
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         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    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
  END IWAT-PARM1

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

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

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

END IMPLND
```

```
SCHEMATIC
<-Source->                    <--Area-->     <-Target->   MBLK   ***
<Name>   #                    <-factor->     <Name>   #   Tbl#   ***
WQ Basin***
IMPLND   1                          0.82     COPY   501     15

******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     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
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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WWHM2012

PROJECT REPORT

Undercanopy Water Quality Flow Rate

General Model Information

WWHM2012 Project Name: 21730-WQ-2023-10-4-UNDERCANOPY

Site Name:	ARCO
Site Address:	
City:	PUYALLUP
Report Date:	1/12/2024
Gage:	42 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/01/27
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

WQ Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.11
Pervious Total	0.11
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.11

Mitigated Land Use

WQ Basin

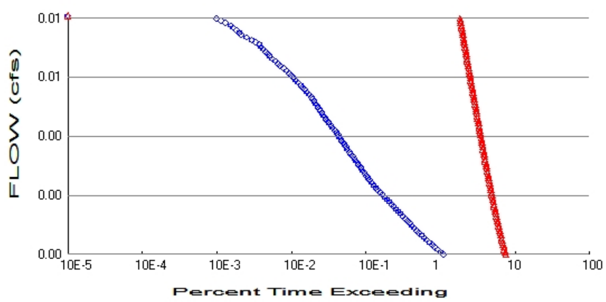
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.11
Impervious Total	0.11
Basin Total	0.11

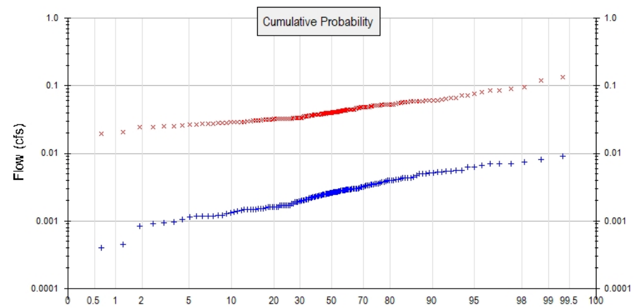
The WWHM calculation and water quality basin map on page 151 of the drainage report do not match. The on-site concrete and asphalt in itself is 5 times more area than what the WWHM calculation is showing. Confirm that the WWHM calculation matches the drainage report basin map and the civil plans. [drainage report, pg 128]

Routing Elements
Predeveloped Routing

Mitigated Routing

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area:	0.11
Total Impervious Area:	0

Mitigated Landuse Totals for POC #1

Total Pervious Area:	0
Total Impervious Area:	0.11

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.002649
5 year	0.004064
10 year	0.004933
25 year	0.005938
50 year	0.006618
100 year	0.007244

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.040285
5 year	0.053937
10 year	0.06384
25 year	0.077372
50 year	0.088217
100 year	0.099738

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.003	0.048
1903	0.002	0.053
1904	0.003	0.060
1905	0.001	0.027
1906	0.001	0.029
1907	0.004	0.040
1908	0.003	0.033
1909	0.003	0.041
1910	0.004	0.039
1911	0.003	0.044

1912	0.009	0.072
1913	0.004	0.032
1914	0.001	0.134
1915	0.002	0.027
1916	0.003	0.051
1917	0.001	0.021
1918	0.003	0.040
1919	0.002	0.025
1920	0.003	0.033
1921	0.003	0.029
1922	0.003	0.044
1923	0.002	0.031
1924	0.001	0.058
1925	0.002	0.025
1926	0.003	0.047
1927	0.002	0.040
1928	0.002	0.029
1929	0.004	0.057
1930	0.003	0.060
1931	0.003	0.029
1932	0.002	0.031
1933	0.002	0.031
1934	0.005	0.050
1935	0.002	0.028
1936	0.002	0.038
1937	0.004	0.050
1938	0.002	0.028
1939	0.000	0.033
1940	0.002	0.061
1941	0.002	0.061
1942	0.004	0.045
1943	0.002	0.044
1944	0.004	0.064
1945	0.003	0.048
1946	0.002	0.038
1947	0.001	0.029
1948	0.006	0.041
1949	0.005	0.062
1950	0.002	0.036
1951	0.002	0.054
1952	0.007	0.060
1953	0.007	0.055
1954	0.002	0.033
1955	0.002	0.031
1956	0.001	0.028
1957	0.003	0.033
1958	0.007	0.041
1959	0.004	0.040
1960	0.001	0.033
1961	0.004	0.091
1962	0.002	0.039
1963	0.001	0.029
1964	0.001	0.084
1965	0.005	0.038
1966	0.002	0.032
1967	0.002	0.045
1968	0.002	0.037
1969	0.002	0.034

1970	0.003	0.038
1971	0.005	0.037
1972	0.003	0.119
1973	0.004	0.072
1974	0.002	0.052
1975	0.005	0.053
1976	0.003	0.057
1977	0.001	0.024
1978	0.005	0.041
1979	0.001	0.044
1980	0.003	0.043
1981	0.003	0.042
1982	0.001	0.033
1983	0.004	0.044
1984	0.002	0.044
1985	0.003	0.050
1986	0.003	0.025
1987	0.005	0.046
1988	0.003	0.027
1989	0.003	0.029
1990	0.003	0.033
1991	0.003	0.047
1992	0.003	0.047
1993	0.004	0.052
1994	0.005	0.036
1995	0.001	0.028
1996	0.006	0.037
1997	0.003	0.033
1998	0.003	0.040
1999	0.000	0.044
2000	0.002	0.038
2001	0.001	0.032
2002	0.004	0.056
2003	0.003	0.032
2004	0.003	0.048
2005	0.005	0.094
2006	0.002	0.043
2007	0.002	0.049
2008	0.003	0.040
2009	0.002	0.030
2010	0.002	0.039
2011	0.002	0.039
2012	0.003	0.038
2013	0.002	0.036
2014	0.001	0.036
2015	0.002	0.060
2016	0.001	0.034
2017	0.004	0.059
2018	0.007	0.035
2019	0.007	0.052
2020	0.002	0.043
2021	0.004	0.036
2022	0.002	0.061
2023	0.003	0.076
2024	0.008	0.081
2025	0.003	0.040
2026	0.004	0.051
2027	0.002	0.048

2028	0.001	0.019
2029	0.003	0.031
2030	0.005	0.066
2031	0.002	0.020
2032	0.001	0.033
2033	0.002	0.041
2034	0.002	0.032
2035	0.006	0.040
2036	0.003	0.033
2037	0.001	0.044
2038	0.003	0.041
2039	0.000	0.084
2040	0.002	0.033
2041	0.002	0.041
2042	0.006	0.048
2043	0.003	0.053
2044	0.004	0.036
2045	0.003	0.029
2046	0.003	0.033
2047	0.002	0.040
2048	0.003	0.033
2049	0.003	0.049
2050	0.002	0.036
2051	0.003	0.051
2052	0.002	0.039
2053	0.003	0.033
2054	0.004	0.066
2055	0.001	0.039
2056	0.001	0.053
2057	0.002	0.026
2058	0.003	0.050
2059	0.004	0.061

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	**Predeveloped**	**Mitigated**
1	0.0091	0.1338
2	0.0082	0.1192
3	0.0074	0.0944
4	0.0071	0.0911
5	0.0070	0.0845
6	0.0069	0.0844
7	0.0066	0.0805
8	0.0063	0.0760
9	0.0062	0.0720
10	0.0056	0.0716
11	0.0056	0.0661
12	0.0055	0.0657
13	0.0054	0.0641
14	0.0053	0.0622
15	0.0053	0.0611
16	0.0052	0.0609
17	0.0052	0.0608
18	0.0051	0.0606
19	0.0050	0.0597
20	0.0050	0.0596
21	0.0047	0.0595
22	0.0044	0.0595

23	0.0044	0.0588
24	0.0044	0.0576
25	0.0043	0.0575
26	0.0043	0.0568
27	0.0042	0.0556
28	0.0041	0.0550
29	0.0041	0.0538
30	0.0040	0.0533
31	0.0040	0.0529
32	0.0040	0.0528
33	0.0040	0.0526
34	0.0038	0.0523
35	0.0038	0.0523
36	0.0038	0.0521
37	0.0036	0.0513
38	0.0036	0.0512
39	0.0036	0.0506
40	0.0035	0.0505
41	0.0035	0.0505
42	0.0035	0.0502
43	0.0034	0.0499
44	0.0034	0.0490
45	0.0033	0.0487
46	0.0033	0.0484
47	0.0033	0.0483
48	0.0032	0.0479
49	0.0031	0.0478
50	0.0031	0.0477
51	0.0031	0.0470
52	0.0030	0.0468
53	0.0030	0.0466
54	0.0030	0.0459
55	0.0030	0.0449
56	0.0030	0.0446
57	0.0030	0.0444
58	0.0029	0.0444
59	0.0029	0.0443
60	0.0029	0.0442
61	0.0029	0.0442
62	0.0029	0.0439
63	0.0029	0.0437
64	0.0029	0.0437
65	0.0029	0.0435
66	0.0029	0.0430
67	0.0028	0.0429
68	0.0028	0.0415
69	0.0027	0.0415
70	0.0027	0.0414
71	0.0027	0.0414
72	0.0027	0.0411
73	0.0027	0.0407
74	0.0027	0.0406
75	0.0027	0.0405
76	0.0027	0.0405
77	0.0026	0.0403
78	0.0026	0.0403
79	0.0026	0.0402
80	0.0026	0.0401

81	0.0026	0.0400
82	0.0025	0.0399
83	0.0025	0.0398
84	0.0025	0.0397
85	0.0025	0.0392
86	0.0025	0.0391
87	0.0025	0.0389
88	0.0025	0.0388
89	0.0025	0.0387
90	0.0024	0.0386
91	0.0024	0.0383
92	0.0024	0.0380
93	0.0024	0.0379
94	0.0023	0.0378
95	0.0023	0.0377
96	0.0023	0.0377
97	0.0023	0.0372
98	0.0023	0.0372
99	0.0023	0.0371
100	0.0022	0.0364
101	0.0022	0.0363
102	0.0022	0.0362
103	0.0022	0.0360
104	0.0021	0.0357
105	0.0021	0.0356
106	0.0020	0.0356
107	0.0020	0.0351
108	0.0020	0.0341
109	0.0020	0.0337
110	0.0020	0.0334
111	0.0020	0.0334
112	0.0019	0.0331
113	0.0019	0.0331
114	0.0019	0.0330
115	0.0018	0.0330
116	0.0018	0.0330
117	0.0017	0.0328
118	0.0017	0.0328
119	0.0017	0.0327
120	0.0017	0.0327
121	0.0017	0.0326
122	0.0017	0.0326
123	0.0017	0.0326
124	0.0016	0.0325
125	0.0016	0.0325
126	0.0016	0.0321
127	0.0016	0.0319
128	0.0016	0.0317
129	0.0016	0.0317
130	0.0015	0.0314
131	0.0015	0.0314
132	0.0015	0.0311
133	0.0015	0.0309
134	0.0015	0.0309
135	0.0015	0.0305
136	0.0015	0.0295
137	0.0015	0.0295
138	0.0015	0.0294

139	0.0014	0.0293
140	0.0014	0.0288
141	0.0013	0.0288
142	0.0013	0.0287
143	0.0013	0.0286
144	0.0012	0.0284
145	0.0012	0.0280
146	0.0012	0.0276
147	0.0012	0.0275
148	0.0012	0.0274
149	0.0012	0.0269
150	0.0011	0.0267
151	0.0011	0.0259
152	0.0010	0.0253
153	0.0009	0.0253
154	0.0009	0.0247
155	0.0008	0.0245
156	0.0004	0.0206
157	0.0004	0.0197
158	0.0002	0.0191

Duration Flows

The Duration Matching Failed

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0013	60110	414175	689	Fail
0.0014	55107	406087	736	Fail
0.0014	50392	398109	790	Fail
0.0015	46232	390464	844	Fail
0.0015	42359	383095	904	Fail
0.0016	39008	376060	964	Fail
0.0016	35999	369190	1025	Fail
0.0017	33296	362597	1089	Fail
0.0018	30697	356060	1159	Fail
0.0018	28343	349966	1234	Fail
0.0019	26326	343983	1306	Fail
0.0019	24515	338166	1379	Fail
0.0020	22781	332515	1459	Fail
0.0020	21246	327030	1539	Fail
0.0021	19833	321435	1620	Fail
0.0021	18537	316227	1705	Fail
0.0022	17202	310964	1807	Fail
0.0022	16011	306199	1912	Fail
0.0023	14930	301324	2018	Fail
0.0023	13900	296615	2133	Fail
0.0024	12991	292072	2248	Fail
0.0024	12133	287529	2369	Fail
0.0025	11324	283263	2501	Fail
0.0026	10593	278887	2632	Fail
0.0026	9861	274843	2787	Fail
0.0027	9174	270798	2951	Fail
0.0027	8543	266920	3124	Fail
0.0028	7961	262987	3303	Fail
0.0028	7435	259275	3487	Fail
0.0029	6947	255452	3677	Fail
0.0029	6554	251796	3841	Fail
0.0030	6199	248195	4003	Fail
0.0030	5895	244649	4150	Fail
0.0031	5573	241214	4328	Fail
0.0031	5275	237890	4509	Fail
0.0032	5012	234566	4680	Fail
0.0032	4761	231187	4855	Fail
0.0033	4528	228084	5037	Fail
0.0034	4290	224871	5241	Fail
0.0034	4072	221769	5446	Fail
0.0035	3861	218666	5663	Fail
0.0035	3656	215619	5897	Fail
0.0036	3442	212683	6179	Fail
0.0036	3283	209802	6390	Fail
0.0037	3124	206921	6623	Fail
0.0037	2976	204151	6859	Fail
0.0038	2829	201381	7118	Fail
0.0038	2683	198722	7406	Fail
0.0039	2575	195952	7609	Fail
0.0039	2452	193404	7887	Fail
0.0040	2359	190911	8092	Fail
0.0041	2239	188362	8412	Fail
0.0041	2140	185869	8685	Fail
0.0042	1991	183376	9210	Fail

0.0042	1869	180994	9684	Fail
0.0043	1757	178556	10162	Fail
0.0043	1673	176229	10533	Fail
0.0044	1583	173958	10989	Fail
0.0044	1506	171742	11403	Fail
0.0045	1429	169526	11863	Fail
0.0045	1354	167310	12356	Fail
0.0046	1295	165149	12752	Fail
0.0046	1234	162989	13208	Fail
0.0047	1181	160883	13622	Fail
0.0047	1119	158723	14184	Fail
0.0048	1072	156673	14615	Fail
0.0049	1026	154679	15075	Fail
0.0049	967	152629	15783	Fail
0.0050	895	150634	16830	Fail
0.0050	834	148695	17829	Fail
0.0051	781	146756	18790	Fail
0.0051	735	144873	19710	Fail
0.0052	678	142989	21089	Fail
0.0052	631	141216	22379	Fail
0.0053	589	139333	23655	Fail
0.0053	555	137504	24775	Fail
0.0054	510	135732	26614	Fail
0.0054	475	134014	28213	Fail
0.0055	430	132241	30753	Fail
0.0055	389	130579	33567	Fail
0.0056	367	128862	35112	Fail
0.0057	340	127255	37427	Fail
0.0057	304	125593	41313	Fail
0.0058	280	123987	44281	Fail
0.0058	265	122435	46201	Fail
0.0059	247	120940	48963	Fail
0.0059	233	119388	51239	Fail
0.0060	218	117893	54079	Fail
0.0060	205	116341	56751	Fail
0.0061	182	114846	63102	Fail
0.0061	161	113350	70403	Fail
0.0062	139	111909	80510	Fail
0.0062	117	110524	94464	Fail
0.0063	110	109084	99167	Fail
0.0064	101	107699	106632	Fail
0.0064	92	106369	115618	Fail
0.0065	85	104984	123510	Fail
0.0065	72	103655	143965	Fail
0.0066	62	102436	165219	Fail
0.0066	54	101106	187233	Fail

These flows appear to be conveyed to CB #1 rather than CB #4. [drainage report, sheet 133 of 365]

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

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.0122 acre-feet
On-line facility target flow:	0.0172 cfs.
Adjusted for 15 min:	0.0172 cfs.
Off-line facility target flow:	0.01 cfs.
Adjusted for 15 min:	0.01 cfs.

Water Quality Flow Rate

LID Report

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

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic

Mitigated Schematic

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   21730-WQ-2023-10-4-UNDERCANOPY.wdm
MESSU      25   Pre21730-WQ-2023-10-4-UNDERCANOPY.MES
           27   Pre21730-WQ-2023-10-4-UNDERCANOPY.L61
           28   Pre21730-WQ-2023-10-4-UNDERCANOPY.L62
           30   POC21730-WQ-2023-10-4-UNDERCANOPY1.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        WQ Basin                   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#   ***
WQ Basin***
PERLND  10                        0.11     COPY   501     12
PERLND  10                        0.11     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   21730-WQ-2023-10-4-UNDERCANOPY.wdm
MESSU      25   Mit21730-WQ-2023-10-4-UNDERCANOPY.MES
           27   Mit21730-WQ-2023-10-4-UNDERCANOPY.L61
           28   Mit21730-WQ-2023-10-4-UNDERCANOPY.L62
           30   POC21730-WQ-2023-10-4-UNDERCANOPY1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND       1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        WQ Basin                    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           ***
  END GEN-INFO
  *** Section PWATER***

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

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

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

```
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  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
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         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
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         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
  END IWAT-PARM2

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

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

END IMPLND
```

```
SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
WQ Basin***
IMPLND   1                        0.11     COPY   501     15

******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     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
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       15
IMPLND     IWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   15


END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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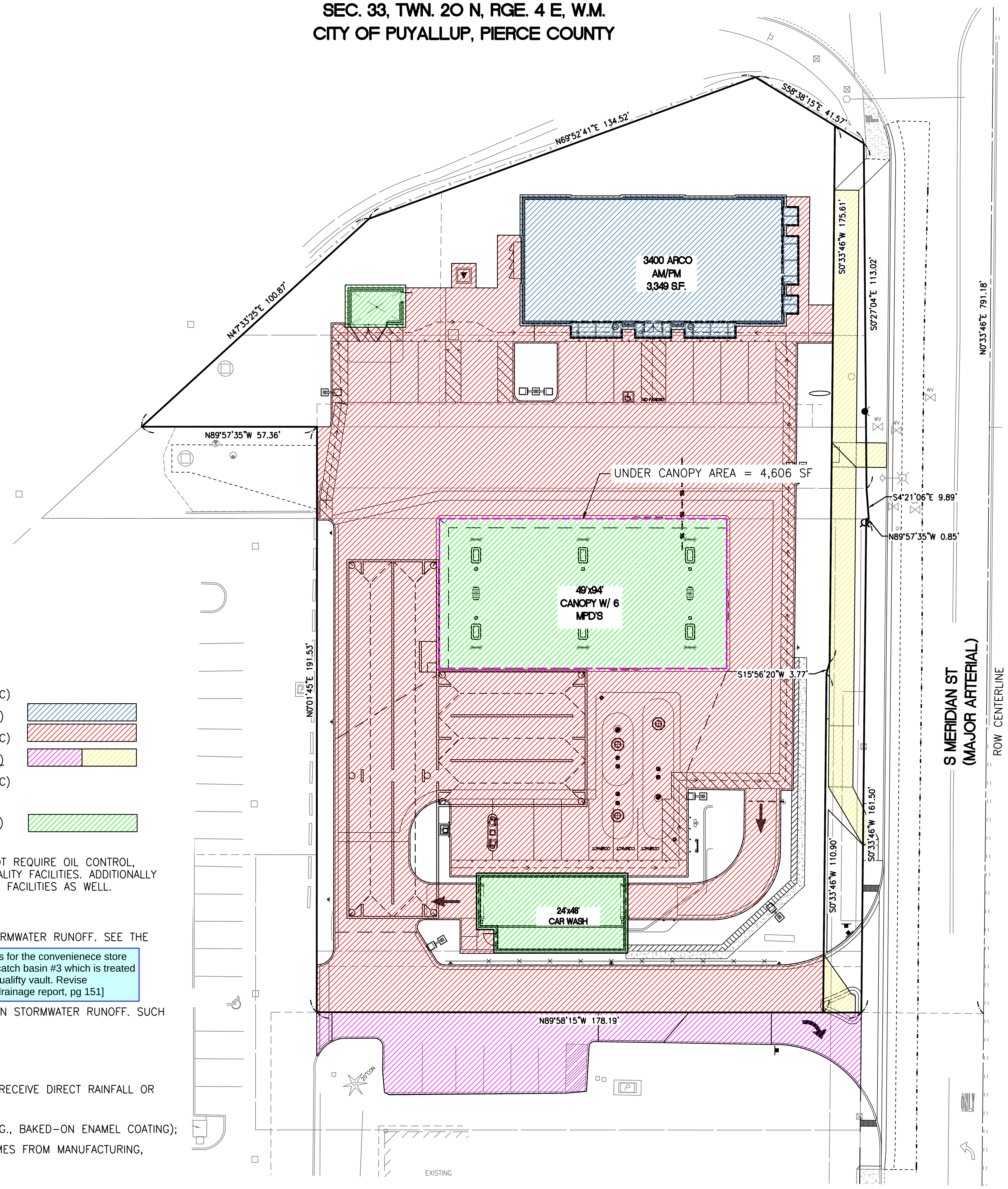
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

Figure 5.6.2 WQ Facility Calculation Package

WATER QUALITY BASIN MAP
FOR
ARCO ampm PUYALLUP
SEC. 33, TWN. 20 N, RGE. 4 E, W.M.
CITY OF PUYALLUP, PIERCE COUNTY



N

SCALE: 1"=20'

Revise flow control trade per separate TDA markup. [drainage report, pg 151]

WATER QUALITY BASIN MAP

ON-SITE HARD SURFACES ROUTED TO WATER QUALITY FACILITY	30,697 SF (0.71 AC)	
ROOF	4,036 SF (0.09 AC)	(blue hatch)
CONCRETE/ASPHALT PAVEMENT	26,661 SF (0.61 AC)	(red hatch)
OFF-SITE HARD SURFACES ROUTED TO WATER QUALITY FACILITY	4,971 SF (0.11 AC)	(magenta/yellow hatch)
TOTAL AREA	35,668 SF (0.82 AC)	
ON-SITE HARD SURFACES BY-PASSING THE WATER QUALITY FACILITY*	6,129 SF (0.14 AC)	(green hatch)

*PER THE DEFINITION OF PGHS THE PROPOSED ROOF TOPS ARE NOT A PGHS AND WILL NOT REQUIRE OIL CONTROL, THEREFORE THE CARWASH AND FUEL CANOPY ROOF RUNOFF WILL BY PASS THE WATER QUALITY FACILITIES. ADDITIONALLY THE TRASH ENCLOSURE WILL DRAIN TO THE SANITARY SEWER, BY PASS THE WATER QUALITY FACILITIES AS WELL.

POLLUTION-GENERATING HARD SURFACE (PGHS)

THOSE HARD SURFACES CONSIDERED TO BE A SIGNIFICANT SOURCE OF POLLUTANTS IN STORMWATER RUNOFF. SEE THE LISTING OF SURFACES UNDER POLLUTION-GENERATING IMPERVIOUS SURFACE

The roof drains for the convenienece store are routed to catch basin #3 which is treated by the water qualifty vault. Revise accordingly. [drainage report, pg 151]

POLLUTION-GENERATING IMPERVIOUS SURFACE (PGIS):

THOSE IMPERVIOUS SURFACES CONSIDERED TO BE A SIGNIFICANT SOURCE OF POLLUTANTS IN STORMWATER RUNOFF. SUCH SURFACES INCLUDE THOSE WHICH ARE SUBJECT TO ANY OF THE FOLLOWING:

1. VEHICULAR USE;
2. INDUSTRIAL ACTIVITIES (AS FURTHER DEFINED IN THIS GLOSSARY);
3. STORAGE OF ERODIBLE OR LEACHABLE MATERIALS, WASTES, OR CHEMICALS, AND WHICH RECEIVE DIRECT RAINFALL OR THE RUN-ON OR BLOW-IN OF RAINFALL;
4. METAL ROOFS UNLESS THEY ARE COATED WITH AN INERT, NON-LEACHABLE MATERIAL (E.G., BAKED-ON ENAMEL COATING);
5. ROOFS THAT ARE SUBJECT TO VENTING SIGNIFICANT AMOUNTS OF DUSTS, MISTS, OR FUMES FROM MANUFACTURING, COMMERCIAL, OR OTHER INDOOR ACTIVITIES.

CLIENT:
bp
ARCO
BP WEST COAST PRODUCTS, LLC

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

NO.	DATE	REVISION DESCRIPTION
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

SEAL:
ALEX WHITE
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER
Not for Construction
10/4/23

DEVELOPMENT INFORMATION:
ARCO NTI
3400 am/pm
FUEL CANOPY w/ 6 MPD's

SITE ADDRESS:
SWC S MERIDIAN
@ HIGHWAY 512
PUYALLUP, WASHINGTON

FACILITY #TBD

DESIGNED BY:	MM	ALLIANCE Z&DM:	
CHECKED BY:	AW	BP REPM:	
DRAWN BY:	MM	ALLIANCE PM:	
VERSION:	- -	PROJECT NO:	21730

DRAWING TITLE:
WATER QUALITY BASIN MAP

SHEET NO:
1 OF 1

P:\21000s\21730\exhibit\21730-WQ MAP.dwg 1/12/2024 11:57 AM JFLEHARTY

FLOW-SPLITTER ORIFICE SIZING CALCULATIONS

Project Name:	Puyallup ARCO	**Date:**	10/04/23
Street Location:	1402 S Meridian	**Our Job No.:**	21730
Municipality:	City of Puyallup		
Engineer:	Nick Schartman		

$Q = CA\sqrt{2gh}$

Q (cfs) =	0.0747	Water Quality Flow Rate (offline rate WWHM2012)
h (feet)=	0.5	(Head on Orifice)
C=	0.62	(Plate Orifice)

$$A = \frac{Q}{CA\sqrt{2gh}}$$

$$A = \frac{0.0747}{(0.62\sqrt{(2)(32.2)(.5)})} \qquad 0.0212 \qquad 3.057 \qquad in^2$$

Circular Orifice

$$A = \frac{\pi D^2}{4}$$

$$D = (4(A) / \pi)^{1/2}$$

1.97 " Ø

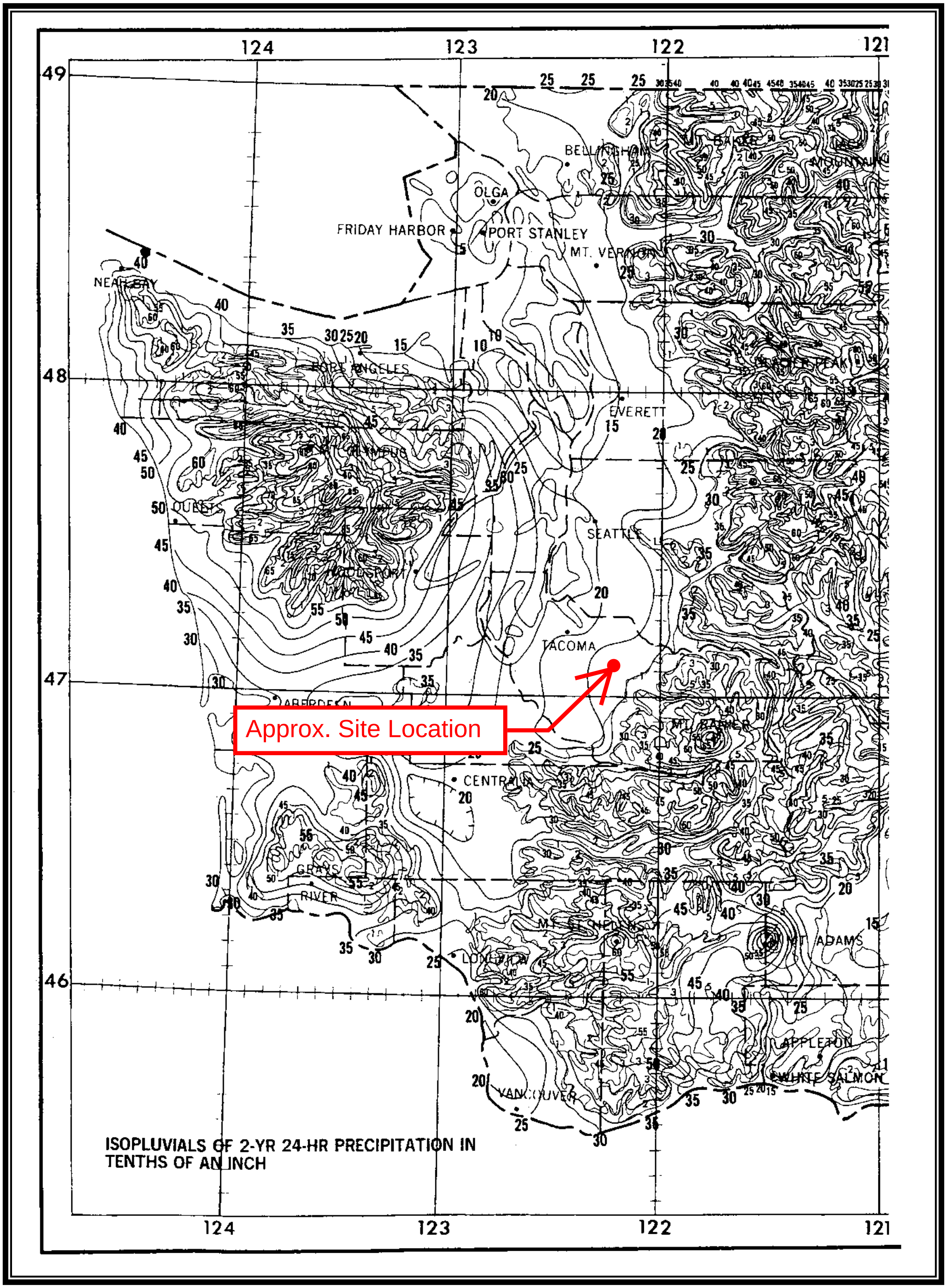
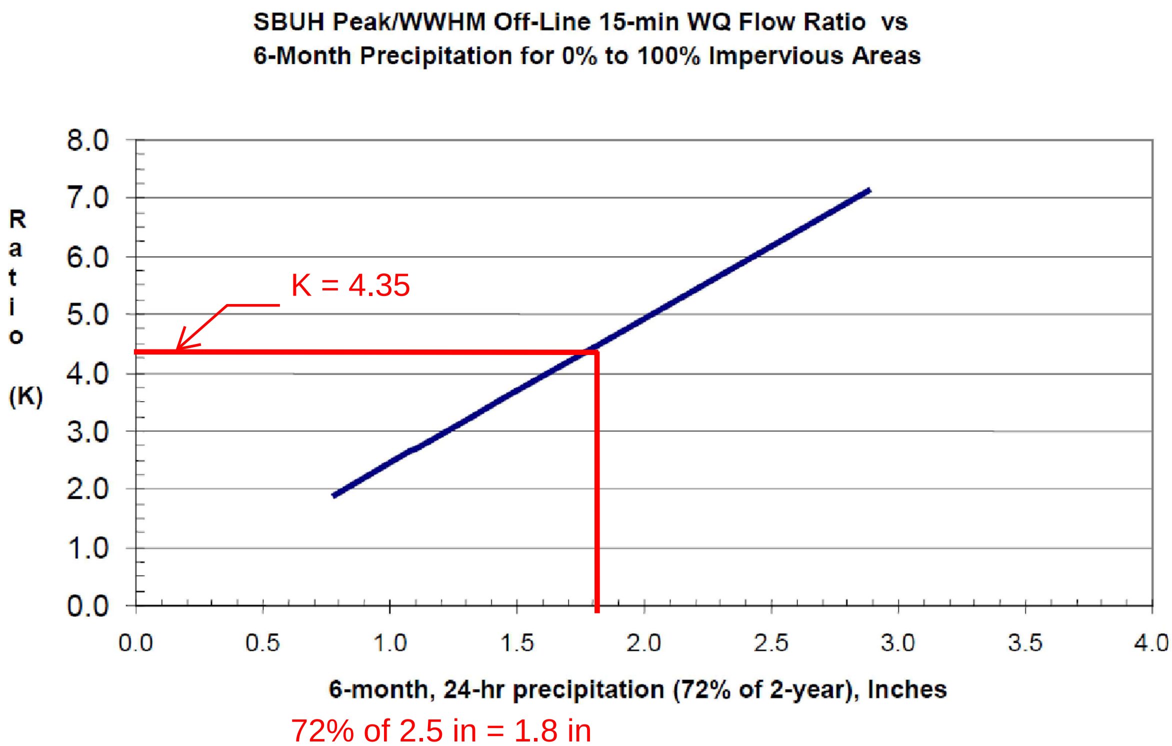


Figure 6A.1. Western Washington Isopluvial 2-Year, 24-Hour.

Figure V-7.8: Ratio of SBUH Peak/WQ Flow (Offline)



NOT TO SCALE

DEPARTMENT OF ECOLOGY
State of Washington

Ratio of SBUH Peak/WQ Flow (Offline)

Revised June 2016

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OVERALL SITE

OIL/WATER SEPARATOR SIZING CALCULATIONS

Project Name: Arco Puyallup

Date: 01/12/24

Site Location: 1402 S Meridian

Our Job No.: 21730

Municipality: City of Puyallup

Engineer: James Fleharty

Sizing per 2019 DOE Stormwater Management Manual for Western Washington
Section 6.6.2.1, page 6-144

Specific Gravity of Water, S_w =	1.0	
Specific Gravity of Oil, S_o =	0.85	
Absolute Viscosity of Water, μ =	0.015674	
Water Quality Design Flow Rate, Q =	0.0747	CFS
k =	4.35	
Adjusted Water Quality Flow Rate(Q * k)	19.4967	CFM
Required Effective Plate Area of Surface Media, A_h =	527.79	SF

Use OldCastle Precast Oil Water Separator 577-CPS (Plate Area = 592 SF)

UNDER CANOPY

OIL/WATER SEPARATOR SIZING CALCULATIONS

Project Name: Arco Puyallup

Date: 01/12/24

Site Location: 1402 S Meridian

Our Job No.: 21730

Municipality: City of Puyallup

Engineer: James Fleharty

There isn't a section 6.6.2.1 or page 6-144 within the 2019 DOE manual, provide updated reference. [drainage report, pg 156]

Sizing per 2019 DOE Stormwater Management Manual for Western Washington
Section 6.6.2.1, page 6-144

Specific Gravity of Water, S_w =	1.0	
Specific Gravity of Oil, S_o =	0.85	
Absolute Viscosity of Water, μ =	0.015674	
Water Quality Design Flow Rate, Q =	0.01	CFS
k =	4.35	
Adjusted Water Quality Flow Rate(Q * k)	2.61	CFM
Required Effective Plate Area of Surface Media, A_h =	70.65	SF

Use OldCastle Precast Oil Water Separator 660-CPS (Plate Area = 444 SF)

MWS Sizing Letter

Prepared by Jordan Drugge on October 5, 2023

Arco AM/PM - Puyallup (BCE #21730)
Puyallup, WA

This unit is sized as MWS-L-6-8-V-UG

Structure ID	MWS L-6-8-V-UG
Water Quality Flow Rate (cfs)	0.0747
Peak Flow Rate (cfs)	0.8523
Pre-Filter cartridges	1.5
Surface Area per Cartridge (sf)	25.6
Loading Rate (Pre-Filter) (gpm/sq ft)	0.9
Loading Rate (Wetland Media) (gpm/sf)	1.0

Additional Information provided:
- Rim to Outlet Elevation- 4.36'
- Piped inlet
- Internal Bypass
- HS-20 Loading (assumed)

The Modular Wetlands System (MWS) Linear units for this project are sized in accordance with the Washington State Technological Assessment Protocol – Ecology (TAPE) General Use Level Designation (GULD) approval. The MWS wetland media is approved at a loading rate of less or equal to 1 gpm/sq ft of surface area, and the prefilters are approved at a loading rate of 2.1 gpm/sq ft or less of surface area. The MWS Linear has GULD designation at these loading rates for total suspended solids (basic), phosphorous, and dissolved metals (enhanced). For this project, the design, sizing, and loading are all confirmed by a Contech representative to ensure the systems are sized appropriately.

Figure 5.6.3
GULD Approval –
Modular Wetland Unit

November 2022

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) ENHANCED AND PHOSPHORUS TREATMENT

For

Contech Engineered Solutions, LLC (Contech) Modular Wetlands Linear

Ecology's Decision

Based on Modular Wetland Systems, Inc, application submissions, including the Technical Evaluation Report, dated April 1, 2014, Ecology hereby issues the following use level designation:

1. General Use Level Designation (GULD) for the Modular Wetlands Linear Stormwater Treatment System for Basic, Phosphorus, and Enhanced treatment
   - Sized at a hydraulic loading rate of:
     - 1 gallon per minute (gpm) per square foot (sq ft) of Wetland Cell Surface Area
     - Prefilter box (approved at either 22 inches or 33 inches tall)
       - 3.0 gpm/sq ft of prefilter box surface area for moderate pollutant loading rates (low to medium density residential basins).
       - 2.1 gpm/sq ft of prefilter box surface area for high pollutant loading rates (commercial and industrial basins).
2. Ecology approves the Modular Wetlands Linear Stormwater Treatment System units for Basic, Phosphorus, and Enhanced treatment at the hydraulic loading rate listed above. Designers shall calculate the water quality design flow rates using the following procedures:
   - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute water quality treatment design flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology- approved continuous runoff model.

- Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute water quality treatment design flow rate as calculated using one of the three methods described in Chapter 2.7.6 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
- Entire State: For treatment installed downstream of detention, the water quality treatment design flow rate is the full 2-year release rate of the detention facility.

3. These use level designations have no expiration date but may be amended or revoked by Ecology, and are subject to the conditions specified below.

Ecology's Conditions of Use

Applicants shall comply with the following conditions:

1) Design, assemble, install, operate, and maintain the Modular Wetlands Linear Stormwater Treatment System units, in accordance with Contech's. applicable manuals and documents and the Ecology Decision.
2) Each site plan must undergo Contech review and approval before site installation. This ensures that site grading and slope are appropriate for use of a Modular Wetlands Linear Stormwater Treatment System unit.
3) Modular Wetlands Linear Stormwater Treatment System media shall conform to the specifications submitted to and approved by Ecology.
4) The applicant tested the Modular Wetlands Linear Stormwater Treatment System with an external bypass weir. This weir limited the depth of water flowing through the media, and therefore the active treatment area, to below the root zone of the plants. This GULD applies to Modular Wetlands Linear Stormwater Treatment Systems whether plants are included in the final product or not.
5) Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of stormwater treatment technology.
    - Typically, Contech designs Modular Wetland systems for a target prefilter media life of 6 to 12 months.
    - Indications of the need for maintenance include effluent flow decreasing to below the design flow rate or decrease in treatment below required levels.
    - Owners/operators must inspect Modular Wetland systems for a minimum of twelve months from the start of post-construction operation to determine site-specific maintenance schedules and requirements. You must conduct inspections monthly during the wet season, and every other month during the dry season (According to the SWMMWW, the wet season in western Washington is October 1 to April 30. According to the SWMMEW, the wet

season in eastern Washington is October 1 to June 30). After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.

- Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flowrate and/or a decrease in pollutant removal ability.
- When inspections are performed, the following findings typically serve as maintenance triggers:
  - Standing water remains in the vault between rain events, or
  - Bypass occurs during storms smaller than the design storm.
  - If excessive floatables (trash and debris) are present (but no standing water or excessive sedimentation), perform a minor maintenance consisting of gross solids removal, not prefilter media replacement.
  - Additional data collection will be used to create a correlation between pretreatment chamber sediment depth and pre-filter clogging (see *Issues to be Addressed by the Company* section below)

6) Discharges from the Modular Wetlands Linear Stormwater Treatment System units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant:	Contech Engineered Solutions, LLC
Applicant's Address:	11815 NE Glenn Widing Dr. Portland, OR 97220

Application Documents:

Original Application for Conditional Use Level Designation, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., January 2011

Quality Assurance Project Plan: Modular Wetland System – Linear Treatment System Performance Monitoring Project, draft, January 2011

Revised Application for Conditional Use Level Designation, Modular Wetland System, Linear Stormwater Filtration System Modular Wetland Systems, Inc., May 2011

Memorandum: Modular Wetland System-Linear GULD Application Supplementary Data, April 2014

Technical Evaluation Report: Modular Wetland System Stormwater Treatment System Performance Monitoring, April 2014

Applicant's Use Level Request:

- General Use Level Designation as a Basic, Enhanced, and Phosphorus treatment device in accordance with Ecology's Guidance for Evaluating Emerging Stormwater Treatment Technologies Technology Assessment Protocol – Ecology (TAPE) January 2011 Revision.

Applicant's Performance Claims:

- The Modular Wetlands Linear is capable of removing a minimum of 80-percent of TSS from stormwater with influent concentrations between 100 and 200 mg/L.
- The Modular Wetlands Linear is capable of removing a minimum of 50-percent of total phosphorus from stormwater with influent concentrations between 0.1 and 0.5 mg/L.
- The Modular Wetlands Linear is capable of removing a minimum 30-percent of dissolved copper from stormwater with influent concentrations between 0.005 and 0.020 mg/L.
- The Modular Wetlands Linear is capable of removing a minimum 60-percent of dissolved zinc from stormwater with influent concentrations between 0.02 and 0.30 mg/L.

Ecology's Recommendations:

- Contech has shown Ecology, through laboratory and field-testing, that the Modular Wetlands Linear Stormwater Treatment System filter system is capable of attaining Ecology's Basic, Phosphorus, and Enhanced treatment goals.

Findings of Fact:

<u>Laboratory Testing</u>

The Modular Wetlands Linear Stormwater Treatment System has the:

- Capability to remove 99 percent of total suspended solids (using Sil-Co-Sil 106) in a quarter-scale model with influent concentrations of 270 mg/L.
- Capability to remove 91 percent of total suspended solids (using Sil-Co-Sil 106) in laboratory conditions with influent concentrations of 84.6 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 93 percent of dissolved Copper in a quarter-scale model with influent concentrations of 0.757 mg/L.
- Capability to remove 79 percent of dissolved Copper in laboratory conditions with influent concentrations of 0.567 mg/L at a flow rate of 3.0 gpm per square foot of media.

- Capability to remove 80.5-percent of dissolved Zinc in a quarter-scale model with influent concentrations of 0.95 mg/L at a flow rate of 3.0 gpm per square foot of media.
- Capability to remove 78-percent of dissolved Zinc in laboratory conditions with influent concentrations of 0.75 mg/L at a flow rate of 3.0 gpm per square foot of media.

Field Testing

- Modular Wetland Systems, Inc. conducted monitoring of an MWS-Linear (Model # MWS-L-4-13) from April 2012 through May 2013, at a transportation maintenance facility in Portland, Oregon. The manufacturer collected flow-weighted composite samples of the system's influent and effluent during 28 separate storm events. The system treated approximately 75 percent of the runoff from 53.5 inches of rainfall during the monitoring period. The applicant sized the system at 1 gpm/sq ft. (wetland media) and 3gpm/sq ft. (prefilter).
- Influent TSS concentrations for qualifying sampled storm events ranged from 20 to 339 mg/L. Average TSS removal for influent concentrations greater than 100 mg/L (n=7) averaged 85 percent. For influent concentrations in the range of 20-100 mg/L (n=18), the upper 95 percent confidence interval about the mean effluent concentration was 12.8 mg/L.
- Total phosphorus removal for 17 events with influent TP concentrations in the range of 0.1 to 0.5 mg/L averaged 65 percent. A bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean total phosphorus reduction was 58 percent.
- The lower 95 percent confidence limit of the mean percent removal was 60.5 percent for dissolved zinc for influent concentrations in the range of 0.02 to 0.3 mg/L (n=11). The lower 95 percent confidence limit of the mean percent removal was 32.5 percent for dissolved copper for influent concentrations in the range of 0.005 to 0.02 mg/L (n=14) at flow rates up to 28 gpm (design flow rate 41 gpm). Laboratory test data augmented the data set, showing dissolved copper removal at the design flow rate of 41 gpm (93 percent reduction in influent dissolved copper of 0.757 mg/L).

Issues to be addressed by the Company:

1. Contech should collect maintenance and inspection data for the first year on all installations in the Northwest in order to assess standard maintenance requirements for various land uses in the region. Contech should use these data to establish required maintenance cycles.
2. Contech should collect pre-treatment chamber sediment depth data for the first year of operation for all installations in the Northwest. Contech will use these data to create a correlation between sediment depth and pre-filter clogging.

Technology Description:
Download at https://www.conteches.com/modular-wetlands

Contact Information:

Applicant: Jeremiah Lehman
Contech Engineered Solutions, LLC
11815 NE Glenn Widing Dr.
Portland, OR 97220
Jeremiah.Lehman@ContechES.com

Applicant website: http://www.conteches.com

Ecology web link: http://www.ecy.wa.gov/programs/wg/stormwater/newtech/index.html

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 870-0983
douglas.howie@ecy.wa.gov

Revision History

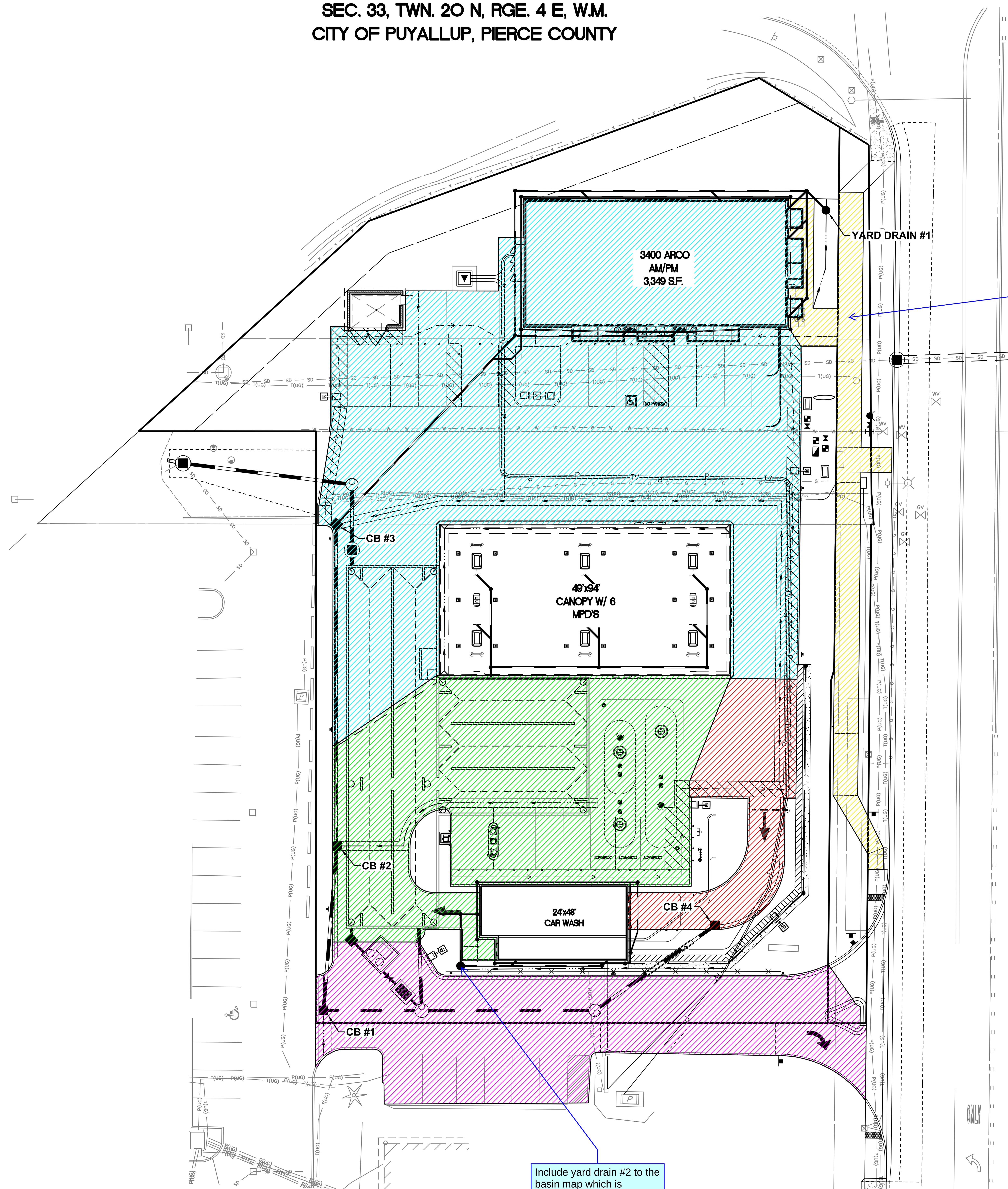
Date	Revision
June 2011	Original use-level-designation document
September 2012	Revised dates for TER and expiration
January 2013	Modified Design Storm Description, added Revision Table, added maintenance discussion, modified format in accordance with Ecology standard
December 2013	Updated name of Applicant
April 2014	Approved GULD designation for Basic, Phosphorus, and Enhanced treatment
December 2015	Updated GULD to document the acceptance of MWS – Linear Modular Wetland installations with or without the inclusion of plants
July 2017	Revised Manufacturer Contact Information (name, address, and email)
December 2019	Revised Manufacturer Contact Address
July 2021	Added additional prefilter sized at 33 inches
August 2021	Changed “Prefilter” to “Prefilter box”
November 2022	Changed Contacts to Contech ES

Figure 5.7.1 Pipe Conveyance Calculations

PIPE CONVEYANCE BASINS

CB #1	6,033 SF (0.14 AC)	
CB #2	8,267 SF (0.19 AC)	
CB #3	17,237 SF (0.40 AC)	
CB #4	2,049 SF (0.06 AC)	
YARD DRAIN	2,186 SF (0.05 AC)	

PIPE CONVEYANCE BASINS
FOR
ARCO ampm PUYALLUP
SEC. 33, TWN. 20 N, RGE. 4 E, W.M.
CITY OF PUYALLUP, PIERCE COUNTY



Public stormwater must be mitigated independently from private stormwater revise the sidewalk in the Meridian from flowing to yard drain #1. [drainage report, pg 166]

Include yard drain #2 to the basin map which is collecting runoff from the south side of the proposed car wash via landscape swale. [civils, pg 166]

CLIENT:

bp

ARCO
BP WEST COAST PRODUCTS, LLC

Barghausen
Consulting Engineers, Inc.

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

NO.	DATE	REVISION DESCRIPTION
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

SEAL:

ALEX WHITE
STATE OF WASHINGTON
REGISTERED PROFESSIONAL ENGINEER
Not for Construction

10/4/23

DEVELOPMENT INFORMATION:

ARCO NTI
3400 am/pm
FUEL CANOPY w/ 6 MPD's

SITE ADDRESS:

SWC S MERIDIAN
@ HIGHWAY 512
PUYALLUP, WASHINGTON

FACILITY #TBD

DESIGNED BY:	MM	ALLIANCE Z&OM:	
CHECKED BY:	AW	BP REPM:	
DRAWN BY:	MM	ALLIANCE PM:	
VERSION:	-	PROJECT NO:	21730

DRAWING TITLE:
PIPE CONVEYANCE BASINS

SHEET NO:
1 OF 1

P:\21000s\21730\engineering\SSA\21730-SSA.dwg 1/12/2024 11:18 AM JFLEHARTY

Pipe Conveyance Calculations

Autodesk® Storm and Sanitary Analysis 2024 - Version 13.6.268 (Build 0)

****
Project Description
****

File Name .... 21730-Submerged Pipe.SPF

****
Analysis Options
****

Flow Units .... cfs
Subbasin Hydrograph Method. Santa Barbara UH
Time of Concentration...... SCS TR-55
Link Routing Method .... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date SEP-27-2023 00:00:00
Ending Date SEP-28-2023 00:00:00
Report Time Step 00:00:10

****
Element Count
****

Number of rain gages 1
Number of subbasins 5
Number of nodes 11
Number of links 10

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	100-Year	CUMULATIVE	15.00

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Imperv. Area %	Raingage
Sub-CB #1	0.14	100.00	Rain Gage-01
Sub-CB #2	0.19	100.00	Rain Gage-01
Sub-CB #3	0.40	100.00	Rain Gage-01
Sub-CB #4	0.06	100.00	Rain Gage-01
Sub-YARD DRAIN #1	0.05	100.00	Rain Gage-01

The plans show this IE at 43.62'.
[drainage report, pg 168]

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
CB #1	JUNCTION	43.92	46.80	0.00	
CB #2	JUNCTION	44.19	47.38	0.00	
CB #3	JUNCTION	44.71	46.71	0.00	
CB #4	JUNCTION	43.64	47.64	0.00	

CB #2 is shown as 43.89
for the civil plans.
[civils, pg 168]

CB #3 ie is 44.41 revise accordingly.
[drainage report, pg 168]

SDCO #1	JUNCTION	45.54	49.52	0.00
SDCO #2	JUNCTION	46.03	48.09	0.00
SDCO #3	JUNCTION	46.97	49.39	0.00
SDMH #3	JUNCTION	43.12	47.63	0.00
SDMH #5	JUNCTION	43.40	51.19	0.00
YARD DRAIN #1	JUNCTION	47.06	49.22	0.00
Out-1Pipe - (49)	OUTFALL	44.48	45.14	0.00

Indicate the pipe links/nodes within the pipe conveyance basin map. [drainage report, pg 169]

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
Link-01	SDMH #5	SDMH #3	CONDUIT	56.1	0.5032	0.0150
Pipe - (42)	SDCO #3	SDCO #2	CONDUIT	94.4	1.0000	0.0140
Pipe - (43)	YARD DRAIN #1	SDCO #3	CONDUIT	8.8	1.0000	0.0140
Pipe - (44)	SDCO #2	SDCO #1	CONDUIT	49.0	1.0000	0.0140
Pipe - (45)	SDCO #1	CB #3	CONDUIT	82.8	1.0000	0.0120
Pipe - (46)	CB #3	CB #2	CONDUIT	104.0	0.5000	0.0140
Pipe - (47)	CB #2	CB #1	CONDUIT	53.4	0.5000	0.0140
Pipe - (48)	CB #1	SDMH #3	CONDUIT	30.8	2.1399	0.0140
Pipe - (49)	SDMH #3	Out-1Pipe - (49)	CONDUIT	4.9	0.5000	0.0140
Pipe - (55)	CB #4	SDMH #5	CONDUIT	47.6	0.5000	0.0140

The nodes in this model don't appear to match the civil plans. SDMH#5 doesn't exist. SDMH#3 does not discharge to the outlet pipe. [drainage report, pg 169]

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
Link-01	CIRCULAR	1.00	1.00	1	0.79	0.25	2.19
Pipe - (42)	CIRCULAR	0.50	0.50	1	0.20	0.13	0.52
Pipe - (43)	CIRCULAR	0.50	0.50	1	0.20	0.13	0.52
Pipe - (44)	CIRCULAR	0.50	0.50	1	0.20	0.13	0.52
Pipe - (45)	CIRCULAR	1.00	1.00	1	0.79	0.25	3.86
Pipe - (46)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.34
Pipe - (47)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.34
Pipe - (48)	CIRCULAR	1.00	1.00	1	0.79	0.25	4.84
Pipe - (49)	CIRCULAR	0.67	0.67	1	0.35	0.17	0.79
Pipe - (55)	CIRCULAR	1.00	1.00	1	0.79	0.25	2.34

************************* Runoff Quantity Continuity *************************	Volume acre-ft	Depth inches
Total Precipitation	0.282	4.031

```
Surface Runoff ...........         0.266         3.799
Continuity Error (%) .....         0.000

**************************        Volume        Volume
Flow Routing Continuity          acre-ft      Mgallons
**************************      ---------     ---------
External Inflow ..........         0.000         0.000
External Outflow .........         0.266         0.087
Initial Stored Volume ....         0.005         0.001
Final Stored Volume ......         0.005         0.001
Continuity Error (%) .....         0.001

******************************************
Composite Curve Number Computations Report
******************************************

---------------------
Subbasin Sub-CB #1
---------------------
                                                         Area         Soil
Soil/Surface Description                                (acres)       Group           CN
--------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.14                       98.00

---------------------
Subbasin Sub-CB #2
---------------------
                                                         Area         Soil
Soil/Surface Description                                (acres)       Group           CN
--------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.19                       98.00

---------------------
Subbasin Sub-CB #3
---------------------
                                                         Area         Soil
Soil/Surface Description                                (acres)       Group           CN
--------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.40                       98.00

---------------------
Subbasin Sub-CB #4
---------------------
                                                         Area         Soil
Soil/Surface Description                                (acres)       Group           CN
--------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.06                       98.00

-----------------------------
Subbasin Sub-YARD DRAIN #1
-----------------------------
                                                         Area         Soil
Soil/Surface Description                                (acres)       Group           CN
--------------------------------------------------------------------------------------------
Composite Area & Weighted CN                              0.05                       98.00

**************************************
Runoff Coefficient Computations Report
**************************************

---------------------
Subbasin Sub-CB #1
---------------------
                                                          Area        Soil        Runoff
Soil/Surface Description                                 (acres)      Group       Coeff.
```

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.14	-	0.50
Composite Area & Weighted Runoff Coeff.	0.14		0.50

Subbasin Sub-CB #2

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.19	-	0.50
Composite Area & Weighted Runoff Coeff.	0.19		0.50

Subbasin Sub-CB #3

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.37	-	0.50
Composite Area & Weighted Runoff Coeff.	0.37		0.50

Subbasin Sub-CB #4

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.03	-	0.50
Composite Area & Weighted Runoff Coeff.	0.03		0.50

Subbasin Sub-YARD DRAIN #1

Soil/Surface Description	Area (acres)	Soil Group	Runoff Coeff.
-	0.05	-	0.50
Composite Area & Weighted Runoff Coeff.	0.05		0.50

SCS TR-55 Time of Concentration Computations Report

Sheet Flow Equation

```
Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n  = Manning's Roughness
Lf = Flow Length (ft)
P  = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)
```

Shallow Concentrated Flow Equation

```
V  = 16.1345 * (Sf^0.5) (unpaved surface)
V  = 20.3282 * (Sf^0.5) (paved surface)
V  = 15.0 * (Sf^0.5) (grassed waterway surface)
V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V  = 7.0 * (Sf^0.5) (short grass pasture surface)
```

```
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)

Channel Flow Equation
---------------------

        V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
        R  = Aq / Wp
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        R  = Hydraulic Radius (ft)
        Aq = Flow Area (ft²)
        Wp = Wetted Perimeter (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)
        n  = Manning's Roughness

---------------------
Subbasin Sub-CB #1
---------------------

================================================================================================
        Total TOC (minutes):                          0.00

================================================================================================


---------------------
Subbasin Sub-CB #2
---------------------

================================================================================================
        Total TOC (minutes):                          0.00

================================================================================================


---------------------
Subbasin Sub-CB #3
---------------------

================================================================================================
        Total TOC (minutes):                          0.00

================================================================================================


---------------------
Subbasin Sub-CB #4
---------------------

================================================================================================
        Total TOC (minutes):                          0.00

================================================================================================
```

Subbasin Sub-YARD DRAIN #1

Total TOC (minutes):	0.00

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
Sub-CB #1	4.03	3.80	0.14	98.000	0	00:05:00
Sub-CB #2	4.03	3.80	0.18	98.000	0	00:05:00
Sub-CB #3	4.03	3.80	0.39	98.000	0	00:05:00
Sub-CB #4	4.03	3.80	0.06	98.000	0	00:05:00
Sub-YARD DRAIN #1	4.03	3.80	0.05	98.000	0	00:05:00

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
CB #1	1.09	1.26	45.18	0	00:51	0	0	0:00:00
CB #2	0.82	1.02	45.21	0	08:01	0	0	0:00:00
CB #3	0.30	0.52	45.23	0	08:01	0	0	0:00:00
CB #4	1.37	1.61	45.25	0	01:14	0	0	0:00:00
SDCO #1	0.03	0.08	45.62	0	08:02	0	0	0:00:00
SDCO #2	0.05	0.11	46.14	0	08:01	0	0	0:00:00
SDCO #3	0.04	0.10	47.07	0	08:00	0	0	0:00:00
SDMH #3	1.89	2.03	45.15	0	08:01	0	0	0:00:00
SDMH #5	1.61	1.77	45.17	0	01:14	0	0	0:00:00
YARD DRAIN #1	0.05	0.11	47.17	0	08:00	0	0	0:00:00
Out-1Pipe - (49)	0.52	0.52	45.00	0	00:00	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
CB #1	JUNCTION	0.14	0.74	0	08:01	0.00		
CB #2	JUNCTION	0.18	0.61	0	08:01	0.00		
CB #3	JUNCTION	0.39	0.43	0	08:00	0.00		
CB #4	JUNCTION	0.06	0.06	0	08:00	0.00		
SDCO #1	JUNCTION	0.00	0.05	0	08:01	0.00		

SDCO #2	JUNCTION	0.00	0.05	0	08:00	0.00
SDCO #3	JUNCTION	0.00	0.05	0	08:00	0.00
SDMH #3	JUNCTION	0.00	0.80	0	08:01	0.00
SDMH #5	JUNCTION	0.00	0.07	0	01:07	0.00
YARD DRAIN #1	JUNCTION	0.05	0.05	0	08:00	0.00
Out-1Pipe - (49)	OUTFALL	0.00	0.80	0	08:01	0.00

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Out-1Pipe - (49)	99.82	0.15	0.80
System	99.82	0.15	0.80

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow Depth	Total Time Surcharged minutes	Reported Condition
Link-01	CONDUIT	0 01:07	0.09	1.00	0.07	2.19	0.03	1.00	1440	SURCHARGED
Pipe - (42)	CONDUIT	0 08:00	1.59	1.00	0.05	0.52	0.09	0.21	0	Calculated
Pipe - (43)	CONDUIT	0 08:00	1.55	1.00	0.05	0.52	0.09	0.22	0	Calculated
Pipe - (44)	CONDUIT	0 08:01	1.89	1.00	0.05	0.52	0.09	0.19	0	Calculated
Pipe - (45)	CONDUIT	0 08:02	0.25	1.00	0.05	3.86	0.01	0.30	0	Calculated
Pipe - (46)	CONDUIT	0 08:01	0.67	1.00	0.43	2.34	0.18	0.76	0	Calculated
Pipe - (47)	CONDUIT	0 08:01	0.78	1.00	0.61	2.34	0.26	1.00	5	SURCHARGED
Pipe - (48)	CONDUIT	0 08:01	0.95	1.00	0.74	4.84	0.15	1.00	1440	SURCHARGED
Pipe - (49)	CONDUIT	0 08:01	2.46	1.00	0.80	0.79	1.01	0.88	0	> CAPACITY
Pipe - (55)	CONDUIT	0 08:00	0.07	1.00	0.06	2.34	0.02	1.00	1440	SURCHARGED

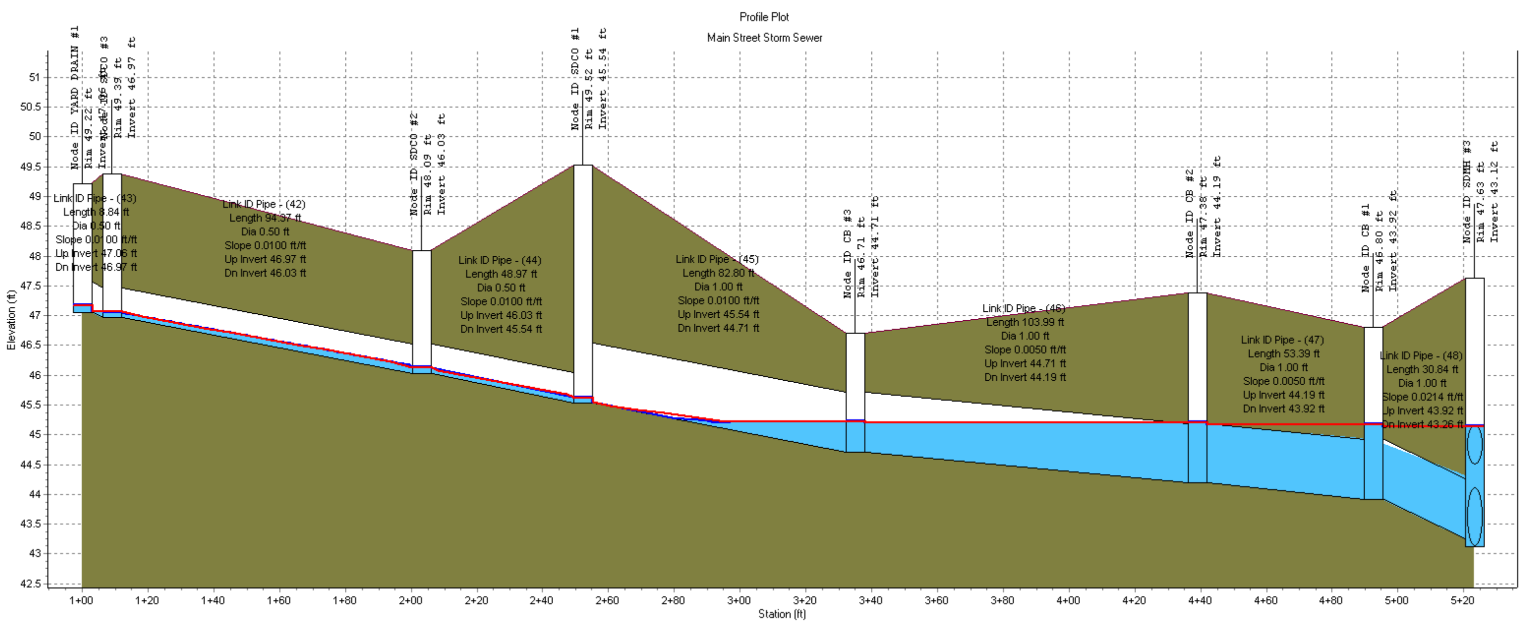
****
Highest Flow Instability Indexes
****

All links are stable.

```
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Pipe - (49) is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.

  Analysis began on:  Fri Jan 12 17:24:41 2024
  Analysis ended on:  Fri Jan 12 17:24:43 2024
  Total elapsed time: 00:00:02
```

Yard Drain to SDMH #4

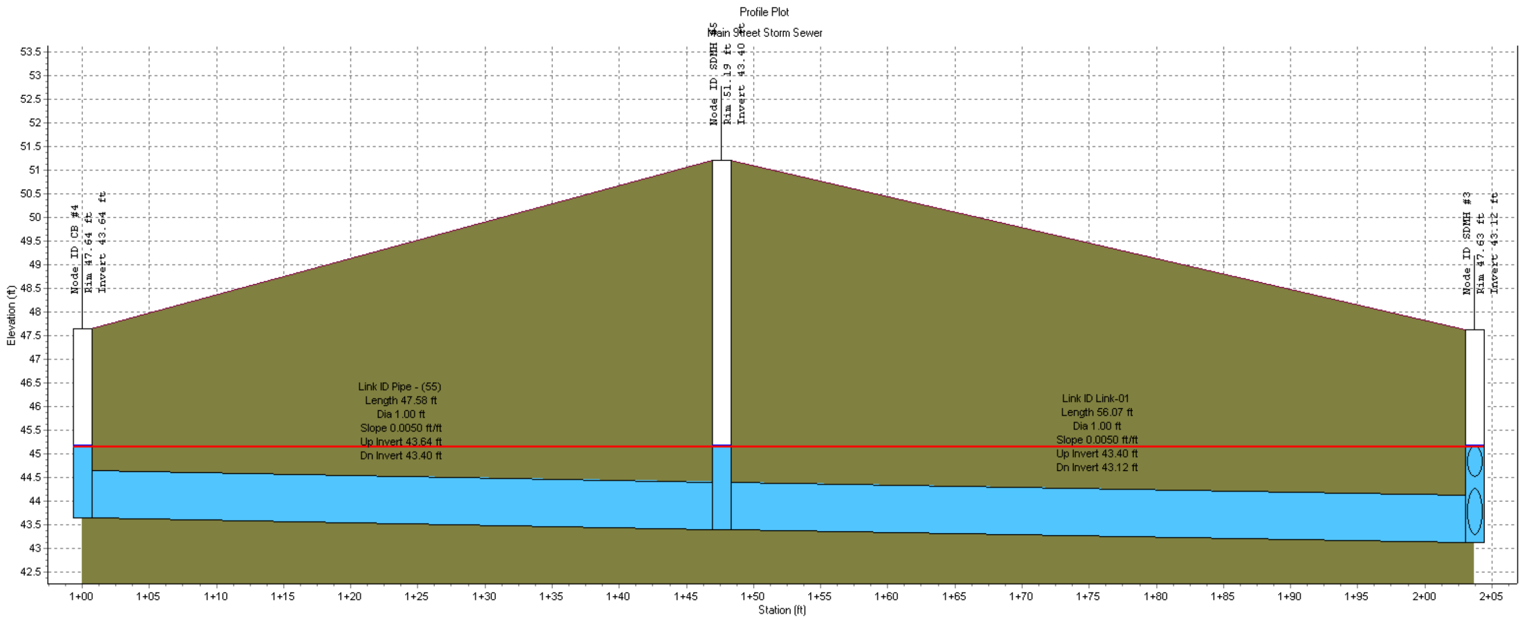


Node ID:		SDCO #3	SDCO #2	SDCO #1	CB #3	CB #2	CB #1	SDMH #3
Rim (ft):	49.22	49.39	48.09	49.52	46.71	47.38	46.80	47.63
Invert (ft):	47.06	46.97	46.03	45.54	44.71	44.19	43.92	43.12
Min Pipe Cover (ft):	1.66	1.92	1.56	2.99	1.00	2.19	1.88	2.46
Max HGL (ft):	47.17	47.07	46.14	45.62	45.23	45.21	45.18	45.15

Link ID:	Pipe - (43)	Pipe - (42)	Pipe - (44)	Pipe - (45)	Pipe - (46)	Pipe - (47)	Pipe - (48)
Length (ft):	8.84	94.37	48.97	82.80	103.99	53.39	30.84
Dia (ft):	0.50	0.50	0.50	1.00	1.00	1.00	1.00
Slope (ft/ft):	0.0100	0.0100	0.0100	0.0100	0.0050	0.0050	0.0214
Up Invert (ft):	47.06	46.97	46.03	45.54	44.71	44.19	43.92
Dn Invert (ft):	46.97	46.03	45.54	44.71	44.19	43.92	43.26
Max Q (cfs):	0.05	0.05	0.05	0.05	0.43	0.61	0.74
Max Vel (ft/s):	1.55	1.59	1.89	0.25	0.67	0.78	0.95
Max Depth (ft):	0.11	0.11	0.09	0.30	0.76	1.00	1.00

Autodesk Storm and Sanitary Analysis

CB #4 to SDMH #4



Node ID:	CB #4	SDMH #5	SDMH #3
Rim (ft):	47.64	51.19	47.63
Invert (ft):	43.64	43.40	43.12
Min Pipe Cover (ft):	3.00	6.79	2.46
Max HGL (ft):	45.25	45.17	45.15

Link ID:	Pipe - (55)	Link-01
Length (ft):	47.58	56.07
Dia (ft):	1.00	1.00
Slope (ft/ft):	0.0050	0.0050
Up Invert (ft):	43.64	43.40
Dn Invert (ft):	43.40	43.12
Max Q (cfs):	0.06	0.07
Max Vel (ft/s):	0.07	0.09
Max Depth (ft):	1.00	1.00

Tab 6.0

6.0 CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

A SWPPP has been prepared and included as Figure 6.1. The following is a list discussing each of the required 13 SWPPP elements and how they have been addressed for this project:

Element No. 1 – Preserve Vegetation/Mark Clearing Limits: Clearing Limits will be delineated on the engineering plans and will be flagged in the field.

Element No. 2 – Establish Construction Access: A stabilized gravel construction entrance will be shown on the engineering plans.

Element No. 3 – Control Flow Rates: A temporary sediment pond will be shown on the engineering plans. Once the permanent infiltration facilities are constructed, the temporary sediment ponds can be removed. The permanent facilities can be used throughout the remainder of construction.

Element No. 4 – Install Sediment Controls: The silt fence will be shown on the engineering plans for perimeter protection. In addition, temporary ditches to divert runoff to the sediment pond will be shown on the engineering plans.

Element No. 5 – Stabilize Soils: Cover measures will be addressed in the TESC notes on the engineering plans.

Element No. 6 – Protect Slopes: Runoff will be diverted away from the site's steep slopes during and after construction. Any erosion on the site's steep slopes will be rectified immediately.

Element No. 7 – Protect Permanent Drain Inlets: A detail for catch basin inserts will be shown on the final engineering plans along with a note specifying that they be installed once the permanent storm system is completed. A note will also be included to state that the contractor shall keep public roadways clear of dirt and debris.

Element No. 8 – Stabilize Channels and Outlets: Notes regarding outfall protection will be shown on the engineering plans. Temporary ditches shall be armored with riprap for slopes greater than 5 percent.

Element No. 9 – Control Pollutants: A note will be added to the engineering plans that the contractor shall dispose of all pollutants and waste materials in a safe and timely manner.

Element No. 10 – Control Dewatering: Groundwater removed from dewatering activity shall be discharged from the site in accordance with the requirements of the City, and Washington State DOE.

Element No. 11 – Maintain Best Management Practices The contractor shall maintain all erosion control measures in accordance with Pierce County Standards and manufacturer's recommendations. In addition, the contractor shall maintain a stockpile of erosion control materials on-site.

Element No. 12 – Manage the Project: The clearing, grading, and seasonal work shall be performed in accordance with Pierce County Code. The contractor shall inspect, maintain, and repair all BMPs as needed to assure continued performance of their intended function. In addition to the engineering plans, the contractor will be required to follow and maintain the Construction SWPPP which has been prepared according to Department of Ecology NPDES requirements.

Element No. 13 – Protect Low Impact Development BMPs: LID BMPs are not feasible for this project, this element does not appear to apply to the project site.

Figure 6.1
SWPPP

Construction Stormwater General Permit

Preliminary Stormwater Pollution Prevention Plan (SWPPP)

for

BP West Coast Products, LLC

Prepared for:

The Washington State Department of Ecology

Southwest Regional Office

300 Desmond Drive S.E.

Lacey, Washington 98503

(360) 407-6300

Permittee / Owner	Developer	Operator / Contractor
BP West Coast Products, LLC.	BP West Coast Products, LLC.	TBD

1402 South Meridian

Puyallup, Washington

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
TBD	TBD	TBD

SWPPP Prepared By

Name	Organization	Contact Phone Number
Alex White	Barghausen Consulting Engineers, Inc.	(425) 251-6222

SWPPP Preparation Date

January 12, 2024

Project Construction Dates

Activity / Phase	Start Date	End Date
TBD	TBD	TBD

Table of Contents

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List of Acronyms and Abbreviations

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

1 Project Information

Project/Site Name: Puyallup ARCO Convenience Store with Fuel
Street/Location: 1402 South Meridian
City: Puyallup State: WA Zip code: 98371
Subdivision: NA
Receiving waterbody: Groundwater

1.1 Existing Conditions

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

Total acreage:	1.30 AC
Disturbed acreage:	1.30 AC
Existing structures:	The project site currently consists of a restaurant, asphalt pavement with parking, trees, shrubs, and associated landscaping.
Landscape Topography:	The site topography varies with the north of the site having slopes between 0 to 3% while the south of the site having slopes between 2 to 14%.
Drainage patterns:	The site has several existing on-site storm drainage systems, collecting and conveying runoff from the roofs and pavement areas into the existing public stormwater infrastructure with S Meridian Street.
Existing Vegetation:	The site contains landscaping primarily along the northern and southern boundaries.
Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes):	This site appears to be located outside any critical areas.

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: NA

Currently no pollutants contaminants exist on-site.

1.2 Proposed Construction Activities

Description of site development (example: subdivision):
This project proposes the construction of an auto-sentry structure.

Description of construction activities (example: site preparation, demolition, excavation):
Construction activities will include the demolition of existing structures and asphalt, grading, and excavation for the proposed stormwater and fueling system.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:
Drainage currently sheet flows north across the site.

Description of final stabilization (example: extent of revegetation, paving, landscaping):
Final site stabilization will include the installation of landscape and hardscapes, such as asphalt and concrete pavement for both the onsite portion of the project and the frontage.

Contaminated Site Information:
Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):

NA

2 Construction Stormwater Best Management Practices (BMPs)

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

2.1 The 13 Elements

2.1.1 Element 1: Preserve Vegetation / Mark Clearing Limits

List and describe BMPs: In order to protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked and enclosed within a construction fence prior to any land disturbing activities. This fence will encompass all areas subject to construction, as well as delineate all areas where no construction is to take place. A silt fence will also be placed in certain areas as shown on the accompanying Site Plan, in order to protect the soil and vegetation outside the construction area. Refer to Appendix B: Construction BMPs for detailed drawings of the proposed BMPs. The proposed BMPs relevant to vegetation preservation/clearing limits are:

- BMP C103: High Visibility Plastic or Metal Fence
- BMP C233: Silt Fence

Installation Schedules: BMPs listed above (Silt Fence and High Visibility Plastic or Metal Fence) will be installed prior to any land disturbing activity.

Inspection and Maintenance plan: TBD

Responsible Staff: TBD

2.1.2 Element 2: Establish Construction Access

List and describe BMPs: In order to protect the adjacent existing asphalt pavement from dirt and debris, the project will construct a Construction Entrance, refer to Appendix A: Site Plan, for the location and Appendix B: Construction BMPs for detailed drawings of the proposed BMP.

- BMP C105: Construction Access

Installation Schedules: Construction Entrance shall be installed prior to the commencement of construction activities.

Inspection and Maintenance plan: TBD

Responsible Staff: TBD

2.1.3 Element 3: Control Flow Rates

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

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

List and describe BMPs: A sediment trap will be installed for the purpose of controlling flow rates during construction. Refer to Appendix A: Site Plan, for the location and Appendix B: Construction BMPs for detailed drawings of the proposed BMP.

The proposed BMP relevant to flow control is:

- BMP C240: Sediment Trap

Installation Schedules: The BMP listed above (Sediment Trap) will be installed prior to any land disturbing activity.

Inspection and Maintenance plan: TBD

Responsible Staff: TBD

2.1.4 Element 4: Install Sediment Controls

List and describe BMPs: On-site sediment contamination shall be controlled by the implementation of silt fences and/or straw wattles. Silt fences will be placed in the necessary areas where soil from the areas marked for excavation may interfere and contaminate with soils located either off site or adjacent. Moreover, wattles are suggested in disturbed areas that require immediate erosion protection and on exposed soils during the period of short construction interruptions or over winter months. See Appendix A: Site Plan, for the location and Appendix B: Construction BMPs for detailed drawings of the proposed BMP. The proposed BMP that will be installed for sediment control is:

- BMP C233: Silt Fence
- BMP C235: Wattles

Installation Schedules: Sediment Controls will be installed prior to any land disturbance activity.

Inspection and Maintenance plan: TBD

Responsible Staff: TBD

2.1.5 Element 5: Stabilize Soils

West of the Cascade Mountains Crest

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

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

Anticipated project dates: Start date: TBD End date: TBD

Will you construct during the wet season?
TBD

List and describe BMPs: Soils exposed and unworked for the time period specified above shall be stabilized with the application of effective BMPs to prevent erosion throughout the duration of the project. Soil stockpiles shall be stabilized or covered using plastic sheeting and where possible, located away from storm inlets, waterways, and drainage channels. The practice of Dust Control is also recommended to prevent wind transport of dust onto roadways and drainage ways. Refer to Appendix B for detailed drawings of the BMPs used. The proposed BMPs specific to Soil Stabilization are:

- BMP C123: Plastic Covering
- BMP C140: Dust Control

Installation Schedules: BMPs shall be implemented as soon as land disturbing activity begins and installed where applicable for the duration of the project.

Inspection and Maintenance plan: TBD

Responsible Staff: TBD

2.1.6 Element 6: Protect Slopes

Will steep slopes be present at the site during construction?
☒ Yes ☐ No

List and describe BMPs: All cut and fill slopes will be designed, constructed, and protected in a manner that minimizes erosion. Temporary and permanent seeding shall be used at all exposed areas pursuant to the prior mentioned schedule (seasonal restrictions). Soil stockpiles shall be stabilized or covered using plastic sheeting and where possible, located away from storm inlets, waterways, and drainage channels.

The proposed BMPs specific to Slope Protection are:

- BMP C120: Temporary and Permanent Seeding
- BMP C123: Plastic Covering

Installation Schedules: BMPs shall be implemented as soon as land disturbing activity begins and installed where applicable for the duration of the project. Implementation of one or more of alternative BMPs may be necessary after the first sign that existing BMPs are ineffective or failing.

Inspection and Maintenance plan: TBD

Responsible Staff: TBD

2.1.7 Element 7: Protect Drain Inlets

List and describe BMPs: All storm drain inlets, both existing and those installed during construction must be protected to prevent unfiltered or untreated water from entering the drainage conveyance system. However, the first priority is to keep all access roads clean of sediment and keep water from washing streets separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on or near the project site. This includes inlets and culverts located offsite. Inlet protection devices shall be cleaned and replaced or removed when sediment has filled a third of the available storage (unless a different standard is specified by the product manufacturer). The following inlet protection measures will be proposed for this project:

- BMP C220: Storm Drain Inlet Protection

Installation Schedules: Storm Drain Inlet Protection will be provided at the start of the project and will be maintained for the duration of the project.

Inspection and Maintenance plan: TBD

Responsible Staff: TBD

2.1.8 Element 8: Stabilize Channels and Outlets

Provide stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent stream banks, slopes, and downstream reaches, will be installed at the outlets of all conveyance systems.

List and describe BMPs: The project site is located west of the Cascade Mountain Crest. As such, where there are any temporary on-site conveyance channels, they shall be designed, constructed, and stabilized to prevent erosion from the expected peak 10-minute velocity of flow from a Type 1A, 10-year, 24-hour recurrence interval storm for the developed condition. An on-site sediment trap is proposed for this project along with a temporary conveyance channel, therefore an Outlet Control BMP is proposed. The following inlet protection measures will be proposed for this project:

- BMP C209: Outlet Protection

Installation Schedules: Outlet Protection will be provided at the start of the project and will be maintained for the duration of the project.

Inspection and Maintenance plan: TBD

Responsible Staff: TBD

2.1.9 Element 9: Control Pollutants

List and describe BMPs: All pollutants, including waste materials and demolition debris, which occur on site will be handled and disposed of in a manner that does not cause contamination of stormwater. Good housekeeping and preventative measures will be taken to ensure that the site will be kept clean, well-organized, and free of debris. The following practices will be implemented:

- All vehicles, equipment, and petroleum product storage/dispensing areas will be inspected regularly to detect any leaks or spills, and to identify maintenance needs to prevent leaks or spills.
- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.
- Any chemicals stored in the construction areas will conform to the appropriate source control BMPs listed in Volume IV of the Ecology stormwater manual. All chemicals shall have cover, containment, and protection provided on site, pursuant to BMP C153 for Material Delivery, Storage and Containment.

Proposed BMPs applicable to Pollutant Control:

- BMP C140: Dust Control
- BMP C151: Concrete Handling
- BMP C 152: Sawcutting and Surface Pollution Prevention
- BMP C 153: Material Delivery, Storage, and Containment
- BMP C154: Concrete Washout Area

Installation Schedules: BMPs shall be installed as necessary to control pollutants for the duration of construction.

Inspection and Maintenance plan: TBD

Responsible Staff: TBD

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

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

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

Table 1 – pH-Modifying Sources

☐	None
☒	Bulk cement
☐	Cement kiln dust
☐	Fly ash
☐	Other cementitious materials
☐	New concrete washing or curing waters
☐	Waste streams generated from concrete grinding and sawing
☐	Exposed aggregate processes
☐	Dewatering concrete vaults
☐	Concrete pumping and mixer washout waters
☐	Recycled concrete
☐	Recycled concrete stockpiles
☐	Other (i.e., calcium lignosulfate) [please describe:]

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

Will uncontaminated water from water-only based shaft drilling for construction of building, road, and bridge foundations be infiltrated provided the wastewater is managed in a way that prohibits discharge to surface waters?

☐ Yes ☒ No

2.1.10 Element 10: Control Dewatering

List and describe BMPs:

- Discharge clean, non-turbid de-watering water, such as well-point groundwater, to systems tributary to, or directly into surface waters of the state, provided that the de-watering flow does not cause erosion or flooding of receiving waters or interfere with the operation of the system. Do not route clean dewatering water through stormwater sediment ponds. Note that "surface waters of the state" may exist on a construction site as well as off site; for example, a creek running through a site.
- Highly turbid or contaminated dewatering water shall be handled separately from stormwater.
- Clean, non-turbid dewatering water, such as well-point ground water, can be discharged to systems tributary to, or directly into surface waters of the state, provided the dewatering flow does not cause erosion or flooding of receiving waters. Clean dewatering water should not be routed through stormwater sediment ponds.
- Other dewatering disposal options may include:
    - Transport off site in a vehicle, such as a vacuum flush truck, for legal disposal in a manner that does not pollute state waters.
    - Infiltration.
    - Ecology-approved on-site chemical treatment or other suitable treatment technologies.
    - Sanitary sewer discharge with local sewer district approval, if there is no other option.
    - Use of a sedimentation bag with outfall to a ditch or swale for small volumes of localized dewatering.

Dewatering activities are likely to occur during the installation of on-site stormwater conveyance systems and/or excavation activities. Contractor to refer to the Dewatering Plan prepared by Bender, LLC. Dewatering water will be conveyed to the sanitary sewer.

Installation Schedules: Dewatering controls will be installed prior to any significant excavation activities.

Inspection and Maintenance plan: TBD

Responsible Staff: TBD

2.1.11 Element 11: Maintain BMPs

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

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

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

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

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

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

2.1.12 Element 12: Manage the Project

The project will be managed based on the following principles:

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

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

Table 2 – Management

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

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

The project does not propose any Low Impact Development BMPs to be implemented as part of this proposal.

3 Pollution Prevention Team

Table 3 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	TBD	TBD
Resident Engineer	Alex White, P.E.	(425) 251-6222
Emergency Ecology Contact	Staff on Duty	(425) 649-7130
Emergency Permittee/ Owner Contact	TBD	TBD
Non-Emergency Owner Contact	TBD	TBD
Monitoring Personnel	TBD	TBD
Ecology Regional Office	Southwest Regional Office	(360) 407-6300

4 Monitoring and Sampling Requirements

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

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

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

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

4.1 Site Inspection

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

The discharge point(s) are indicated on the Site Map (see Appendix A) and in accordance with the applicable requirements of the CSWGP.

4.2 Stormwater Quality Sampling

4.2.1 Turbidity Sampling

Requirements include calibrated turbidity meter or transparency tube to sample site discharges for compliance with the CSWGP. Sampling will be conducted at all discharge points at least once per calendar week.

Method for sampling turbidity:

Check the analysis method you will use:

Table 4 – Turbidity Sampling Method

☐	Turbidity Meter/Turbidimeter (required for disturbances 5 acres or greater in size)
☒	Transparency Tube (option for disturbances less than 1 acre and up to 5 acres in size)

The benchmark for turbidity value is 25 nephelometric turbidity units (NTU) and a transparency less than 33 centimeters.

If the discharge's turbidity is 26 to 249 NTU **or** the transparency is less than 33 cm but equal to or greater than 6 cm, the following steps will be conducted:

1. Review the SWPPP for compliance with Special Condition S9. Make appropriate revisions within 7 days of the date the discharge exceeded the benchmark.
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period.
3. Document BMP implementation and maintenance in the site log book.

If the turbidity exceeds 250 NTU **or** the transparency is 6 cm or less at any time, the following steps will be conducted:

1. Telephone or submit an electronic report to the applicable Ecology Region's Environmental Report Tracking System (ERTS) within 24 hours.
    - **Central Region** (Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima): (509) 575-2490 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/CRO_nerts_online.html
    - **Eastern Region** (Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman): (509) 329-3400 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/ERO_nerts_online.html
    - **Northwest Region** (King, Kitsap, Island, San Juan, Skagit, Snohomish, Whatcom): (425) 649-7000 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/NWRO_nerts_online.html
    - **Southwest Region** (Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, Wahkiakum,): (360) 407-6300 or http://www.ecy.wa.gov/programs/spills/forms/nerts_online/SWRO_nerts_online.html
2. Immediately begin the process to fully implement and maintain appropriate source control and/or treatment BMPs as soon as possible. Address the problems within 10 days of the date the discharge exceeded the benchmark. If installation of necessary treatment BMPs is not feasible within 10 days, Ecology may approve additional time when the Permittee requests an extension within the initial 10-day response period
3. Document BMP implementation and maintenance in the site log book.
4. Continue to sample discharges daily until one of the following is true:
    - Turbidity is 25 NTU (or lower).
    - Transparency is 33 cm (or greater).
    - Compliance with the water quality limit for turbidity is achieved.
        - 1 - 5 NTU over background turbidity, if background is less than 50 NTU
        - 1% - 10% over background turbidity, if background is 50 NTU or greater
    - The discharge stops or is eliminated.

4.2.2 pH Sampling

pH monitoring is required for "Significant concrete work" (i.e., greater than 1000 cubic yards poured concrete over the life of the project). The use of recycled concrete or engineered soils (soil amendments including but not limited to Portland cement-treated base [CTB], cement kiln dust [CKD] or fly ash) also requires pH monitoring.

For significant concrete work, pH sampling will start the first day concrete is poured and continue until it is cured, typically three (3) weeks after the last pour.

For engineered soils and recycled concrete, pH sampling begins when engineered soils or recycled concrete are first exposed to precipitation and continues until the area is fully stabilized.

If the measured pH is 8.5 or greater, the following measures will be taken:

1. Prevent high pH water from entering storm sewer systems or surface water.
2. Adjust or neutralize the high pH water to the range of 6.5 to 8.5 su using appropriate technology such as carbon dioxide (CO_2) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO_2 sparging or dry ice.

Method for sampling pH:

Check the analysis method you will use:

Table 5 – pH Sampling Method

☐	pH meter
☒	pH test kit
☐	Wide range pH indicator paper

5 Discharges to 303(d) or Total Maximum Daily Load (TMDL) Waterbodies

5.1 303(d) Listed Waterbodies

Circle the applicable answer, if necessary:

Is the receiving water 303(d) (Category 5) listed for turbidity, fine sediment, phosphorus, or pH?

☐ Yes ☒ No

6 Reporting and Record Keeping

6.1 Record Keeping

This section does not need to be filled out. It is a list of reminders for the permittee.

6.1.1 Site Log Book

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

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

6.1.2 Records Retention

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

Permit documentation to be retained on-site:

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

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

6.1.3 Updating the SWPPP

The SWPPP will be modified if:

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

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

6.2 Reporting

6.2.1 Discharge Monitoring Reports

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

6.2.2 Notification of Noncompliance

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

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

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

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

Include the following information:

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

6. Date / Time of sample
7. Project name

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

Appendix/Glossary

A. Site Map
B. BMP Detail
C. Site Inspection Form
D. Engineering Calculations

Appendix A
Site Map

COVER SHEET

FOR

ARCO ampm PUYALLUP

SEC. 33, TWN. 20 N, RGE. 4 E, W.M.
CITY OF PUYALLUP, PIERCE COUNTY

GENERAL SITE NOTES:

1. THE CONTRACTOR SHALL OBTAIN AND HAVE AVAILABLE COPIES OF THE APPLICABLE GOVERNING AGENCY STANDARDS AT THE JOB SITE DURING THE RELATED CONSTRUCTION OPERATIONS.
2. CONTRACTOR SHALL ENSURE THAT ALL NECESSARY PERMITS HAVE BEEN OBTAINED PRIOR TO COMMENCING WORK.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION, DIMENSION AND DEPTH OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION WHETHER SHOWN ON THESE PLANS OR NOT. UTILITIES OTHER THAN THOSE SHOWN MAY EXIST ON THIS SITE. ONLY THOSE UTILITIES WITH EVIDENCE OF THEIR INSTALLATION VISIBLE AT GROUND SURFACE OR SHOWN ON RECORD DRAWING PROVIDED BY OTHERS ARE SHOWN HEREON. EXISTING UNDERGROUND UTILITY LOCATIONS SHOWN ARE APPROXIMATE ONLY AND ARE SUBJECT TO A DEGREE OF UNKNOWN VARIATION. SOME UNDERGROUND LOCATIONS SHOWN HEREON MAY HAVE BEEN TAKEN FROM PUBLIC RECORDS. BARGHAUSEN CONSULTING ENGINEERS, INC. ASSUMES NO LIABILITY FOR THE ACCURACY OF PUBLIC RECORDS OR RECORDS OF OTHERS. IF CONFLICTS SHOULD OCCUR, THE CONTRACTOR SHALL CONSULT BARGHAUSEN CONSULTING ENGINEERS, INC. TO RESOLVE ALL PROBLEMS PRIOR TO PROCEEDING WITH CONSTRUCTION.
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REVIEW ALL OF THE DRAWINGS AND SPECIFICATIONS ASSOCIATED WITH THE PROJECT WORK SCOPE PRIOR TO THE INITIATION OF CONSTRUCTION. SHOULD THE CONTRACTOR FIND A CONFLICT WITH THE DOCUMENTS RELATIVE TO THE SPECIFICATIONS OR THE RELATIVE CODES, IT IS THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE ENGINEER OF RECORD IN WRITING PRIOR TO THE START OF CONSTRUCTION. FAILURE BY THE CONTRACTOR TO NOTIFY THE PROJECT ENGINEER SHALL CONSTITUTE ACCEPTANCE OF FULL RESPONSIBILITY BY THE CONTRACTOR TO COMPLETE THE SCOPE OF WORK AS DEFINED BY THE DRAWINGS AND IN FULL COMPLIANCE WITH LOCAL REGULATIONS AND CODES.
5. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE APPROPRIATE UTILITIES INVOLVED PRIOR TO CONSTRUCTION.
6. INSPECTION OF SITE WORK WILL BE ACCOMPLISHED BY A REPRESENTATIVE OF THE GOVERNING JURISDICTION. INSPECTION OF PRIVATE FACILITIES WILL BE ACCOMPLISHED BY A REPRESENTATIVE OF THE OWNER. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE INSPECTOR 24 HOURS IN ADVANCE OF BACKFILLING ALL CONSTRUCTION.
7. PRIOR TO ANY CONSTRUCTION OR DEVELOPMENT ACTIVITY THE CONTRACTOR SHALL CONTACT THE AGENCY AND/OR UTILITY INSPECTION PERSONNEL AND ARRANGE ANY REQUIRED PRE-CONSTRUCTION MEETING(S). CONTRACTOR SHALL PROVIDE ONE WEEK MINIMUM ADVANCE NOTIFICATION TO OWNER, FIELD ENGINEER AND ENGINEER OF PRE-CONSTRUCTION MEETINGS.
8. THE CONTRACTOR IS RESPONSIBLE FOR WORKER AND SITE SAFETY AND SHALL COMPLY WITH THE LATEST OSHA STANDARDS AND REGULATIONS, OR ANY OTHER AGENCY HAVING JURISDICTION FOR EXCAVATION AND TRENCHING PROCEDURES. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE "MEANS AND METHODS" REQUIRED TO MEET THE INTENT AND PERFORMANCE CRITERIA OF OSHA, AS WELL AS ANY OTHER ENTITY THAT HAS JURISDICTION FOR EXCAVATION AND/OR TRENCHING PROCEDURES.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ADEQUATE SAFEGUARDS, SAFETY DEVICES, PROTECTIVE EQUIPMENT, FLAGGERS, AND ANY OTHER NEEDED ACTIONS TO PROTECT THE LIFE, HEALTH, AND SAFETY OF THE PUBLIC, AND TO PROTECT PROPERTY IN CONNECTION WITH THE PERFORMANCE OF WORK COVERED BY THE CONTRACTOR. ANY WORK WITHIN THE TRAVELED RIGHT-OF-WAY THAT MAY INTERRUPT NORMAL TRAFFIC FLOW SHALL REQUIRE AT LEAST ONE FLAGGER FOR EACH LANE OF TRAFFIC AFFECTED.
10. PROTECTIVE MEASURES SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT ALL ADJACENT PUBLIC AND PRIVATE PROPERTIES AT ALL TIMES DURING CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTION OF ALL EXISTING UTILITY SERVICES THAT ARE TO REMAIN OPERATIONAL WITHIN THE CONSTRUCTION AREA WHETHER SHOWN OR NOT SHOWN ON THE PLANS.
11. TWO (2) COPIES OF THESE APPROVED PLANS MUST BE ON THE JOB SITE WHENEVER CONSTRUCTION IS IN PROGRESS. ONE (1) SET WITH RECORDS OF AS-BUILT INFORMATION SHALL BE SUBMITTED TO BARGHAUSEN CONSULTING ENGINEERS, INC. AT COMPLETION OF PROJECT.
12. CONTRACTOR SHALL OBTAIN SERVICES OF A LICENSED LAND SURVEYOR TO STAKE HORIZONTAL CONTROL FOR ALL NEW IMPROVEMENTS. STAKING CONTROL SHALL BE TAKEN FROM ELECTRONIC PLAN FILES PROVIDED BY BARGHAUSEN CONSULTING ENGINEERS, INC.
13. CONTRACTOR SHALL REQUEST FROM BARGHAUSEN CONSULTING ENGINEERS, INC., PRIOR TO ANY CONSTRUCTION STAKING OR CONSTRUCTION WORK, A FORMAL CONSTRUCTION RELEASE PLAN SET OR SPECIFIC RELEASE IN WRITING. THE APPROVED AGENCY PERMIT DRAWINGS WILL NOT BE CONSIDERED CONSTRUCTION RELEASE PLANS BY BARGHAUSEN CONSULTING ENGINEERS, INC. UNLESS BARGHAUSEN CONSULTING ENGINEERS, INC. HAS GIVEN A FORMAL WRITTEN RELEASE OR ISSUED A CONSTRUCTION RELEASE PLAN SET.

HORIZONTAL CONTROL NOTE:

CONTRACTOR SHALL HAVE ALL PROPERTY LINES, CURB, SIDEWALK, STRUCTURES, CONCRETE PADS AND ANY OTHER ABOVE GROUND PERMANENT STRUCTURE DEPICTED ON THESE PLANS STAKED FOR CONSTRUCTION BY A LICENSED SURVEYOR. LICENSED SURVEYOR SHALL STAKE ALL ITEMS USING COORDINATE GEOMETRY (RECTIFIED TO SITE CONTROL) CONTAINED IN CAD DRAWING FILES PROVIDED BY BARGHAUSEN CONSULTING ENGINEERS, INC. IT IS THE CONTRACTOR'S RESPONSIBILITY TO RETRIEVE LATEST CAD FILES FROM BARGHAUSEN CONSULTING ENGINEERS INC., REFLECTING ANY ISSUED PLAN REVISIONS. BARGHAUSEN CONSULTING ENGINEERS SHALL IMMEDIATELY BE NOTIFIED OF ANY DISCREPANCIES PRIOR TO THE START OF CONSTRUCTION.

MONUMENT PROTECTION NOTE:

CONTRACTOR SHALL FIELD LOCATE ALL MONUMENTS WITHIN THE AREA OF DISTURBANCE PRIOR TO CONSTRUCTION AND PROTECT FROM DESTRUCTION/DISTURBANCE TO THE MAXIMUM EXTENT FEASIBLE. IF IT IS NECESSARY TO REMOVE OR REPLACE A MONUMENT DURING CONSTRUCTION, THE CONTRACTOR SHALL NOTIFY THE LOCAL JURISDICTION HAVING AUTHORITY (RCW 58.24.040) AND BE FULLY RESPONSIBLE FOR OBTAINING PERMITS FROM THE WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES PRIOR TO DISTURBANCE, DESTRUCTION, OR RELOCATION (WAC 332-120). APPLICATIONS MUST BE COMPLETED BY A REGISTERED LAND SURVEYOR AND MAY BE OBTAINED FROM THE WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES:

WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES
PUBLIC LAND SURVEY OFFICE
1111 WASHINGTON STREET S.E.
P.O. BOX 47060
OLYMPIA, WASHINGTON 98504-7060
(206) 902-1190

UPON COMPLETION OF CONSTRUCTION, ALL MONUMENTS DISPLACED, REMOVED, OR DESTROYED THAT ARE ABLE TO BE REPLACED, SHALL BE REPLACED BY A REGISTERED LAND SURVEYOR AT THE COST AND AT THE DIRECTION OF THE CONTRACTOR PURSUANT TO THESE REGULATIONS. THE APPROPRIATE FORMS FOR REPLACEMENTS OF SAID MONUMENTATION SHALL ALSO BE THE RESPONSIBILITY OF THE CONTRACTOR.

UTILITY PROTECTION NOTE:

APPROXIMATE LOCATION OF EXISTING UTILITIES ARE SHOWN ON THESE PLANS. CONTRACTOR TO COORDINATE WITH PURVEYOR AND USE EXTREME CAUTION WHEN EXCAVATING ON-SITE, UNTIL EXISTING GAS AND POWER SERVICE LOCATIONS ARE CONFIRMED. CONTRACTOR TO ORDER INDEPENDENT UTILITY LOCATES (INCLUDING GAS AND POWER) FOR THE FULL SCOPE OF WORK PRIOR TO CONSTRUCTION OR ANY GROUND DISTURBING ACTIVITIES.

UTILITY CONFLICT NOTE:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION, DIMENSION, AND DEPTH OF ALL EXISTING UTILITIES WHETHER SHOWN ON THESE PLANS OR NOT BY POTHOLING THE UTILITIES AND SURVEYING THE HORIZONTAL AND VERTICAL LOCATION PRIOR TO CONSTRUCTION. THIS SHALL INCLUDE CALLING UTILITY LOCATE AT 811 48 HOURS IN ADVANCE AND THEN POTHOLING ALL OF THE EXISTING UTILITIES AT LOCATIONS OF NEW UTILITY CROSSINGS TO PHYSICALLY VERIFY WHETHER OR NOT CONFLICTS EXIST. LOCATIONS OF SAID UTILITIES AS SHOWN ON THESE PLANS ARE BASED UPON THE UNVERIFIED PUBLIC INFORMATION AND ARE SUBJECT TO VARIATION. IF CONFLICTS SHOULD OCCUR, THE CONTRACTOR SHALL NOTIFY BARGHAUSEN CONSULTING ENGINEERS, INC. TO RESOLVE ALL PROBLEMS PRIOR TO PROCEEDING WITH CONSTRUCTION.

811 Know what's **below.** **Call** before you dig. Dial 811

CITY OF PUYALLUP - GENERAL NOTES:

1. ALL WORK IN CITY RIGHT-OF-WAY REQUIRES A PERMIT FROM THE CITY OF PUYALLUP. PRIOR TO ANY WORK COMMENCING, THE GENERAL CONTRACTOR SHALL ARRANGE FOR A PRECONSTRUCTION MEETING AT THE DEVELOPMENT SERVICES CENTER TO BE ATTENDED BY ALL CONTRACTORS THAT WILL PERFORM WORK SHOWN ON THE APPROVED ENGINEERING PLANS, REPRESENTATIVES FROM ALL APPLICABLE UTILITY COMPANIES, THE PROJECT OWNER AND APPROPRIATE CITY STAFF. CONTACT ENGINEERING SERVICES AT (253-841-5568) TO SCHEDULE THE MEETING. THE CONTRACTOR IS RESPONSIBLE TO HAVE THEIR OWN SET OF APPROVED PLANS AT THE MEETING.
2. AFTER COMPLETION OF ALL ITEMS SHOWN ON THESE PLANS AND BEFORE ACCEPTANCE OF THE PROJECT THE CONTRACTOR SHALL OBTAIN A "PUNCH LIST" PREPARED BY THE CITY'S INSPECTOR DETAILING REMAINING ITEMS OF WORK TO BE COMPLETED. ALL ITEMS OF WORK SHOWN ON THESE PLANS SHALL BE COMPLETED TO THE SATISFACTION OF THE CITY PRIOR TO ACCEPTANCE OF THE WATER SYSTEM AND PROVISION OF SANITARY SEWER SERVICE.
3. ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION (HEREINAFTER REFERRED TO AS THE "STANDARD SPECIFICATIONS"), WASHINGTON STATE DEPARTMENT OF TRANSPORTATION AND AMERICAN PUBLIC WORKS ASSOCIATION, WASHINGTON STATE CHAPTER, LATEST EDITION, UNLESS SUPERSEDED OR AMENDED BY THE CITY OF PUYALLUP CITY STANDARDS FOR PUBLIC WORKS ENGINEERING AND CONSTRUCTION (HEREINAFTER REFERRED TO AS THE "CITY STANDARDS").
4. A COPY OF THESE APPROVED PLANS AND APPLICABLE CITY DEVELOPER SPECIFICATIONS AND DETAILS SHALL BE ON SITE DURING CONSTRUCTION.
5. ANY REVISIONS MADE TO THESE PLANS MUST BE REVIEWED AND APPROVED BY THE DEVELOPER'S ENGINEER AND THE CITY PRIOR TO ANY IMPLEMENTATION IN THE FIELD. THE CITY SHALL NOT BE RESPONSIBLE FOR ANY ERRORS AND/OR OMISSIONS ON THESE PLANS.
6. THE CONTRACTOR SHALL HAVE ALL UTILITIES VERIFIED ON THE GROUND PRIOR TO ANY CONSTRUCTION. CALL (811) AT LEAST TWO WORKING DAYS IN ADVANCE. THE OWNER AND HIS/HER ENGINEER SHALL BE CONTACTED IMMEDIATELY IF A CONFLICT EXISTS.
7. ANY STRUCTURE AND/OR OBSTRUCTION THAT REQUIRES REMOVAL OR RELOCATION RELATING TO THIS PROJECT SHALL BE DONE AT THE DEVELOPER'S EXPENSE.
8. LOCATIONS OF EXISTING UTILITIES ARE APPROXIMATE. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE TRUE ELEVATIONS AND LOCATIONS OF HIDDEN UTILITIES. ALL VISIBLE ITEMS SHALL BE THE ENGINEER'S RESPONSIBILITY.
9. THE CONTRACTOR SHALL INSTALL, REPLACE, OR RELOCATE ALL SIGNS, AS SHOWN ON THE PLANS OR AS AFFECTED BY CONSTRUCTION, PER CITY STANDARDS.
10. POWER, STREET LIGHT, CABLE, AND TELEPHONE LINES SHALL BE IN A TRENCH LOCATED WITHIN A 10-FOOT UTILITY EASEMENT ADJACENT TO PUBLIC RIGHT-OF-WAY. RIGHT-OF-WAY CROSSINGS SHALL HAVE A MINIMUM HORIZONTAL SEPARATION FROM OTHER UTILITIES (SEWER, WATER, AND STORM) OF 5 FEET.
11. ALL CONSTRUCTION SURVEYING FOR EXTENSIONS OF PUBLIC FACILITIES SHALL BE DONE UNDER THE DIRECTION OF A WASHINGTON STATE LICENSED LAND SURVEYOR OR A WASHINGTON STATE LICENSE PROFESSIONAL CIVIL ENGINEER.
12. DURING CONSTRUCTION, ALL PUBLIC STREETS ADJACENT TO THIS PROJECT SHALL BE KEPT CLEAN OF ALL MATERIAL DEPOSITS RESULTING FROM ON-SITE CONSTRUCTION, AND EXISTING STRUCTURES SHALL BE PROTECTED AS DIRECTED BY THE CITY.
13. CERTIFIED RECORD DRAWINGS ARE REQUIRED PRIOR TO PROJECT ACCEPTANCE.
14. A NPDES STORMWATER GENERAL PERMIT MAY BE REQUIRED BY THE DEPARTMENT OF ECOLOGY FOR THIS PROJECT. FOR INFORMATION CONTACT THE DEPARTMENT OF ECOLOGY, SOUTHWEST REGION OFFICE AT (360)407-6300.
15. ANY DISTURBANCE OR DAMAGE TO CRITICAL AREAS AND ASSOCIATED BUFFERS, OR SIGNIFICANT TREES DESIGNATED FOR PRESERVATION AND PROTECTION SHALL BE MITIGATED IN ACCORDANCE WITH A MITIGATION PLAN REVIEWED AND APPROVED BY THE CITY'S PLANNING DIVISION. PREPARATION AND IMPLEMENTATION OF THE MITIGATION PLAN SHALL BE AT THE DEVELOPER'S EXPENSE.

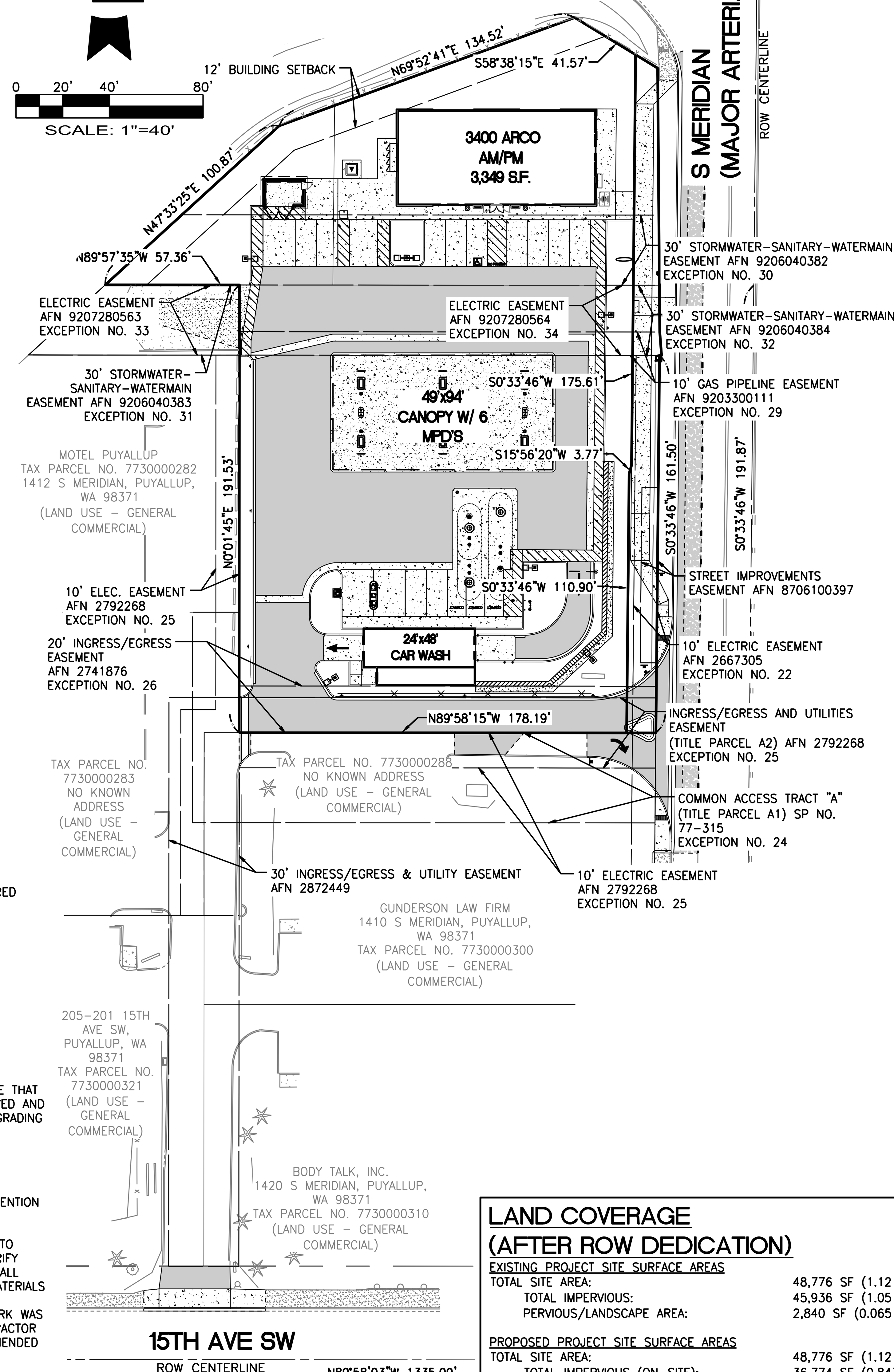
SOILS REPORT NOTES:

1. THE FOLLOWING SOILS REPORT FOR THE SITE SHALL BE CONSIDERED PART OF THESE CONSTRUCTION DOCUMENTS:

   GEOTECHNICAL ENGINEERING STUDY
   ARCO AMPM REFUELING STATION
   1402 S MERIDIAN AVENUE
   PUYALLUP, WASHINGTON 98371
   DATED MAY 6, 2022

   KRAZAN & ASSOCIATES, INC.
   825 CENTER STREET, STE A
   TACOMA, WASHINGTON 98409
   PHONE: (253) 939-2500

2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT ALL PROVISIONS OF THE SOILS REPORT FOR THE SITE BE OBSERVED AND COMPLIED WITH DURING ALL PHASES OF THE SITE PREPARATION, GRADING OPERATIONS, FOUNDATION, SLAB, DETENTION VAULT, AND PAVING CONSTRUCTION.
3. ANY PROVISIONS OF THE SOILS REPORT WHICH CONFLICT WITH INFORMATION SHOWN ELSEWHERE ON THESE DRAWINGS, OR WHICH REQUIRE FURTHER CLARIFICATION, SHALL BE BROUGHT TO THE ATTENTION OF BARGHAUSEN CONSULTING ENGINEERS, INC.
4. A REPRESENTATIVE OF THE SOILS ENGINEER SHALL BE AVAILABLE TO OBSERVE AND APPROVE THE EARTHWORK OPERATIONS AND TO VERIFY FIELD CONDITIONS AS WORK PROCEEDS. THE SOILS ENGINEER SHALL SUBMIT FIELD REPORTS DOCUMENTING THAT THE METHODS AND MATERIALS OF THE EARTHWORK OPERATIONS WERE IN ACCORDANCE WITH THE RECOMMENDATION OF THE SOILS INVESTIGATION AND THAT THE WORK WAS PERFORMED TO THE SATISFACTION OF THE ENGINEER. THE CONTRACTOR SHALL MAKE ALL PROVISIONS FOR SOILS INSPECTIONS AS RECOMMENDED WITHIN THE SOILS REPORT. AT A MINIMUM, THIS INCLUDES THE OBSERVATIONS OF THE FOLLOWING BY A SOILS ENGINEER:
   A. OVER-EXCAVATION RECOMMENDATIONS
   B. PLACEMENT OF STRUCTURAL FILL MATERIAL BENEATH PAVEMENT
   C. SUBGRADE PREPARATION OF STRUCTURAL FOOTINGS
   D. EXCAVATION FOR UNDERGROUND STORAGE TANKS AND STORMWATER FACILITIES
5. THE CONTRACTOR SHALL QUALIFY ANY LIMITATIONS TO SOILS INSPECTIONS WITHIN BID PROPOSAL.



ESTIMATED EARTHWORK QUANTITIES:

CUT: 7,400 CY (EXPORT)
FILL: 3,600 CY (IMPORT)
AREA TO BE DISTURBED = 1.28 AC

EARTHWORK CALCULATIONS

CUT		FILL	
SITE PREP:	3,200 CY	SITE PREP:	3,600 CY
UST EXCAVATION:	1,000 CY		
VAULT EXCAVATION:	3,200 CY		
TOTAL:	7,400 CY	TOTAL:	3,600 CY

EARTHWORK QUANTITIES ARE APPROXIMATE AND HIGHLY DEPENDENT ON SOIL CONDITIONS ENCOUNTERED DURING CONSTRUCTION. TOTAL **DOES NOT** ASSUME RE-USE OF EXISTING SOILS. CONTRACTOR SHOULD PERFORM INDEPENDENT ESTIMATE FOR BIDDING.

LAND COVERAGE (AFTER ROW DEDICATION)

EXISTING PROJECT SITE SURFACE AREAS	
TOTAL SITE AREA:	48,776 SF (1.12 AC)
TOTAL IMPERVIOUS:	45,936 SF (1.05 AC)
PERVIOUS/LANDSCAPE AREA:	2,840 SF (0.065 AC)
PROPOSED PROJECT SITE SURFACE AREAS	
TOTAL SITE AREA:	48,776 SF (1.12 AC)
TOTAL IMPERVIOUS (ON-SITE):	36,774 SF (0.843 AC)
PERVIOUS/LANDSCAPE AREA:	12,002 SF (0.277 AC)

STORMWATER IMPERVIOUS AREA TABLE

ON-SITE (AFTER DEDICATION)	
PROPOSED IMPERVIOUS SURFACES	36,774 SF (0.84 AC)
ROOF CANOPY (COLLECTED)	10,106 SF (0.23 AC)
CURBS/ASPHALT/CONCRETE (COLLECTED)	26,668 SF (0.61 AC)
PROPOSED LANDSCAPING	12,002 SF (0.28 AC)
TOTAL AREA	48,776± SF (1.120± AC)
OFFSITE (ADJACENT PROPERTY)	
REPLACED ASPHALT DRIVEWAY SECTION (COLLECTED)	741 SF (0.017 AC)
EXISTING IMPERVIOUS SURFACE (COLLECTED, BYPASS TRADE-OFF)	2,284 SF (0.052 AC)
TOTAL AREA	3,025 SF (0.069 AC)
NOTE: WWHM CALCS ONLY INCLUDE AREA REQUIRED TO PROVIDE BYPASS TRADE OFF.	
RIGHT-OF-WAY (AFTER DEDICATION)	
ROADWAY/SIDEWALK/CURB & GUTTER (BYPASS)	2,567 SF (0.06 AC)
REVERSE SLOPE SIDEWALK (COLLECTED)	1,768 SF (0.04 AC)
DRIVEWAY (COLLECTED)	123 SF (0.003 AC)
PROPOSED LANDSCAPE	2,624 SF (0.06 AC)
TOTAL AREA	7,082 SF (0.163 AC)

SHEET SET

CIVIL:
EN1.0 - COVER SHEET
EN2.0 - DEMOLITION PLAN
EN2.1 - TESC PLAN
EN2.2 - TESC NOTES AND PROFILES
EN2.3 - TESC NOTES AND DETAILS
EN2.4 - TESC DETAILS

SURVEY
1 OF 2 - ALTA & NSPS LAND TITLE SURVEY
2 OF 2 - ALTA & NSPS LAND TITLE SURVEY

APPLICANT/DEVELOPER

BP FUELS, NA
P.O. BOX 696049
SAN ANTONIO, TX 78269-9931
CONTACT: RANDALL ARNOLD

ENGINEER/SURVEYOR

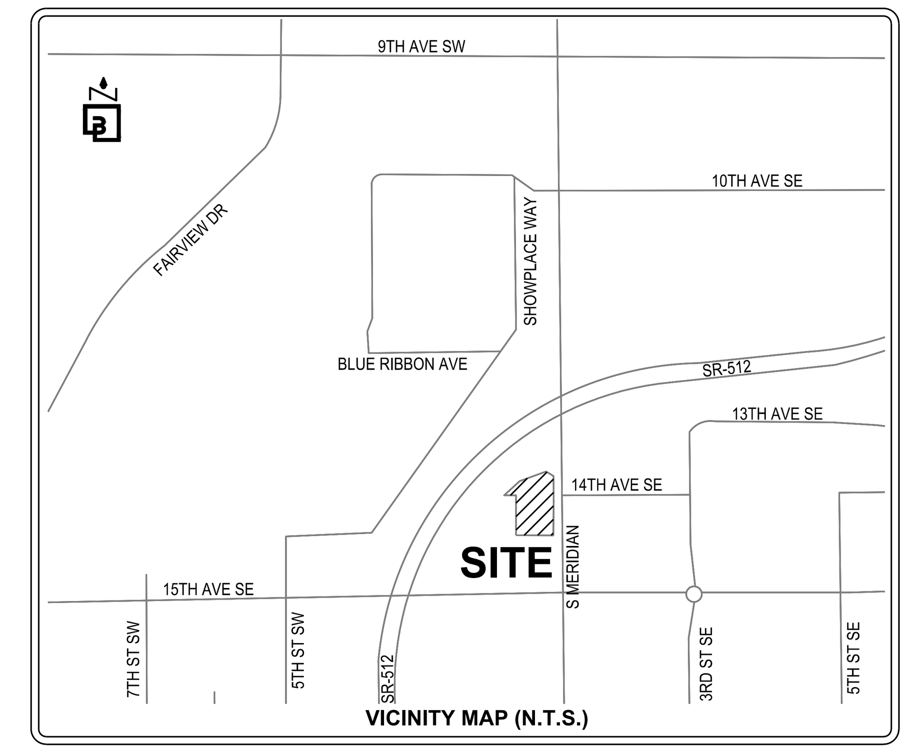
BARGHAUSEN CONSULTING ENGINEERS, INC.
18215 72ND AVE. SOUTH
KENT, WA 98032
TEL: (425) 251-6222
FAX: (425) 251-8782
CONTACT: CHRIS JENSEN, P.E./DAVE WILLIAMS

ARCHITECT

BARGHAUSEN CONSULTING ENGINEERS, INC.
18215 72ND AVE. SOUTH
KENT, WA 98032
TEL: (425) 251-6222
FAX: (425) 251-8782
CONTACT: DAN GOALWIN, R.A.

GEOTECHNICAL ENGINEER:

KRAZAN & ASSOCIATES, INC.
825 CENTER STREET, STE A
TACOMA, WASHINGTON 98409
PHONE: (253) 939-2500
CONTACT: VIJAY CHAUDARY



VICINITY MAP (N.T.S.)

SURVEY INFORMATION

HORIZONTAL DATUM - BASIS OF BEARINGS:
NAD 83/2011 WASHINGTON STATE COORDINATE SYSTEM, SOUTH ZONE, ESTABLISHED BY GPS OBSERVATION UTILIZING THE WASHINGTON STATE REFERENCE NETWORK. THE BASIS OF BEARINGS IS N 00°33'46" E BETWEEN THE FOUND 2"BRASS DISK AT THE INTERSECTION OF S. MERIDIAN & 15TH AVE SW AND THE FOUND 2"IRON PIPE W/TACK IN MONUMENT CASE AT THE INTERSECTION OS S. MERIDIAN & THE ON/OFF RAMP TO SR 512.

VERTICAL DATUM
VERTICAL DATUM FOR THIS SURVEY IS NAVD88 ESTABLISHED FROM WSDOT MONUMENT ID NO. 247. ELEVATION = 80.449' (NAVD88)

LOT AREA
52,078± SF (1.20± AC)

ADDRESS
1402 S. MERIDIAN, PUYALLUP, WA 98371

TAX PARCEL NUMBER
773000-028-1 & 773000-028-8: TITLE PARCEL A
773000-003-1 & 773000-002-1: TITLE PARCEL B

REFERENCE SURVEYS:
1. PIERCE COUNTY SHORT PLAT OF MERIDIAN CENTER - AFN 77-315 (1977)
2. PLAT OF SOURWINE'S ACRE LOTS - VOL 8 PLATS, PAGE 10 (1905)
3. PIERCE COUNTY SHORT PLAT - AFN 8706010381 (1987)
4. WSDOT SR 512 96TH ST TO JCT. SR 167, DATED MAY 23, 1968

DATE OF SURVEY:
THIS SURVEY REPRESENTS VISIBLE PHYSICAL IMPROVEMENT CONDITIONS EXISTING ON MARCH 22, 2022. ALL SURVEY CONTROL INDICATED AS "FOUND" WAS RECOVERED FOR THIS PROJECT IN MARCH OF 2022.

FLOOD INFORMATION:
FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) INFORMATION: FIRM (FLOOD INSURANCE RATE MAP) MAP NO. 53053C0341E PANEL 341 OF 1375, DATED MARCH 7, 2017. THE SUBJECT PROPERTY IS IN ZONE X, AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.

ZONING INFORMATION:
(A ZONING REPORT WAS NOT FURNISHED FOR THIS SITE)

LEGAL DESCRIPTION
(PER ABOVE REFERENCED TITLE REPORT)
PARCEL A: (773000-028-1 & 773000-028-8)
LOT 1 AND THE NORTH 15 FEET OF THE EAST 178.33 FEET OF "COMMON ACCESS TRACT A", OF PIERCE COUNTY SHORT PLAT RECORDED UNDER RECORDING NO. 77-315, RECORDS OF PIERCE COUNTY WASHINGTON, FORMERLY BEING DESCRIBED AS THE NORTH 161.5 FEET OF THE WEST 178.33 FEET OF THE EAST 188.33 FEET OF LOT 20, SOURWINE'S ACRE LOTS, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 8 OF PLATS, PAGE 10, RECORDS OF PIERCE COUNTY, WASHINGTON;
TOGETHER WITH THAT PORTION OF 14TH AVENUE SW, VACATED BY ORDINANCE NO. 2304 ABUTTING THEREON AND ATTACHED THERETO, RECORDED UNDER RECORDING NO. 9206040385.
PARCEL A1:
RIGHTS TO USE THAT PORTION OF THE WITHIN DESCRIBED PROPERTY LYING WITHIN COMMON ACCESS TRACT "A" OF SIDE SHORT PLAT, FOR INGRESS, EGRESS, AND INSTALLATION AND MAINTENANCE OF UTILITIES, AS SET FORTH AND DELINEATED ON PIERCE COUNTY SHORT PLAT NO. 77-315;
EXCEPT ANY PORTION LYING WITHIN PARCEL A ABOVE.
PARCEL A2:
AN EASEMENT FOR INGRESS AND EGRESS AS SET FORTH IN DOCUMENTS ENTITLED "STATUTORY WARRANTY DEED" AS RECORDED UNDER RECORDING NUMBERS 2741876 AND 2792268.
PARCEL B: (773000-003-1 & 773000-002-1)
LOT 2, SOURWINE'S ACRE LOTS, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 8 OF PLATS, PAGE 10, RECORDS OF PIERCE COUNTY, WASHINGTON;
EXCEPT THAT PORTION LYING WITHIN STATE HIGHWAY NO. SR-512, 96TH STREET TO JUNCTION SR-167;
TOGETHER WITH THAT PORTION OF 14TH AVENUE SW, VACATED BY ORDINANCE NO. 2304 ABUTTING THEREON AND ATTACHED THERETO, RECORDED UNDER RECORDING NO. 9206040385.
SITUATE IN THE COUNTY OF PIERCE, STATE OF WASHINGTON.

LEGEND

	EXISTING	PROPOSED		EXISTING	PROPOSED
CURB AND GUTTER			STORM LINE	SD	
BARRIER CURB			CATCH BASIN TYPE 1		
CONCRETE			CATCH BASIN TYPE 2		
ASPHALT			SANITARY SEWER LINE	SS	
PAINT STRIPING			SANITARY SEWER MANHOLE		
DIRECTIONAL ARROW			CLEANOUT (AS NOTED)		
SAWCUT			POWER OVERHEAD	P (OH)	P(OH)
BOLLARD			POWER UNDERGROUND	P (UG)	P(UG)
SIGN			POWER METER		
BUILDING LINE			UTILITY POLE		
CONTOURS	432	432	JUNCTION BOX (TYPE 1,2,3)		
WATER LINE	W	W	LUMINAIRE		
FIRE HYDRANT			YARD LIGHT		
WATER METER			TELEPHONE	T(UG)	T
WATER VALVE			GAS	G	G
FIRE DEPARTMENT CONN.			GAS METER		
POST INDICATOR VALVE			GAS VALVE		
PEDESTRIAN ACCESS PATH			PROPERTY LINE		
FENCE	X				

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.

CLIENT:
bp
ARCO
BP WEST COAST PRODUCTS, LLC

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

NO.	DATE	REVISION DESCRIPTION
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SEAL:
ALEX WHITE
STATE OF WASHINGTON
30677
REGISTERED PROFESSIONAL ENGINEER
1/12/24

DEVELOPMENT INFORMATION:
ARCO NTI
3400 am/pm
FUEL CANOPY w/ 6 MPD's

SITE ADDRESS:
1402 S. MERIDIAN
@ HIGHWAY 512
PUYALLUP, WASHINGTON

FACILITY #TBD

DESIGNED BY:	JDF	ALLIANCE Z&OM:	
CHECKED BY:	AW	BP REPM:	
DRAWN BY:	JDF	ALLIANCE PM:	
VERSION:	-	PROJECT NO:	21730

DRAWING TITLE:
COVER SHEET

SHEET NO:
EN1.0

P:\21000s\21730\engineering\21730-0-GRAD.dwg 1/12/2024 3:26 PM JFLEHARTY

DEMOLITION PLAN

FOR

ARCO ampm PUYALLUP

SEC. 33, TWN. 20 N, RGE. 4 E, W.M.

CITY OF PUYALLUP, PIERCE COUNTY

(#) - DEMOLITION CONSTRUCTION NOTES:

1. DEMOLISH EXISTING BUILDING. DISPOSE OF OFF-SITE.
2. DEMOLISH EXISTING BARRIER CURB. DISPOSE OF OFF-SITE.
3. DEMOLISH EXISTING ASPHALT/CONCRETE PAVEMENTS. DISPOSE OF OFF-SITE.
4. REMOVE EXISTING GRAVEL. CONFIRM REUSE WITH GEOTECH ENGINEER.
5. REMOVE EXISTING UNDERGROUND POWER LINE AND DISPOSE OF OFF-SITE.
6. REMOVE EXISTING UNDERGROUND TELECOMMUNICATIONS LINE AND DISPOSE OF OFF-SITE. COORDINATION REMOVAL WITH PURVEYOR.
7. REMOVE GAS LINE AND DISPOSE OF OFF-SITE. COORDINATION REMOVAL WITH PURVEYOR.
8. REMOVE EXISTING LOT LIGHTS AND DISPOSE OF OFF-SITE.
9. PROTECT EXISTING UNDERGROUND POWER, ASSOCIATED JUNCTION BOX, AND POWER VAULT TO REMAIN.
10. REMOVE EXISTING FENCE AND DISPOSE OF OFF-SITE.
11. REMOVE EXISTING STORM STRUCTURES. DISPOSE OF OFF-SITE.
12. PROTECT EXISTING TREE TO REMAIN. SEE TREE PROTECTION NOTE THIS SHEET.
13. PROTECT EXISTING CURB/CURB AND GUTTER TO REMAIN.
14. PROTECT EXISTING UNDERGROUND TELECOMMUNICATION LINE TO REMAIN.
15. PROTECT EXISTING SANITARY SEWER LINE AND ASSOCIATED STRUCTURE TO REMAIN.
16. PROTECT EXISTING STORM STRUCTURES AND PIPING TO REMAIN.
17. PROTECT EXISTING POWER VAULT TO REMAIN.
18. PROTECT EXISTING SIGN TO REMAIN.
19. PROTECT EXISTING FIRE HYDRANT TO REMAIN.
20. PROTECT EXISTING WATER MAIN TO REMAIN.
21. PROTECT EXISTING GAS LINE, GAS VALVE, AND ASSOCIATED PIPING TO REMAIN.
22. REMOVE EXISTING ROCKS AND DISPOSE OF OFF-SITE.
23. REMOVE EXISTING WHEEL STOPS (TYP.) AND DISPOSE OF OFF-SITE.
24. PROTECT EXISTING BILLBOARD TO REMAIN.
25. REMOVE WATER SERVICE AND DISPOSE OF OFF-SITE. INSTALL BRASS PLUG AT WATER MAIN TO ABANDON.
26. REMOVE EXISTING FENCE POST. DISPOSE OF OFF-SITE.
27. REMOVE EXISTING MONITORING WELL. DISPOSE OF OFF-SITE. CONTRACTOR TO PROTECT ALL EXISTING MONITORING WELLS TO THE MAXIMUM EXTENT FEASIBLE. MODIFICATION TO ANY EXISTING MONITORING WELL MUST BE COORDINATED WITH ARCO'S MONITORING WELL PROGRAM. ALL EXISTING MONITORING WELLS TO BE REMOVED OR ABANDONED SHALL BE PER D.O.E. STANDARDS. CONTRACTOR SHALL PROVIDE A LICENSED DRILL CONTRACTOR TO APPLY FOR N.O.I. W/D.O.E. TO DECOMMISSION WELL AND SUBMIT PROOF OF COMPLETED ABANDONMENT PRIOR TO OCCUPANCY/PERMIT FINAL.
28. REMOVE EXISTING STORM PIPING. DISPOSE OF OFF-SITE.
29. REMOVE AND RELOCATE EXISTING TELEPHONE CABINET. CONTRACTOR TO COORDINATE AND CONFIRM SCOPE OF WORK WITH PURVEYOR.
30. EXISTING SIGN TO BE RE-INSTALLED. FINAL LOCATION TO BE APPROVED WITH ROW INSPECTOR.
31. REMOVE EXISTING GAS METER AND DISPOSE OF OFF-SITE. COORDINATION REMOVAL WITH PURVEYOR.
32. REMOVE EXISTING POWER METER AND DISPOSE OF OFF-SITE. COORDINATION REMOVAL WITH PURVEYOR.
33. REMOVE EXISTING SANITARY SIDE SEWER AND DISPOSE OF OFF-SITE. CUT AND CAP AT MAIN.
34. PROTECT EXISTING WHEEL STOPS TO REMAIN.
35. PROTECT EXISTING LOT LIGHT TO REMAIN.
36. REMOVE EXISTING FIRE HYDRANT AND DISPOSE OF OFF-SITE. INSTALL BRASS PLUG AT WATER MAIN TO ABANDON.

DEMOLITION NOTES:

1. ALL PAVEMENTS, SLABS, GROUND COVER, UTILITIES, ETC., INSIDE LIMITS OF DISTURBANCE SHALL BE REMOVED UNLESS OTHERWISE SHOWN ON THE PLANS.
2. CONTRACTOR SHALL CONTACT AND COORDINATE WITH THE VARIOUS UTILITY COMPANIES ON REQUESTING DISCONNECTIONS, REMOVALS AND/OR RELOCATION OF EXISTING SERVICE.
3. CONTRACTOR SHALL ENSURE THAT ALL NECESSARY PERMITS AND CONSTRUCTION APPROVALS HAVE BEEN OBTAINED PRIOR TO COMMENCING WORK.
4. CONTRACTOR SHALL REPLACE ALL EXISTING CURB, PAVEMENT AND/OR LANDSCAPING DAMAGED AS A RESULT OF CONSTRUCTION ACTIVITY.
5. CONTRACTOR SHALL, PRIOR TO CONSTRUCTION OR REMOVAL OF IMPROVEMENTS, FIELD VERIFY AND CONFIRM LIMITS OF DEMOLITION AS WELL AS EXISTING UTILITIES AND IMPROVEMENTS TO REMAIN.

TREE PROTECTION NOTE:

EXISTING TREES TO REMAIN SHALL BE PROTECTED. CONTRACTOR TO ENSURE NO DAMAGE ON TREE ROOT ZONES OCCUR. CONTRACTOR TO INSTALL/IMPLEMENT TREE PROTECTION MEASURES AS NECESSARY.

TEMPORARY EXCAVATION SLOPE NOTE:

CONTRACTOR TO ENSURE TEMPORARY SLOPES HAVE A MAXIMUM SLOPE INCLINATION OF 1.5H:1V. CONTRACTOR TO REFER TO THE GEOTECHNICAL ENGINEERING STUDY PREPARED BY KRAZEN & ASSOCIATES, INC. DATED MAY 6, 2022 FOR EXCAVATION AND SLOPE REQUIREMENTS.

DUST CONTROL NOTES:

CONTRACTOR SHALL DETERMINE THE APPLICABILITY OF DUST CONTROL AND APPLY APPROPRIATE DUST CONTROL MEASURES AS NEEDED.

1. WATER ALL ACTIVE CONSTRUCTION AREAS AT LEAST TWICE DAILY.
2. WATER OR COVER STOCKPILES OF DEBRIS, SOIL, SAND OR OTHER MATERIALS THAT CAN BE BLOWN BY THE WIND.
3. COVER ALL TRUCKS HAULING SOIL, SAND, AND OTHER LOOSE MATERIALS OR REQUIRE ALL TRUCKS TO MAINTAIN AT LEAST TWO FEET OF FREEBOARD.
4. SWEEP DAILY (PREFERABLY WITH WATER SWEEPERS) ALL PAVED ACCESS ROADS, PARKING AREAS AND STAGING AREAS AT CONSTRUCTION SITES.
5. SWEEP STREETS DAILY (PREFERABLY WITH WATER SWEEPERS) IF VISIBLE SOIL MATERIAL IS CARRIED ONTO ADJACENT PUBLIC STREETS.

NOTIFICATION REQUIREMENT NOTE:

PROPOSED DEVELOPMENT INCLUDES WORK ON ADJACENT PARCELS. CONTRACTOR TO CONFIRM WITH BP FUELS FOR ANY RESTRICTIONS, TEMPORARY EASEMENTS OR AGREEMENTS FOR CONSTRUCTION, PROPER NOTIFICATION TIMING, AND PHASING CONSIDERATIONS TO LIMIT DISTURBANCE TO ADJACENT PROPERTY OWNERS.

DEMO LEGEND:

CONCRETE TO BE REMOVED

ASPHALT TO BE REMOVED

CURB TO BE REMOVED

SAWCUT LINE

LIMITS OF DISTURBANCE

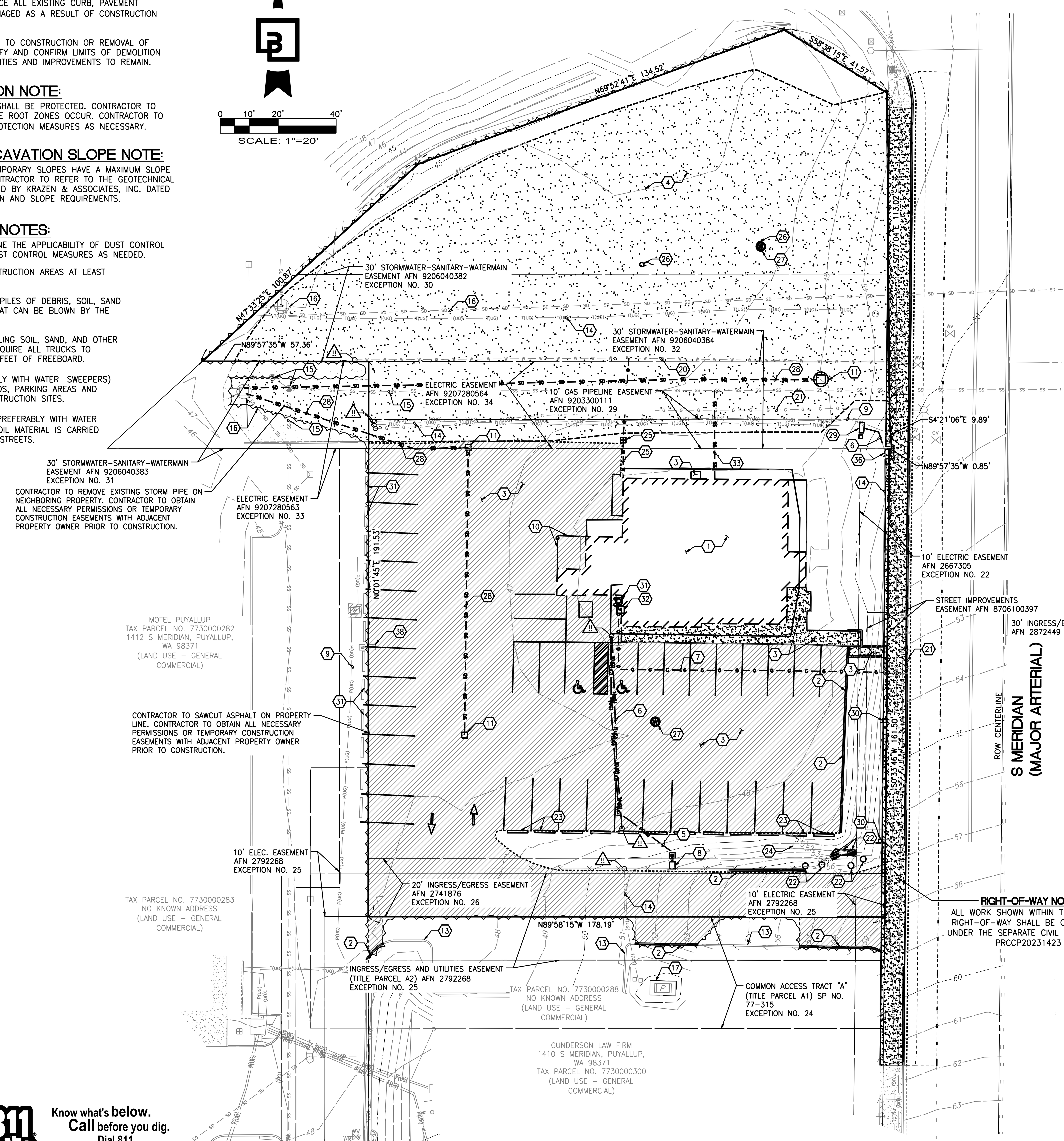
CONSTRUCTION SEQUENCE:

1. HOLD A PRECONSTRUCTION MEETING WITH THE CITY AND OBTAIN REQUIRED PERMITS.
2. ESTABLISH CLEARING AND GRADING LIMITS.
3. CONSTRUCT TEMPORARY CONSTRUCTION ENTRANCE.
4. CONSTRUCT PERIMETER DITCHES, SILT FENCES, AND OTHER DEVICES.
5. CONSTRUCT PROTECTION DEVICES FOR CRITICAL AREAS AND SIGNIFICANT TREES PROPOSED FOR RETENTION.
6. SCHEDULE AN EROSION CONTROL INSPECTION WITH THE CITY.
7. CONSTRUCT STORM DRAINAGE RETENTION/DETENTION FACILITIES. PROVIDE EMERGENCY OVERFLOW AS APPLICABLE.
8. ALL DITCHES AND SWALE DIRECT ALL SURFACE WATER TO THE RETENTION/DETENTION AND SEDIMENTATION POND AS CLEARING AND GRADING PROGRESSES. NO UNCONTROLLED SURFACE WATER SHALL BE ALLOWED TO LEAVE THE SITE.
9. CLEARLY STATE AT WHAT POINT GRADING ACTIVITIES CAN BEGIN.
10. IDENTIFY EROSION CONTROL MEASURES WHICH REQUIRE REGULAR MAINTENANCE.

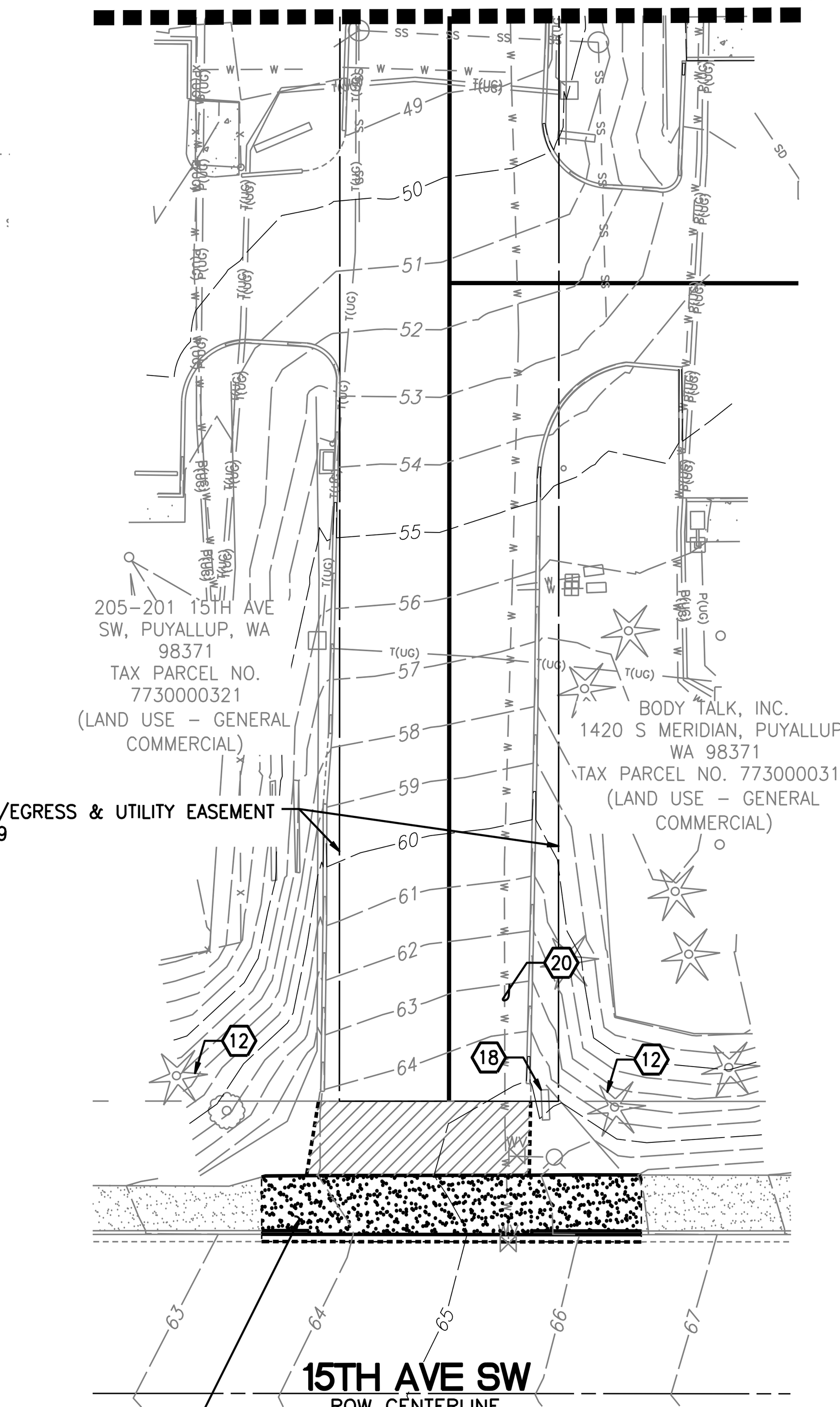
N

0 10' 20' 40'

SCALE: 1"=20'



MATCHLINE - SEE LEFT FOR CONTINUATION



RIGHT-OF-WAY NOTE

ALL WORK SHOWN WITHIN THE PUBLIC RIGHT-OF-WAY SHALL BE COMPLETED UNDER THE SEPARATE CIVIL PERMIT NO. PRCCP20231423

MATCHLINE - SEE RIGHT FOR CONTINUATION

UTILITY POTHOLING NOTE:

THE CIRCLED LOCATIONS ARE REQUIRED TO BE POTHOLED TO VERIFY HORIZONTAL AND VERTICAL LOCATION OF EXISTING UTILITIES AND/OR POTENTIAL CONFLICTS WITH EXISTING UTILITIES. POTHOLING SHALL BE PERFORMED PRIOR TO INSTALLING ANY PROPOSED UTILITIES. CONTRACTOR SHALL NOTIFY BARGHAUSEN CONSULTING ENGINEERS, INC. OF ANY CONFLICTS.

UTILITY PROTECTION NOTE:

APPROXIMATE LOCATION OF EXISTING UTILITIES ARE SHOWN ON THESE PLANS. CONTRACTOR TO COORDINATE WITH PURVEYORS AND USE EXTREME CAUTION WHEN EXCAVATING ON-SITE, UNTIL EXISTING GAS AND POWER SERVICE LOCATIONS ARE CONFIRMED. CONTRACTOR TO ORDER INDEPENDENT UTILITY LOCATES (INCLUDING GAS AND POWER) FOR THE FULL SCOPE OF WORK PRIOR TO CONSTRUCTION OR ANY GROUND DISTURBING ACTIVITIES.

UTILITY CONFLICT NOTE:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION, DIMENSION, AND DEPTH OF ALL EXISTING UTILITIES WHETHER SHOWN ON THESE PLANS OR NOT BY POTHOLING THE UTILITIES AND SURVEYING THE HORIZONTAL AND VERTICAL LOCATION PRIOR TO CONSTRUCTION. THIS SHALL INCLUDE CALLING UTILITY LOCATE AT 811 48 HOURS IN ADVANCE AND THEN POTHOLING ALL OF THE EXISTING UTILITIES AT LOCATIONS OF NEW UTILITY CROSSINGS TO PHYSICALLY VERIFY WHETHER OR NOT CONFLICTS EXIST. LOCATIONS OF SAID UTILITIES AS SHOWN ON THESE PLANS ARE BASED UPON THE UNVERIFIED PUBLIC INFORMATION AND ARE SUBJECT TO VARIATION. IF CONFLICTS SHOULD OCCUR, THE CONTRACTOR SHALL NOTIFY BARGHAUSEN CONSULTING ENGINEERS, INC. TO RESOLVE ALL PROBLEMS PRIOR TO PROCEEDING WITH CONSTRUCTION.

811 Know what's **below.** **Call** before you dig. Dial 811

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.

CLIENT:

bp

ARCO

BP WEST COAST PRODUCTS, LLC

Barghausen Consulting Engineers, Inc.

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

NO.	DATE	REVISION DESCRIPTION
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SEAL:

ALEX WHITE
STATE OF WASHINGTON
1030777
REGISTERED PROFESSIONAL ENGINEER

1/12/24

DEVELOPMENT INFORMATION:

ARCO NTI
3400 am/pm
FUEL CANOPY w/ 6 MPD's

SITE ADDRESS:

1402 S. MERIDIAN
@ HIGHWAY 512
PUYALLUP, WASHINGTON

FACILITY #TBD

DESIGNED BY: JDF	ALLIANCE Z&OM:		
CHECKED BY: AW	BP REPM:		
DRAWN BY: JDF	ALLIANCE PM:		
VERSION: -	PROJECT NO: 21730		

DRAWING TITLE:

DEMOLITION PLAN

SHEET NO:

EN2.0

P:\21000s\21730\engineering\21730-DEMO-GRAD.dwg 1/12/2024 12:58 PM JFLEHARTY

TESC PLAN

FOR

ARCO ampm PUYALLUP

SEC. 33, TWN. 20 N, RGE. 4 E, W.M.
CITY OF PUYALLUP, PIERCE COUNTY

N

0 10' 20' 40'
SCALE: 1"=20'

(1) - TESC CONSTRUCTION NOTES:

1. INSTALL SILTATION FENCE PER CITY OF PUYALLUP STANDARD DETAIL 02.03.02 AROUND PERIMETER OF SITE TO PREVENT SILT-LADEN RUNOFF FROM LEAVING SITE. ADJUST LOCATION AS DIRECTED BY THE CITY INSPECTOR. SEE DETAIL 6/EN2.4.
2. INSTALL CATCH BASIN INSERTS IN ALL CATCH BASINS LOCATED ON-SITE PER BMP C220-INLET PROTECTION OF THE 2019 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON (2019 SWMMWW). SEE DETAIL 3/EN2.4.
3. APPROXIMATE LOCATION OF CONSTRUCTION STAGING AREA. CONTRACTOR TO USE THIS AREA FOR TEMPORARY STOCKPILE STORAGE AND CONCRETE WASHOUT PER 2019 SWMMWW BMP C154-CONCRETE WASHOUT AREA, SEE DETAIL 4/EN2.4. ADJUST SIZE AND LOCATION OF AREA AS NEEDED DURING CONSTRUCTION.
4. INSTALL CONSTRUCTION ENTRANCE PER CITY OF PUYALLUP STANDARD DETAIL 05.01.01. ADJUST LOCATION AS NEEDED OR AS DIRECTED BY THE CITY INSPECTOR. SEE DETAIL 5/EN2.4.
5. INSTALL TEMPORARY CONSTRUCTION FENCE AND SITE ACCESS GATE (6' HIGH-CHAIN LINK WITH LOCKING DEVICE) AT TEMPORARY CONSTRUCTION ENTRANCE. SEE DETAIL 4/EN2.3.
6. APPROXIMATE LIMITS OF DISTURBANCE.
7. APPROXIMATE LOCATION OF TEMPORARY SEDIMENT TRAP PER 2019 SWMMWW BMP C240. MINIMUM REQUIRED SURFACE AREA FOR SEDIMENT TRAP IS 1,000 SF MIN. CONTRACTOR TO ENSURE SEDIMENT TRAP LENGTH TO WIDTH RATIO OF 3:1. SEE DETAIL 1/EN2.4.
   TOP ELEVATION: 44.00
   BOTTOM ELEVATION: 42.00
8. APPROXIMATE LOCATION OF TEMPORARY "V" DITCH. SEE DETAIL 5/EN2.3.
9. APPROXIMATE LOCATION OF TEMPORARY ROCK CHECK DAM, PER 2019 SWMMWW BMP C207. SEE DETAIL 2/EN2.4.
10. INSTALL CATCH BASIN INSERTS IN ALL CATCH BASINS LOCATED WITHIN DRIVE AISLES PER WSDOT STANDARD DETAIL I-40.20-00. CONTRACTOR TO ALSO INSTALL CATCH BASIN INSERTS IN ANY CATCH BASIN LOCATED WITH 500' OF THE JOB SITE. SEE DETAIL 2/EN2.3.
11. APPROXIMATE LOCATION OF DEWATERING EXTRACTION POINT (TYP. OF 12). REFER TO COMPLETE DEWATERING PLAN PREPARED BY BENDER, LLC.
12. DEWATERING WATER TO BE DISCHARGED TO THE SANITARY SEWER. REFER TO COMPLETE DEWATERING PLAN PREPARED BY BENDER, LLC

EROSION CONTROL NOTES:

1. ALL NECESSARY EQUIPMENT AND MATERIALS SHALL BE AVAILABLE ON SITE TO FACILITATE RAPID INSTALLATION OF EROSION AND SEDIMENT CONTROL BMPS WHEN RAIN IS IMMINENT.
2. THE CONTRACTOR SHALL RESTORE ALL EROSION CONTROL DEVICES TO WORKING ORDER TO THE SATISFACTION OF THE AUTHORITY HAVING JURISDICTION AFTER EACH RUN-OFF PRODUCING RAINFALL.
3. THE CONTRACTOR SHALL INSTALL ADDITIONAL EROSION CONTROL MEASURES AS MAY BE REQUIRED BY THE AUTHORITY HAVING JURISDICTION DUE TO UNCOMPLETED GRADING OPERATIONS OR UNFORESEEN CIRCUMSTANCES WHICH MAY ARISE.
4. ADEQUATE EROSION AND SEDIMENT CONTROL AND PERIMETER PROTECTION BEST MANAGEMENT PRACTICE MEASURES MUST BE INSTALLED AND MAINTAINED.
5. CONTRACTOR TO IMPLEMENT SLOPE STABILIZATION MEASURES AS NECESSARY FOR EXPOSED SLOPES DURING CONSTRUCTION. MEASURES CAN INCLUDE TEMPORARY AND PERMANENT SEEDING PER DOE BMP C120.

DUST CONTROL NOTES:

CONTRACTOR SHALL DETERMINE THE APPLICABILITY OF DUST CONTROL AND APPLY APPROPRIATE DUST CONTROL MEASURES AS NEEDED.

1. WATER ALL ACTIVE CONSTRUCTION AREAS AT LEAST TWICE DAILY.
2. WATER OR COVER STOCKPILES OF DEBRIS, SOIL, SAND OR OTHER MATERIALS THAT CAN BE BLOWN BY THE WIND.
3. BE BLOWN BY THE WIND.
4. COVER ALL TRUCKS HAULING SOIL, SAND, AND OTHER LOOSE MATERIALS OR REQUIRE ALL TRUCKS TO MAINTAIN AT LEAST TWO FEET OF FREEBOARD.
5. SWEEP DAILY (PREFERABLY WITH WATER SWEEPERS) ALL PAVED ACCESS ROADS, PARKING AREAS AND STAGING AREAS AT CONSTRUCTION SITES.
6. SWEEP STREETS DAILY (PREFERABLY WITH WATER SWEEPERS) IF VISIBLE SOIL MATERIAL IS CARRIED ONTO ADJACENT PUBLIC STREETS.

SOIL STABILIZATION AND REVEGETATION:

EXPOSED AREAS AND SOIL STOCKPILES MUST BE STABILIZED ACCORDING TO THE FOLLOWING SCHEDULE:

1. FROM APRIL 1 TO OCTOBER 31 ALL DISTURBED AREAS AT FINAL GRADE AND ALL EXPOSED AREAS THAT ARE SCHEDULED TO REMAIN UNWORKED FOR MORE THAN 30 DAYS SHALL BE STABILIZED WITHIN 10 DAYS.
2. FROM NOVEMBER 1 TO MARCH 31 ALL EXPOSED SOILS AT FINAL GRADE SHALL BE STABILIZED IMMEDIATELY USING PERMANENT OR TEMPORARY MEASURES. EXPOSED SOILS WITH AN AREA GREATER THAN 5,000 SQUARE FEET THAT ARE SCHEDULED TO REMAIN UNWORKED FOR MORE THAN 24 HOURS AND EXPOSED AREAS OF LESS THAN 5,000 SQUARE FEET THAT WILL REMAIN UNWORKED FOR MORE THAN SEVEN (7) DAYS SHALL BE STABILIZED IMMEDIATELY.

ALL DISTURBED AREAS WHICH ARE NOT PLANNED TO BE CONSTRUCTED ON WITHIN 90 DAYS FROM TIME OF CLEARING AND GRADING SHALL BE REVEGETATED WITH THE NATIVE VEGETATION.

UTILITY CONFLICT NOTE:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION, DIMENSION, AND DEPTH OF ALL EXISTING UTILITIES WHETHER SHOWN ON THESE PLANS OR NOT BY POTHOLING THE UTILITIES AND SURVEYING THE HORIZONTAL AND VERTICAL LOCATION PRIOR TO CONSTRUCTION. THIS SHALL INCLUDE CALLING UTILITY LOCATE AT 811 48 HOURS IN ADVANCE AND THEN POTHOLING ALL OF THE EXISTING UTILITIES AT LOCATIONS OF NEW UTILITY CROSSINGS TO PHYSICALLY VERIFY WHETHER OR NOT CONFLICTS EXIST. LOCATIONS OF SAID UTILITIES AS SHOWN ON THESE PLANS ARE BASED UPON THE UNVERIFIED PUBLIC INFORMATION AND ARE SUBJECT TO VARIATION. IF CONFLICTS SHOULD OCCUR, THE CONTRACTOR SHALL NOTIFY BARGHAUSEN CONSULTING ENGINEERS, INC. TO RESOLVE ALL PROBLEMS PRIOR TO PROCEEDING WITH CONSTRUCTION.

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TEMPORARY SHORING AND DEEP EXCAVATION NOTE:

TANK AND STORM FACILITY EXCAVATIONS SHALL BE PER OSHA REQUIREMENTS. TANK AND STORM FACILITY EXCAVATIONS THAT REQUIRE SHORING SHALL BE ENGINEERED AND PERMITTED SEPARATELY AND SHALL BE THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR.

TEMPORARY CONSTRUCTION DEWATERING NOTE:

TEMPORARY CONSTRUCTION DEWATERING MAY BE REQUIRED DURING EXCAVATION AND CONSTRUCTION OF THE PROPOSED DETENTION VAULT AND USTS. CONTRACTOR SHALL REFER TO TEMPORARY DEWATERING PLAN PREPARED BY OTHERS.

TEMPORARY SEDIMENT TRAP DISCHARGE TESTING NOTE:

STORMWATER FROM THE TEMPORARY SEDIMENT TRAP MAY NOT BE DISCHARGED INTO THE MS4 WITHOUT PRIOR TESTING FROM THE ON-SITE CESCL OR GEOTECHNICAL ENGINEER PER THE CONSTRUCTION STORMWATER GENERAL PERMIT STORMWATER POLLUTION PREVENTION PLAN.

SOIL AMENDMENT NOTE:

ALL SOIL DISTURBED FOR LANDSCAPE AREA SHALL BE AMENDED PER CITY OF PUYALLUP STANDARD DETAIL 1.02.08A. REFER TO DETAIL 3/EN2.3

TREE PROTECTION NOTE:

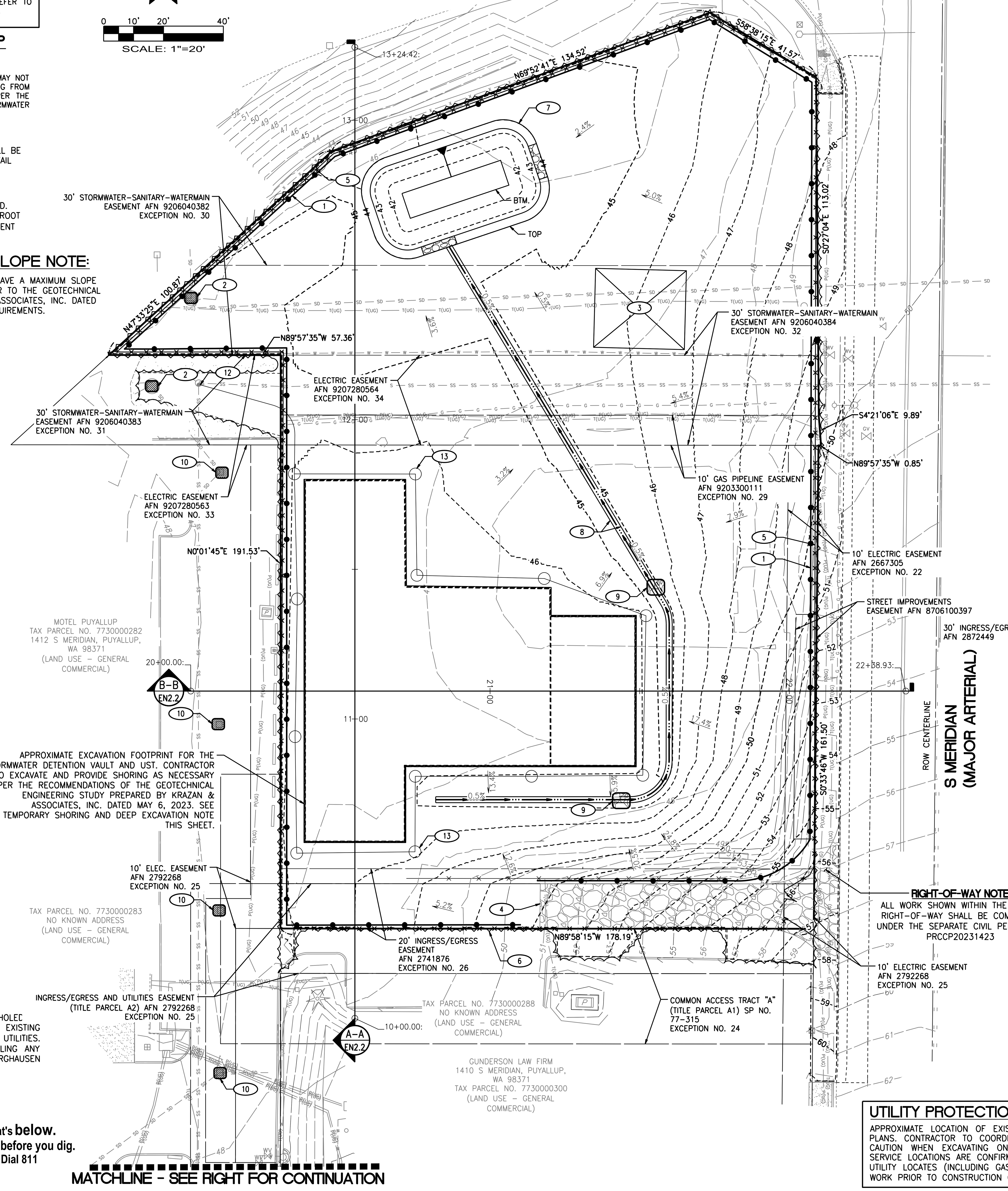
EXISTING TREES TO REMAIN SHALL BE PROTECTED. CONTRACTOR TO ENSURE NO DAMAGE ON TREE ROOT ZONES OCCUR. CONTRACTOR TO INSTALL/IMPLEMENT TREE PROTECTION MEASURES AS NECESSARY.

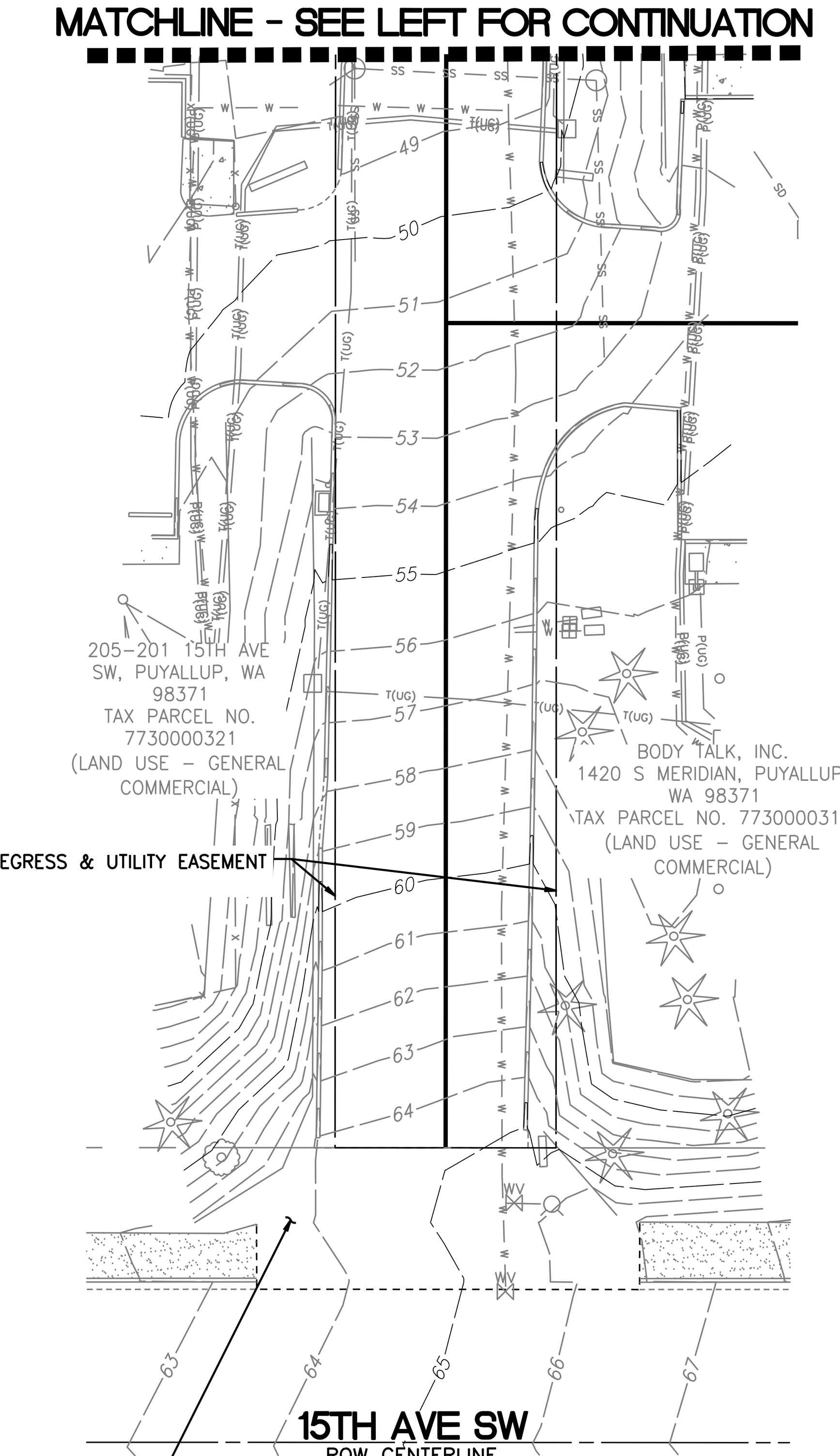
TEMPORARY EXCAVATION SLOPE NOTE:

CONTRACTOR TO ENSURE TEMPORARY SLOPES HAVE A MAXIMUM SLOPE INCLINATION OF 1.5H:1V. CONTRACTOR TO REFER TO THE GEOTECHNICAL ENGINEERING STUDY PREPARED BY KRAZEN & ASSOCIATES, INC. DATED MAY 6, 2022 FOR EXCAVATION AND SLOPE REQUIREMENTS.

UTILITY POTHOLING NOTE:

THE CIRCLED LOCATIONS ARE REQUIRED TO BE POTHOLED VERIFY VERTICAL AND HORIZONTAL LOCATION OF EXISTING UTILITY AND/OR POTENTIAL CONFLICTS WITH EXISTING UTILITIES. POTHOLING SHALL BE PERFORMED PRIOR TO INSTALLING ANY PROPOSED UTILITIES. CONTRACTOR SHALL NOTIFY BARGHAUSEN CONSULTING ENGINEERS, INC. OF ANY CONFLICTS.





TESC LEGEND:

- LIMITS OF DISTURBANCE
- CATCH BASIN PROTECTION
- SILT FENCE
- TEMPORARY CONSTRUCTION FENCE
- DRAINAGE FLOWPATH
- ROCK CHECK DAM

CONSTRUCTION SEQUENCE:

1. HOLD A PRECONSTRUCTION MEETING WITH THE CITY AND OBTAIN REQUIRED PERMITS.
2. ESTABLISH CLEARING AND GRADING LIMITS.
3. CONSTRUCT TEMPORARY CONSTRUCTION ENTRANCE.
4. CONSTRUCT PERIMETER DITCHES, SILT FENCES, AND OTHER DEVICES.
5. CONSTRUCT PROTECTION DEVICES FOR CRITICAL AREAS AND SIGNIFICANT TREES PROPOSED FOR RETENTION.
6. SCHEDULE AN EROSION CONTROL INSPECTION WITH THE CITY.
7. CONSTRUCT STORM DRAINAGE RETENTION/DETENTION FACILITIES. PROVIDE EMERGENCY OVERFLOW AS APPLICABLE.
8. ALL DITCHES AND SWALE DIRECT ALL SURFACE WATER TO THE RETENTION/DETENTION AND SEDIMENTATION POND AS CLEARING AND GRADING PROGRESSES. NO UNCONTROLLED SURFACE WATER SHALL BE ALLOWED TO LEAVE THE SITE.
9. CLEARLY STATE AT WHAT POINT GRADING ACTIVITIES CAN BEGIN.
10. IDENTIFY EROSION CONTROL MEASURES WHICH REQUIRE REGULAR MAINTENANCE.

UTILITY PROTECTION NOTE:

APPROXIMATE LOCATION OF EXISTING GAS SERVICE IS SHOWN ON THESE PLANS. CONTRACTOR TO COORDINATE WITH PURVEYOR AND USE EXTREME CAUTION WHEN EXCAVATING ON-SITE, UNTIL EXISTING GAS AND POWER SERVICE LOCATIONS ARE CONFIRMED. CONTRACTOR TO ORDER INDEPENDENT UTILITY LOCATES (INCLUDING GAS AND POWER) FOR THE FULL SCOPE OF WORK PRIOR TO CONSTRUCTION OR ANY GROUND DISTURBING ACTIVITIES.

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.

CLIENT: bp
ARCO
BP WEST COAST PRODUCTS, LLC

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

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SEAL: ALEX WHITE, STATE OF WASHINGTON, 1036777, REGISTERED PROFESSIONAL ENGINEER
1/12/24

DEVELOPMENT INFORMATION:
ARCO NTI
3400 am/pm
FUEL CANOPY w/ 6 MPD's

SITE ADDRESS:
1402 S. MERIDIAN
@ HIGHWAY 512
PUYALLUP, WASHINGTON

FACILITY #TBD

DESIGNED BY: JDF	ALLIANCE Z&OM:		
CHECKED BY: AW	BP REPM:		
DRAWN BY: JDF	ALLIANCE PM:		
VERSION: -	PROJECT NO: 21730		

DRAWING TITLE: TESC PLAN

SHEET NO: EN2.1

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TESC NOTES AND PROFILES

FOR

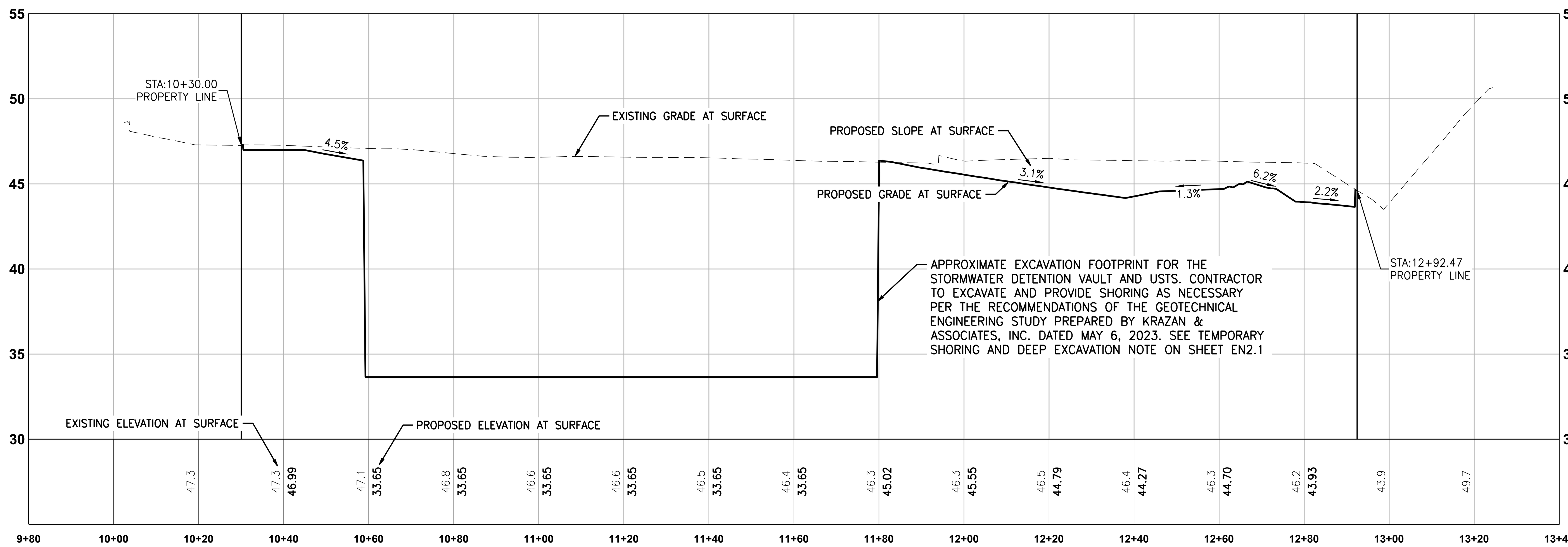
ARCO ampm PUYALLUP

SEC. 33, TWN. 20 N, RGE. 4 E, W.M.

CITY OF PUYALLUP, PIERCE COUNTY

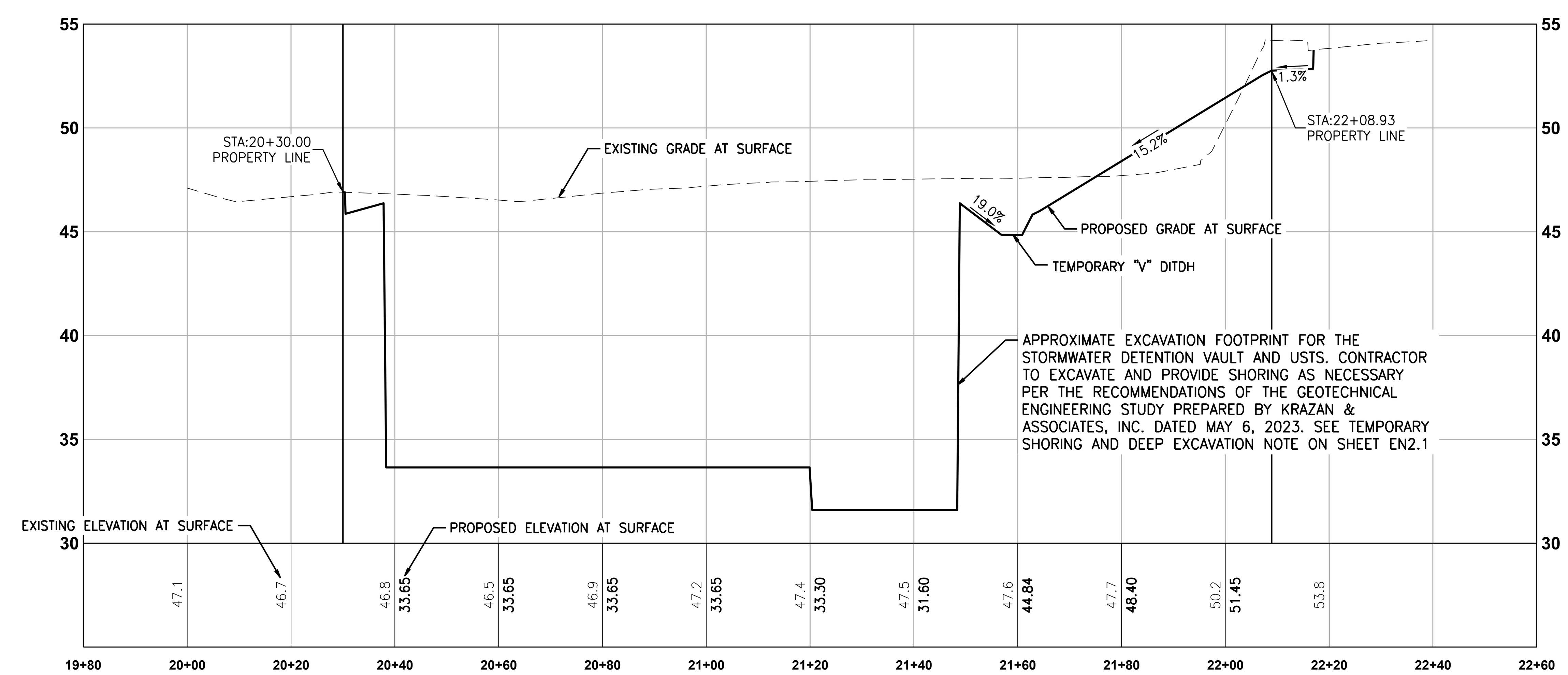
CITY OF PUYALLUP - GRADING, EROSION AND SEDIMENTATION CONTROL NOTES:

1. ALL WORK IN CITY RIGHT-OF-WAY REQUIRES A PERMIT FROM THE CITY OF PUYALLUP. PRIOR TO ANY WORK COMMENCING, THE GENERAL CONTRACTOR SHALL ARRANGE FOR A PRECONSTRUCTION MEETING AT THE DEVELOPMENT SERVICES CENTER TO BE ATTENDED BY ALL CONTRACTORS THAT WILL PERFORM WORK SHOWN ON THE APPROVED ENGINEERING PLANS, REPRESENTATIVES FROM ALL APPLICABLE UTILITY COMPANIES, THE PROJECT OWNER AND APPROPRIATE CITY STAFF. CONTACT ENGINEERING SERVICES AT (253-841-5568) TO SCHEDULE THE MEETING. THE CONTRACTOR IS RESPONSIBLE TO HAVE THEIR OWN SET OF APPROVED PLANS AT THE MEETING.
2. AFTER COMPLETION OF ALL ITEMS SHOWN ON THESE PLANS AND BEFORE ACCEPTANCE OF THE PROJECT THE CONTRACTOR SHALL OBTAIN A "PUNCH LIST" PREPARED BY THE CITY'S INSPECTOR DETAILING REMAINING ITEMS OF WORK TO BE COMPLETED. ALL ITEMS OF WORK SHOWN ON THESE PLANS SHALL BE COMPLETED TO THE SATISFACTION OF THE CITY PRIOR TO ACCEPTANCE OF THE WATER SYSTEM AND PROVISION OF SANITARY SEWER SERVICE.
3. ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION (HEREINAFTER REFERRED TO AS THE "STANDARD SPECIFICATIONS"), WASHINGTON STATE DEPARTMENT OF TRANSPORTATION AND AMERICAN PUBLIC WORKS ASSOCIATION, WASHINGTON STATE CHAPTER, LATEST EDITION, UNLESS SUPERSEDED OR AMENDED BY THE CITY OF PUYALLUP CITY STANDARDS FOR PUBLIC WORKS ENGINEERING AND CONSTRUCTION (HEREINAFTER REFERRED TO AS THE "CITY STANDARDS").
4. A COPY OF THESE APPROVED PLANS AND APPLICABLE CITY DEVELOPER SPECIFICATIONS AND DETAILS SHALL BE ON SITE DURING CONSTRUCTION.
5. ANY REVISIONS MADE TO THESE PLANS MUST BE REVIEWED AND APPROVED BY THE DEVELOPER'S ENGINEER AND THE CITY PRIOR TO ANY IMPLEMENTATION IN THE FIELD. THE CITY SHALL NOT BE RESPONSIBLE FOR ANY ERRORS AND/OR OMISSIONS ON THESE PLANS.
6. THE CONTRACTOR SHALL HAVE ALL UTILITIES VERIFIED ON THE GROUND PRIOR TO ANY CONSTRUCTION. CALL (811) AT LEAST TWO WORKING DAYS IN ADVANCE. THE OWNER AND HIS/HER ENGINEER SHALL BE CONTACTED IMMEDIATELY IF A CONFLICT EXISTS.
7. ALL LIMITS OF CLEARING AND AREAS OF VEGETATION PRESERVATION AS PRESCRIBED ON THE PLANS SHALL BE CLEARLY FLAGGED IN THE FIELD AND OBSERVED DURING CONSTRUCTION.
8. ALL REQUIRED SEDIMENTATION AND EROSION CONTROL FACILITIES MUST BE CONSTRUCTED AND IN OPERATION PRIOR TO ANY LAND CLEARING AND/OR OTHER CONSTRUCTION TO ENSURE THAT SEDIMENT LADEN WATER DOES NOT ENTER THE NATURAL DRAINAGE SYSTEM. THE CONTRACTOR SHALL SCHEDULE AN INSPECTION OF THE EROSION CONTROL FACILITIES PRIOR TO ANY LAND CLEARING AND/OR OTHER CONSTRUCTION. ALL EROSION AND SEDIMENT FACILITIES SHALL BE MAINTAINED IN A SATISFACTORY CONDITION AS DETERMINED BY THE CITY, UNTIL SUCH TIME THAT CLEARING AND/OR CONSTRUCTION IS COMPLETED AND THE POTENTIAL FOR ON-SITE EROSION HAS PASSED. THE IMPLEMENTATION, MAINTENANCE, REPLACEMENT, AND ADDITIONS TO THE EROSION AND SEDIMENTATION CONTROL SYSTEMS SHALL BE RESPONSIBILITY OF THE PERMITTEE.
9. THE EROSION AND SEDIMENTATION CONTROL SYSTEM FACILITIES DEPICTED ON THESE PLANS ARE INTENDED TO BE MINIMUM REQUIREMENTS TO MEET ANTICIPATED SITE CONDITIONS. AS CONSTRUCTION PROGRESSES AND UNEXPECTED OR SEASONAL CONDITIONS DICTATE, FACILITIES WILL BE NECESSARY TO ENSURE COMPLETE SILTATION CONTROL ON THE SITE. DURING THE COURSE OF CONSTRUCTION, IT SHALL BE THE OBLIGATION AND RESPONSIBILITY OF THE PERMITTEE TO ADDRESS ANY NEW CONDITIONS THAT MAY BE CREATED BY HIS ACTIVITIES AND TO PROVIDE ADDITIONAL FACILITIES, OVER AND ABOVE THE MINIMUM REQUIREMENTS, AS MAY BE NEEDED TO PROTECT ADJACENT PROPERTIES, SENSITIVE AREAS, NATURAL WATER COURSES, AND/OR STORM DRAINAGE SYSTEMS.
10. APPROVAL OF THESE PLANS IS FOR GRADING, TEMPORARY DRAINAGE, EROSION AND SEDIMENTATION CONTROL ONLY. IT DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT STORM DRAINAGE DESIGN, SIZE OR LOCATION OF PIPES, RESTRICTORS, CHANNELS, OR RETENTION FACILITIES.
11. ANY DISTURBED AREA WHICH HAS BEEN STRIPPED OF VEGETATION AND WHERE NO FURTHER WORK IS ANTICIPATED FOR A PERIOD OF 30 DAYS OR MORE, MUST BE IMMEDIATELY STABILIZED WITH MULCHING, GRASS PLANTING, OR OTHER APPROVED EROSION CONTROL TREATMENT APPLICABLE TO THE TIME OF YEAR IN QUESTION. GRASS SEEDING ALONE WILL BE ACCEPTABLE ONLY DURING THE MONTHS OF APRIL THROUGH SEPTEMBER INCLUSIVE. SEEDING MAY PROCEED OUTSIDE THE SPECIFIED TIME PERIOD WHENEVER IT IS IN THE INTEREST OF THE PERMITTEE BUT MUST BE AUGMENTED WITH MULCHING, NETTING, OR OTHER TREATMENT APPROVED BY THE CITY.
12. IN CASE EROSION OR SEDIMENTATION OCCURS TO ADJACENT PROPERTIES, ALL CONSTRUCTION WORK WITHIN THE DEVELOPMENT THAT WILL FURTHER AGGRAVATE THE SITUATION MUST CEASE, AND THE OWNER/CONTRACTOR WILL IMMEDIATELY COMMENCE RESTORATION METHODS. RESTORATION ACTIVITY WILL CONTINUE UNTIL SUCH TIME AS THE AFFECTED PROPERTY OWNER IS SATISFIED.
13. NO TEMPORARY OR PERMANENT STOCKPILING OF MATERIALS OR EQUIPMENT SHALL OCCUR WITHIN CRITICAL AREAS OR ASSOCIATED BUFFERS, OR THE CRITICAL ROOT ZONE FOR VEGETATION PROPOSED FOR RETENTION.



A-A: STORMTECH VAULT LOOKING WEST

HORIZONTAL SCALE: 1"=20', VERTICAL SCALE: 1"=5'



B-B: STORMTECH EXCAVATION LOOKING NORTH

HORIZONTAL SCALE: 1"=20', VERTICAL SCALE: 1"=5'

UTILITY CONFLICT NOTE:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION, DIMENSION, AND DEPTH OF ALL EXISTING UTILITIES WHETHER SHOWN ON THESE PLANS OR NOT BY POTHOLING THE UTILITIES AND SURVEYING THE HORIZONTAL AND VERTICAL LOCATION PRIOR TO CONSTRUCTION. THIS SHALL INCLUDE CALLING UTILITY LOCATE AT 811 48 HOURS IN ADVANCE AND THEN POTHOLING ALL OF THE EXISTING UTILITIES AT LOCATIONS OF NEW UTILITY CROSSINGS TO PHYSICALLY VERIFY WHETHER OR NOT CONFLICTS EXIST. LOCATIONS OF SAID UTILITIES AS SHOWN ON THESE PLANS ARE BASED UPON THE UNVERIFIED PUBLIC INFORMATION AND ARE SUBJECT TO VARIATION. IF CONFLICTS SHOULD OCCUR, THE CONTRACTOR SHALL NOTIFY BARGHAUSEN CONSULTING ENGINEERS, INC. TO RESOLVE ALL PROBLEMS PRIOR TO PROCEEDING WITH CONSTRUCTION.

811 Know what's below. Call before you dig. Dial 811

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.

CLIENT: bp

ARCO
BP WEST COAST PRODUCTS, LLC

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18215 72nd Avenue South
Kent, WA 98032
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SEAL: ALEX WHITE, STATE OF WASHINGTON, 51036777, REGISTERED PROFESSIONAL ENGINEER
1/12/24

DEVELOPMENT INFORMATION:
ARCO NTI
3400 am/pm
FUEL CANOPY w/ 6 MPD's

SITE ADDRESS:
1402 S. MERIDIAN
@ HIGHWAY 512
PUYALLUP, WASHINGTON

FACILITY #TBD

DESIGNED BY:	JDF	ALLIANCE Z&OM:	
CHECKED BY:	AW	BP REPM:	
DRAWN BY:	JDF	ALLIANCE PM:	
VERSION:	-	PROJECT NO:	21730

DRAWING TITLE: TESC NOTES AND PROFILES

SHEET NO: EN2.2

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TESC NOTES AND DETAILS

FOR

ARCO ampm PUYALLUP

SEC. 33, TWN. 20 N, RGE. 4 E, W.M.

CITY OF PUYALLUP, PIERCE COUNTY

GEOTECHNICAL RECOMMENDATIONS

THE FOLLOWING NOTES HAVE BEEN REFERENCED FROM THE REPORT TITLED "GEOTECHNICAL ENGINEERING INVESTIGATION" DATED MAY 6, 2022, PREPARED BY KRAZAN & ASSOCIATES, INC. REFER TO THE COMPLETE REPORT FOR ALL EARTHWORK REQUIREMENTS.

SITE PREPARATION:
GENERAL SITE CLEARING SHOULD INCLUDE REMOVAL OF TOPSOIL MATERIAL, ASPHALTIC CONCRETE, ABANDONED UTILITIES, AND STRUCTURES INCLUDING FOUNDATIONS, SLABS, RUBBLE, AND TRASH, DOWN TO NATIVE SUITABLE SOILS. IN ADDITION, ANY BURIED STRUCTURES, SUCH AS GREASE TRAPS, SEPTIC TANKS, UNDERGROUND STORAGE TANKS, DEBRIS PITS, CESSPOOLS, OR SIMILAR STRUCTURES, SHOULD BE COMPLETELY REMOVED AND BACKFILLED WITH STRUCTURAL FILL. THE UNDOCUMENTED FILL AND THE NATIVE VERY LOOSE SANDS AND VERY SOFT TO MEDIUM STIFF ORGANIC SILT/PEAT, CLAY, AND SANDY OR CLAYEY SILT ENCOUNTERED IN OUR FIELD EXPLORATIONS ARE CONSIDERED UNSUITABLE FOR SUPPORT OF THE AM/PM BUILDING, FUEL CANOPY STRUCTURE, CAR WASH STRUCTURE, FLOOR SLABS AND EXTERIOR SLABS-ON-GRADE, AND PAVEMENT LOADS.

BASED ON THE SHALLOW GROUNDWATER LEVELS ENCOUNTERED IN OUR EXPLORATIONS CONDUCTED IN MARCH 2022, TEMPORARY DEWATERING MEASURES WILL LIKELY BE REQUIRED TO CONDUCT THE OVER-EXCAVATION OF UNSUITABLE SOILS, ESPECIALLY IF CONSTRUCTION TAKES PLACE DURING THE "WET WEATHER" SEASON.

KRAZAN & ASSOCIATES RECOMMEND THE UNDOCUMENTED FILL AND UNSUITABLE NATIVE SOILS BE OVER-EXCAVATED TO A DEPTH OF AT LEAST 2 FEET BELOW THE FOOTING BEARING LEVEL FOR SHALLOW FOUNDATIONS OR THE PLANNED SUBGRADE ELEVATION FOR SLABS-ON-GRADE OR PAVEMENTS. DEEPER EXCAVATIONS MAY BE REQUIRED IF SOFT AND YIELDING SOIL CONDITIONS ARE EXPOSED AT THE BOTTOM OF THE OVER-EXCAVATION. A LAYER OF ROCK SPALLS SHOULD BE PLACED ON THE EXCAVATION BOTTOM AND TAMPED IN-PLACE TO PROVIDE A STABLE WORKING SURFACE FOR PLACEMENT OF STRUCTURAL FILL. KRAZAN & ASSOCIATES RECOMMEND A HIGH-STRENGTH GEOTEXTILE SEPARATION FABRIC, SUCH AS MIRAFI 600X OR EQUIVALENT, THEN BE PLACED OVER THE ROCK SPALLS. AFTER THE FABRIC IS PLACED, THE AREA SHOULD BE FILLED TO THE PLANNED PAVEMENT SUBGRADE ELEVATION WITH STRUCTURAL FILL. THE STRUCTURAL FILL SHOULD BE COMPACTED TO AT LEAST 95 PERCENT OF THE MAXIMUM DRY DENSITY (ASTM D1557) AND TO WITHIN 2 PERCENT OF THE OPTIMUM MOISTURE CONTENT. IN-PLACE DENSITY TESTS SHOULD BE PERFORMED TO VERIFY PROPER MOISTURE CONTENT AND ADEQUATE COMPACTION LEVELS ARE ACHIEVED IN THE STRUCTURAL FILL. AN EXISTING RESTAURANT BUILDING IS LOCATED WITHIN THE EASTERN CENTRAL PORTION OF THE PROPERTY WHERE THE CANOPY AND FUEL PUMPS ARE PLANNED, AND EXTENDS INTO PART OF THE PROPOSED AREA OF THE FUTURE USTS. THE DEBRIS FROM DEMOLITION OF THE EXISTING BUILDING SHOULD BE HAULED OFF-SITE. AS-BUILT RECORDS FOR THE EXISTING BUILDING WERE NOT AVAILABLE AT THE TIME OF THIS REPORT. ASSUMING THE RESTAURANT IS SUPPORTED ON A SHALLOW FOUNDATION SYSTEM, THEN EXISTING CONCRETE FOOTINGS SHOULD BE COMPLETELY REMOVED WITHIN THE FOOTPRINT OF THE CANOPY STRUCTURE, AND TO A DEPTH OF AT LEAST 1-FOOT BELOW THE PLANNED SUBGRADE ELEVATION IN NEW PAVEMENT OR EXTERIOR SLAB-ON-GRADE AREAS. IF THE EXISTING BUILDING IS PILE SUPPORTED, THE TYPE AND LOCATION OF THE PILES WILL NEED TO BE EVALUATED PRIOR TO OR DURING CONSTRUCTION AS INFORMATION BECOMES AVAILABLE TO DETERMINE IF THE PILES SHOULD BE LEFT IN-PLACE, OR PARTIALLY OR COMPLETELY REMOVED. KRAZAN & ASSOCIATES SHOULD BE ONSITE FULL-TIME DURING THE DEMOLITION ACTIVITIES TO DOCUMENT THAT ALL BELOW-GRADE STRUCTURES HAVE BEEN PROPERLY REMOVED AND BACKFILLED WITH PROPERLY PLACED AND COMPACTED STRUCTURAL FILL, AND THAT THE RESULTING DEBRIS FROM THE DEMOLITION ACTIVITIES HAS BEEN HAULED OFF-SITE AND NOT RE-USED AS FILL AT ANY LOCATION ON THE PROPERTY.

WET SEASON
DURING WET WEATHER CONDITIONS, SUBGRADE STABILITY PROBLEMS AND GRADING DIFFICULTIES MAY DEVELOP DUE TO THE EXCESS MOISTURE, DISTURBANCE OF SENSITIVE SOILS, SHALLOW GROUNDWATER LEVELS, AND/OR THE PRESENCE OF PERCHED GROUNDWATER. CONSTRUCTION DURING EXTENDED PERIODS OF WET WEATHER COULD RESULT IN THE NEED TO REMOVE WET DISTURBED SOILS IF THEY CANNOT BE SUITABLY COMPACTED DUE TO ELEVATED MOISTURE CONTENTS. THE PREPARED SUBGRADE SHOULD BE PROTECTED FROM CONSTRUCTION TRAFFIC AND SURFACE WATER SHOULD BE DIVERTED AROUND THE PREPARED SUBGRADE. SOILS THAT HAVE BECOME UNSTABLE MAY REQUIRE OVER-EXCAVATION, OR DRYING AND RECOMPACTION. SELECTIVE DRYING MAY BE ACCOMPLISHED BY SCARIFYING OR WINDROWING SURFICIAL MATERIAL DURING EXTENDED PERIODS OF DRY, WARM WEATHER (TYPICALLY DURING THE SUMMER MONTHS). IF THE SOILS CANNOT BE DRIED BACK TO A WORKABLE MOISTURE CONDITION, REMOVAL OF THE UNSTABLE SOILS OR THE USE OF REMEDIAL MEASURES MAY BE REQUIRED. THESE REMEDIAL MEASURES COULD INCLUDE PLACEMENT OF A BLANKET OF ROCK SPALLS
TO PROTECT THE EXPOSED SUBGRADE AND CONSTRUCTION TRAFFIC AREAS. THE LATERAL EXTENT AND DEPTH OF ROCK SPALLS, IF REQUIRED, SHOULD BE DETERMINED BASED ON EVALUATION OF THE NEAR SURFACE SOIL CONDITIONS AT THE TIME OF CONSTRUCTION. GENERAL PROJECT SITE WINTERIZATION SHOULD CONSIST OF THE PLACEMENT OF AGGREGATE BASE AND THE PROTECTION OF EXPOSED SOILS DURING THE CONSTRUCTION PHASE.

GROUNDWATER:
POREWATER PRESSURE DISSIPATION TESTS CONDUCTED ON MARCH 30, 2022 IN THE CPTS INDICATED
A GROUNDWATER LEVEL RANGING BETWEEN 1.2 TO 3.7 FEET BGS. SHALLOW GROUNDWATER WAS ALSO ENCOUNTERED IN THE TEST PITS; HOWEVER, AFTER WAITING 3 HOURS THE WATER LEVEL WAS STILL RISING SO THE TEST PITS WERE BACKFILLED FOR SAFETY REASONS. TWO MONITORING WELLS INSTALLED BY OTHERS, ONE NEAR CPT-1 AND THE OTHER NEAR CPT-4, INDICATED WATER LEVELS AT 4.6 AND 1.5 FEET BGS. A MANHOLE COVER FOR THE COMMUNICATIONS LINE AT THE NORTHEAST SIDE OF THE SITE WAS REMOVED DURING OUR MARCH 28, 2022 SITE VISIT AND THE WATER LEVEL WAS MEASURED AT A DEPTH OF ABOUT 5.5 FEET BG.

DEWATERING
SUMP PIT AND PUMPING METHODS MAY BE ABLE TO HANDLE GROUNDWATER ENCOUNTERED IN SHALLOW EXCAVATIONS DEPENDING ON THE TIME OF YEAR CONSTRUCTION TAKES PLACE, THE PLANNED EXCAVATION DEPTH, AND THE SOILS ENCOUNTERED WITHIN THE EXCAVATION. THE TEST PITS CONDUCTED FOR THIS EXPLORATION ENCOUNTERED GROUNDWATER AS SHALLOW AS 1.5 FEET BGS, AND CAVE-IN OF THE PIT SIDEWALLS OCCURRED IN THE VERY LOOSE TO LOOSE SOILS AT ABOUT THE LEVEL GROUNDWATER WAS ENCOUNTERED. DEEPER EXCAVATIONS, SUCH AS FOR INSTALLATION OF THE USTS, WILL REQUIRE MORE A MORE AGGRESSIVE DEWATERING METHOD, SUCH AS WELL POINTS. TO MAINTAIN THE STABILITY OF THE EXCAVATION BOTTOM, GROUNDWATER LEVELS SHOULD BE DRAWN DOWN A MINIMUM OF 2 FEET BELOW THE LOWEST PORTION OF THE EXCAVATION. THE GROUNDWATER LEVEL SHOULD BE MAINTAINED BELOW THE RECOMMENDED LEVEL UNTIL THE BACKFILL HAS BEEN PLACED AND COMPACTED.

TEMPORARY EXCAVATIONS
THE ONSITE SOILS HAVE VARIABLE FRICTION AND COHESION STRENGTHS, THEREFORE THE SAFE ANGLES TO WHICH THESE MATERIALS MAY BE CUT FOR TEMPORARY EXCAVATIONS IS VARIABLE, AS THE SOILS MAY BE PRONE TO CAVING AND SLOPE FAILURES IN TEMPORARY EXCAVATIONS DEEPER THAN ABOUT 2 FEET OR AT THE LEVEL WHERE GROUNDWATER IS ENCOUNTERED. TEMPORARY EXCAVATIONS IN THE FILL MATERIAL AND UNDERLYING NATIVE SOILS SHOULD BE SLOPED NO STEEPER THAN 2H:1V (HORIZONTAL TO VERTICAL) WHERE ROOM PERMITS. DEPENDING ON SITE SOIL AND GROUNDWATER CONDITIONS, IT MAY BE NECESSARY TO FLATTEN THE SIDE SLOPES OF THE EXCAVATION AND LOWER THE GROUNDWATER LEVEL AS NECESSARY TO ACHIEVE STABLE CONDITIONS. SLOPE CUTS INTO EXCAVATIONS GREATER THAN 20 FEET IN DEPTH SHOULD BE DESIGNED BY A PROFESSIONAL ENGINEER FOR THE CONTRACTOR.

UTILITY TRENCHING AND BACKFILL
THE ONSITE UNDOCUMENTED FILL AND NATIVE SOILS ARE CONSIDERED UNSUITABLE FOR RE-USE AS TRENCH BACKFILL, STRUCTURAL FILL SHOULD BE USED AS BACKFILL. TRENCH BACKFILL LIFTS SHOULD BE PLACED IN EQUAL MEASURES ON EACH SIDE OF THE UTILITY PIPE TO THE TOP OF THE PIPE. TRENCH BACKFILL LIFTS SHOULD NOT EXCEED 8 INCHES IN LOOSE THICKNESS PRIOR TO COMPACTION, WITH THE EXCEPTION THAT THE FIRST LIFT PLACED OVER THE PIPE MAY BE UP TO 14 INCHES IN LOOSE THICKNESS. EACH LIFT OF TRENCH BACKFILL SHOULD BE MOISTURE CONDITIONED TO WITHIN 2 PERCENT OF ITS OPTIMUM MOISTURE CONTENT AND COMPACTED TO THE REQUIRED RELATIVE DENSITY PRIOR TO PLACEMENT OF ADDITIONAL FILL LIFTS. A FIRM AND UNYIELDING SUBGRADE (I.E. BEARING SOILS AT BOTTOM OF TRENCH) SHOULD ALLOW FOR THE PROPER PLACEMENT OF SUBSURFACE UTILITIES. IF UNSTABLE SOILS ARE ENCOUNTERED AT THE UTILITY TRENCH BOTTOM, WE RECOMMEND PLACEMENT OF GEOTEXTILE AND QUARRY ROCK (ROCK SPALLS) ON THE BOTTOM OF UTILITY TRENCHES PRIOR TO PLACEMENT OF PIPE BEDDING TO PROVIDE A STABLE SUBGRADE FOR PLACEMENT OF THE PIPE BEDDING, UTILITY, AND TRENCH BACKFILL. THE THICKNESS OF THE ROCK SPALL LAYER WILL DEPEND ON THE INSTABILITY OF THE SUBGRADE SOILS AT THE TIME OF EXCAVATION. PIPE BEDDING SHOULD BE IN ACCORDANCE WITH THE PIPE MANUFACTURER'S RECOMMENDATION.

STRUCTURAL FILL

BASED ON THE FIELD EXPLORATION, THE UNDOCUMENTED FILL AND NATIVE SOIL THAT WILL BE ENCOUNTERED WITHIN ROUGHLY THE UPPER 10 FEET DURING SITE DEVELOPMENT ARE CONSIDERED UNSUITABLE FOR RE-USE AS STRUCTURAL FILL MATERIAL DUE TO THEIR HIGH FINES CONTENT (PERCENT SILT AND/OR CLAY MATERIAL PASSING THE NO. 200 SIEVE), AS WELL AS ORGANIC CONTENT FOR THE SHALCAR MUCK ENCOUNTERED IN OUR EXPLORATIONS. THESE SOILS ARE CONSIDERED EXTREMELY MOISTURE-SENSITIVE AND WILL LIKELY DISTURB EASILY IN WET CONDITION.

IMPORTED FILL MATERIAL SHOULD BE ALL-WEATHER STRUCTURAL FILL CONSISTING OF WELL-GRADED GRAVEL OR A SAND AND GRAVEL MIXTURE WITH A MAXIMUM GRAIN SIZE OF 3 INCHES AND LESS THAN 5 PERCENT FINES (MATERIAL PASSING THE U.S. STANDARD NO. 200 SIEVE). STRUCTURAL FILL MAY ALSO CONSIST OF CRUSHED ROCK, ROCK SPALLS, OR CONTROLLED DENSITY FILL (CDF).

ALL STRUCTURAL FILL MATERIAL SHOULD BE SUBMITTED FOR APPROVAL TO THE GEOTECHNICAL ENGINEER AT LEAST 48 HOURS PRIOR TO DELIVERY TO THE SITE. FILL SOILS SHOULD BE PLACED IN HORIZONTAL LIFTS NOT EXCEEDING 8 INCHES LOOSE THICKNESS, MOISTURE-CONDITIONED AS NECESSARY (MOISTURE CONTENT OF SOIL SHALL NOT VARY BY MORE THAN ±2 PERCENT OF ITS OPTIMUM MOISTURE CONTENT), AND COMPACTED TO AT LEAST 95 PERCENT OF THE MAXIMUM DRY DENSITY BASED ON ASTM TEST METHOD D1557 (MODIFIED PROCTOR). IN-PLACE DENSITY TESTS SHOULD BE PERFORMED ON ALL STRUCTURAL FILL TO DOCUMENT
PROPER MOISTURE CONTENT AND ADEQUATE COMPACTION LEVELS HAVE BEEN ATTAINED. ADDITIONAL FILL LIFTS SHOULD NOT BE PLACED IF THE PREVIOUS LIFT DID NOT MEET THE COMPACTION REQUIREMENTS OR IF SOIL CONDITIONS ARE NOT CONSIDERED STABLE. PLACING SEVERAL LIFTS OF FILL AND THEN POTHOLING DOWN TO EACH LIFT TO CONDUCT COMPACTION TESTING IS NOT ACCEPTABLE, AND WILL REQUIRE COMPLETE REMOVAL OF THE FILL DOWN TO THE FIRST LIFT. PONDING OR JETTING THE SOIL IS NOT AN APPROVED METHOD OF SOIL COMPACTION

UTILITY CONFLICT NOTE:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION, DIMENSION, AND DEPTH OF ALL EXISTING UTILITIES WHETHER SHOWN ON THESE PLANS OR NOT BY POTHOLING THE UTILITIES AND SURVEYING THE HORIZONTAL AND VERTICAL LOCATION PRIOR TO CONSTRUCTION. THIS SHALL INCLUDE CALLING UTILITY LOCATE AT 811 48 HOURS IN ADVANCE AND THEN POTHOLING ALL OF THE EXISTING UTILITIES AT LOCATIONS OF NEW UTILITY CROSSINGS TO PHYSICALLY VERIFY WHETHER OR NOT CONFLICTS EXIST. LOCATIONS OF SAID UTILITIES AS SHOWN ON THESE PLANS ARE BASED UPON THE UNVERIFIED PUBLIC INFORMATION AND ARE SUBJECT TO VARIATION. IF CONFLICTS SHOULD OCCUR, THE CONTRACTOR SHALL NOTIFY BARGHAUSEN CONSULTING ENGINEERS, INC. TO RESOLVE ALL PROBLEMS PRIOR TO PROCEEDING WITH CONSTRUCTION.

811 Know what's below. Call before you dig. Dial 811

1. ALL LIMITS OF CLEARING AND AREAS OF VEGETATION PRESERVATION AS PRESCRIBED ON THE PLANS SHALL BE CLEARLY FLAGGED IN THE FIELD AND OBSERVED DURING CONSTRUCTION.

2. ALL REQUIRED SEDIMENTATION AND EROSION CONTROL FACILITIES MUST BE CONSTRUCTED AND IN OPERATION PRIOR TO ANY LAND CLEARING AND/OR OTHER CONSTRUCTION TO ENSURE THAT SEDIMENT LADEN WATER DOES NOT ENTER THE NATURAL DRAINAGE SYSTEM. THE CONTRACTOR SHALL SCHEDULE AN INSPECTION OF THE EROSION CONTROL FACILITIES PRIOR TO ANY LAND CLEARING AND/OR CONSTRUCTION. ALL EROSION AND SEDIMENT FACILITIES SHALL BE MAINTAINED IN A SATISFACTORY CONDITION AS DETERMINED BY THE CITY, UNTIL SUCH TIME THAT CLEARING AND/OR CONSTRUCTION IS COMPLETED AND THE POTENTIAL FOR ON-SITE EROSION HAS PASSED. THE IMPLEMENTATION, MAINTENANCE, REPLACEMENT, AND ADDITIONS TO THE EROSION AND SEDIMENTATION CONTROL SYSTEMS SHALL BE THE RESPONSIBILITY OF THE PERMITEE.

3. THE EROSION AND SEDIMENTATION CONTROL SYSTEM FACILITIES DEPICTED ON THESE PLANS ARE INTENDED TO BE MINIMUM REQUIREMENTS TO MEET ANTICIPATED SITE CONDITIONS. AS CONSTRUCTION PROGRESSES AND UNEXPECTED OR SEASONAL CONDITIONS DICTATE, FACILITIES WILL BE NECESSARY TO ENSURE COMPLETE SILTATION CONTROL ON THE SITE. DURING THE COURSE OF CONSTRUCTION, IT SHALL BE THE OBLIGATION AND RESPONSIBILITY OF THE PERMITEE TO ADDRESS ANY NEW CONDITIONS THAT MAY BE CREATED BY HIS ACTIVITIES AND TO PROVIDE ADDITIONAL FACILITIES, OVER AND ABOVE THE MINIMUM REQUIREMENTS, AS MAY BE NEEDED TO PROTECT ADJACENT PROPERTIES, SENSITIVE AREAS, NATURAL WATER COURSES, AND/OR STORM DRAINAGE SYSTEMS.

4. APPROVAL OF THESE PLANS IS FOR GRADING, TEMPORARY DRAINAGE, EROSION AND SEDIMENTATION CONTROL ONLY. IT DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT STORM DRAINAGE DESIGN, SIZE OR LOCATION OF PIPES, RESTRICTORS, CHANNELS, OR RETENTION FACILITIES.

5. ANY DISTURBED AREA WHICH HAS BEEN STRIPPED OF VEGETATION AND WHERE NO FURTHER WORK IS ANTICIPATED FOR A PERIOD OF 30 DAYS OR MORE, MUST BE IMMEDIATELY STABILIZED WITH MULCHING, GRASS PLANTING, OR OTHER APPROVED EROSION CONTROL TREATMENT APPLICABLE TO THE TIME OF YEAR IN QUESTION. GRASS SEEDING ALONE WILL BE ACCEPTABLE ONLY DURING THE MONTHS OF APRIL THROUGH SEPTEMBER INCLUSVE. SEEDING MAY PROCEED OUTSIDE THE SPECIFIED TIME PERIOD WHENEVER IT IS IN THE INTEREST OF THE PERMITEE BUT MUST BE AUGMENTED WITH MULCHING, NETTING, OR OTHER TREATMENT APPROVED BY THE CITY.

6. IN CASE EROSION OR SEDIMENTATION OCCURS TO ADJACENT PROPERTIES, ALL CONSTRUCTION WORK WITHIN THE DEVELOPMENT THAT WILL FURTHER AGGRAVATE THE SITUATION MUST CEASE, AND THE OWNER/CONTRACTOR WILL IMMEDIATELY COMMENCE RESTORATION METHODS. RESTORATION ACTIVITY WILL CONTINUE UNTIL SUCH TIME AS THE AFFECTED PROPERTY OWNER IS SATISFIED.

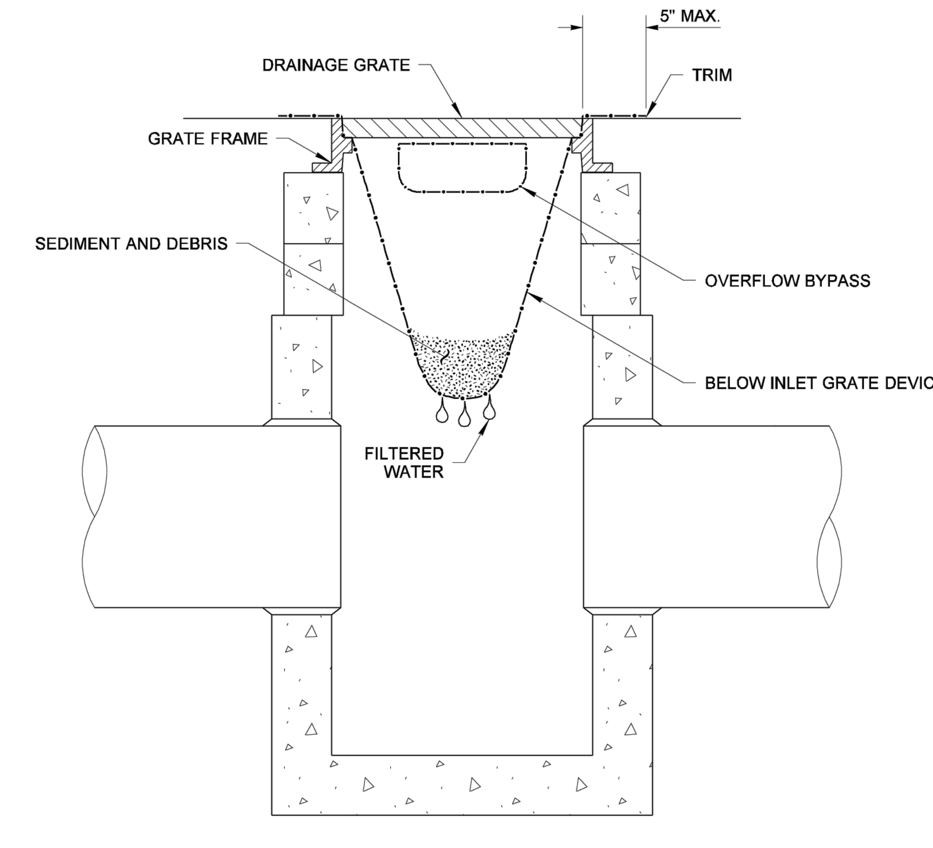
7. NO TEMPORARY OR PERMANENT STOCKPILING OF MATERIALS OR EQUIPMENT SHALL OCCUR WITHIN CRITICAL AREAS OR ASSOCIATED BUFFERS, OR THE CRITICAL ROOT ZONE FOR VEGETATION PROPOSED FOR RETENTION.

CITY OF PUYALLUP
DEVELOPMENT ENGINEERING and PUBLIC WORKS DEPARTMENTS

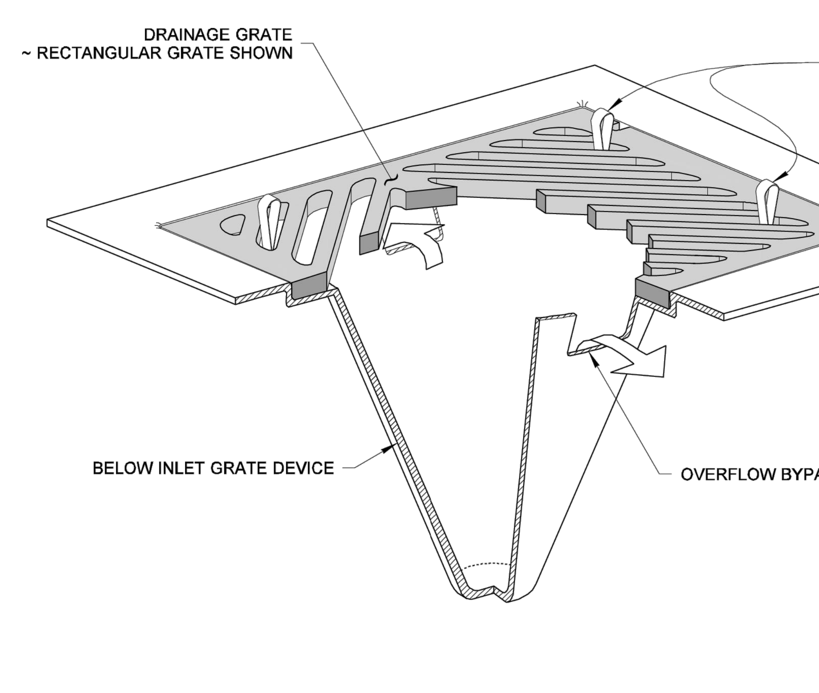
GRADING, EROSION, AND SEDIMENTATION CONTROL NOTES

CITY STANDARD 05.02.01

1 / EN2.3 — CITY OF PUYALLUP NOTES
SCALE: NTS



SECTION VIEW
NOT TO SCALE



ISOMETRIC VIEW

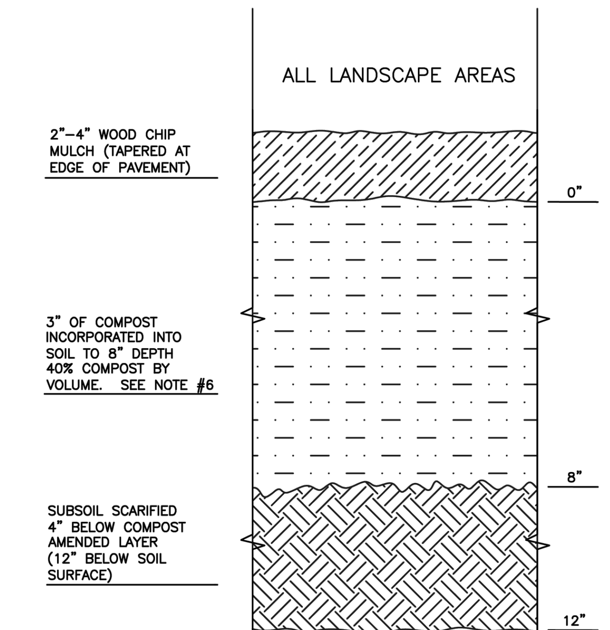
NOTES

1. Size the Below Inlet Grate Device (BIGD) for the storm water structure it will service.
2. The BIGD shall have a built-in high-flow relief system (overflow bypass).
3. The retrieval system must allow removal of the BIGD without spilling the collected material.
4. Perform maintenance in accordance with Standard Specification 8-01.3(15).

STATE OF WASHINGTON REGISTERED LANDSCAPE ARCHITECT
MARK W. MAURER
CERTIFICATE NO. 000598

STORM DRAIN INLET PROTECTION
STANDARD PLAN I-40.20-00
SHEET 1 OF 1 SHEET
APPROVED FOR PUBLICATION
Pasco Bakotich III 09-20-07
STATE DESIGN ENGINEER DATE
Washington State Department of Transportation

2 / EN2.3 — STORM DRAIN INLET PROTECTION
SCALE: NTS



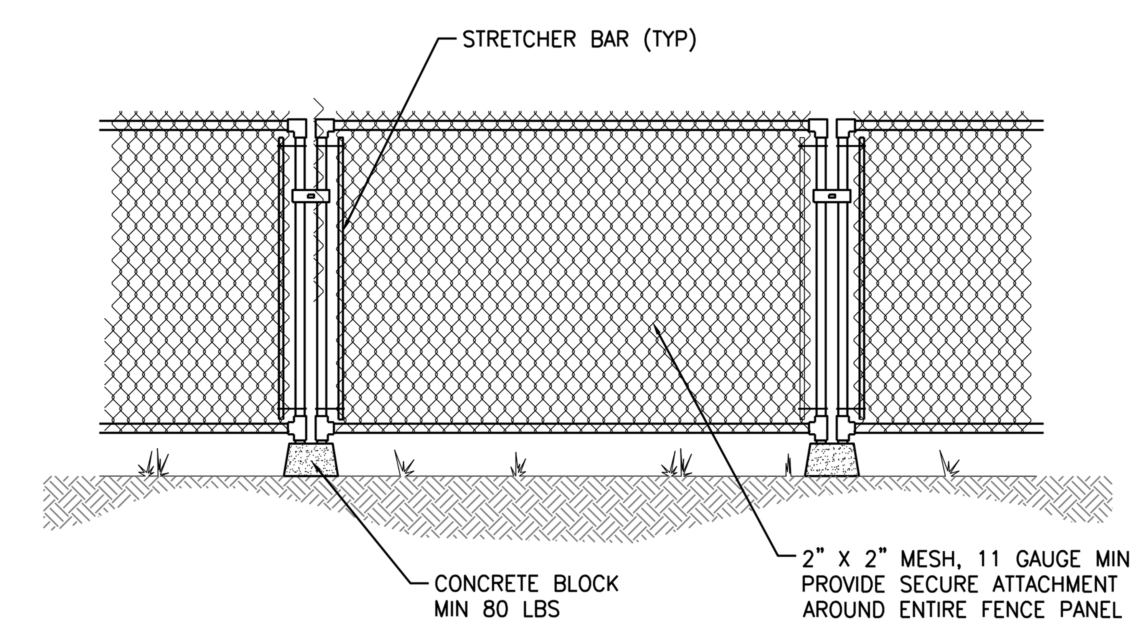
NOTES:
1. ALL SOIL AREAS DISTURBED OR COMPACTED DURING CONSTRUCTION, AND NOT COVERED BY BUILDINGS OR PAVEMENT, SHALL BE AMENDED WITH COMPOST AS DESCRIBED BELOW.
2. SUBSOIL SHOULD BE SCARIFIED (LOOSENED) 4 INCHES BELOW AMENDED LAYER, TO PRODUCE 12-INCH DEPTH OF UN-COMPACTED SOIL, EXCEPT WHERE SCARIFICATION WOULD DAMAGE TREE ROOTS OR AS DETERMINED BY THE ENGINEER. SEE NOTE BELOW REGARDING PLANTING STEPS FOR STREET TREES.
3. COMPOST SHALL BE TILLED IN TO 8 INCH DEPTH INTO EXISTING SOIL, OR PLACE 8 INCHES OF COMPOST-AMENDED SOIL, PER SOIL SPECIFICATION.
4. PLANTING BEDS SHALL RECEIVE 3 INCHES OF COMPOST TILLED IN TO 8-INCH DEPTH, OR MAY SUBSTITUTE 8" OF IMPORTED SOIL CONTAINING 35–40% COMPOST BY VOLUME. MULCH AFTER PLANTING, WITH 4 INCHES OF ARBORIST WOOD CHIP MULCH OR APPROVED EQUAL (6" OF LOOSE WOOD CHIPS AT THE TIME OF PLANTING TO ALLOW SETTLING TO 4").
5. SETBACKS: TO PREVENT UNEVEN SETTLING, DO NOT COMPOST-AMEND SOILS WITHIN 3 FEET OF UTILITY INFRASTRUCTURES (POLES, VAULTS, METERS ETC.). WITHIN ONE FOOT OF PAVEMENT EDGE, CURBS AND SIDEWALKS SOIL SHOULD BE COMPACTED TO APPROXIMATELY 95% PROCTOR TO ENSURE A FIRM SURFACE.
6. SEE SECTION 8.2(B) OF THE VMS FOR SOIL AMENDMENT AND INSTRUCTION PROCEDURES FOR STREET TREE PLANTER STRIPS. ALL STREET TREE PLANTER STRIPS SHALL RECEIVE 40% COMPOST AMENDED SOIL TO THE FULL DEPTH OF THE STREET TREE ROOTBALL.

CITY OF PUYALLUP
DEVELOPMENT ENGINEERING and PUBLIC WORKS DEPARTMENTS

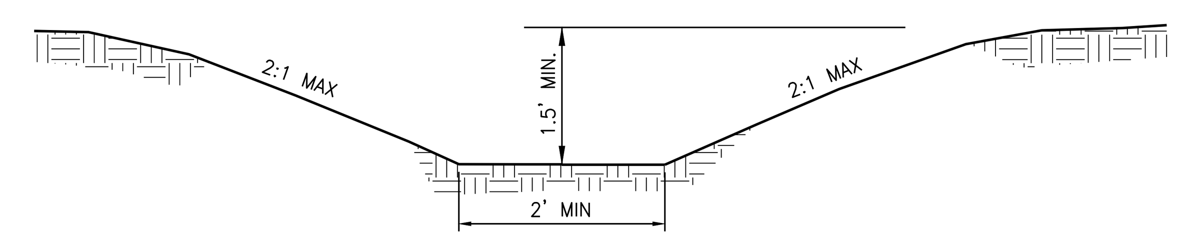
SOIL AMENDMENT AND DEPTH

DRAWN BY	CHECKED BY	APPROVED BY	REVISED BY	CITY STANDARD
LINDA LIAN	CHRIS BEALE	COLLEEN HARRIS	XXXX	01.02.08a
FILE NAME F:\DWG\COMMON\STDS\CITYSTDS\STR\01.02.08		DATE APPROVED 08/01/2015	DATE REVISED XX/XX/XX	SCALE 1:1

3 / EN2.3 — SOIL AMENDMENT AND DEPTH
SCALE: NTS



4 / EN2.3 — TEMPORARY CONSTRUCTION FENCE
SCALE: NTS



5 / EN2.3 — TEMPORARY "V" DITCH
SCALE: NTS

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.

CLIENT: bp — ARCO — BP WEST COAST PRODUCTS, LLC

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

NO.	DATE	REVISION DESCRIPTION

SEAL: ALEX WHITE, STATE OF WASHINGTON, 1036777, REGISTERED PROFESSIONAL ENGINEER — 1/12/24

DEVELOPMENT INFORMATION:
ARCO NTI
3400 am/pm
FUEL CANOPY w/ 6 MPD's

SITE ADDRESS:
1402 S. MERIDIAN
@ HIGHWAY 512
PUYALLUP, WASHINGTON

FACILITY #TBD

DESIGNED BY:	JDF	ALLIANCE Z&OM:	
CHECKED BY:	AW	BP REPM:	
DRAWN BY:	JDF	ALLIANCE PM:	
VERSION:	-	PROJECT NO:	21730

DRAWING TITLE: TESC NOTES AND DETAILS

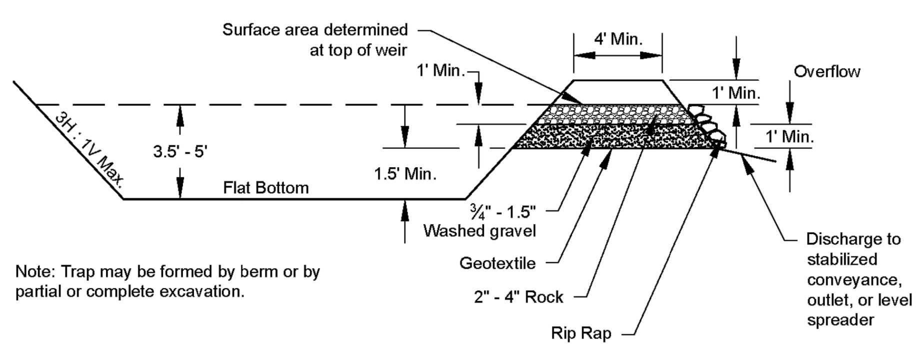
SHEET NO: EN2.3

P:\21000s\21730\engineering\21730-EN-GRAD.dwg 1/12/2024 3:26 PM JFLEHARTY

TESC DETAILS

FOR
ARCO ampm PUYALLUP
SEC. 33, TWN. 20 N, RGE. 4 E, W.M.
CITY OF PUYALLUP, PIERCE COUNTY

Figure II-3.26: Cross Section of Sediment Trap



NOT TO SCALE

DEPARTMENT OF ECOLOGY State of Washington

Cross Section of Sediment Trap

Revised June 2016

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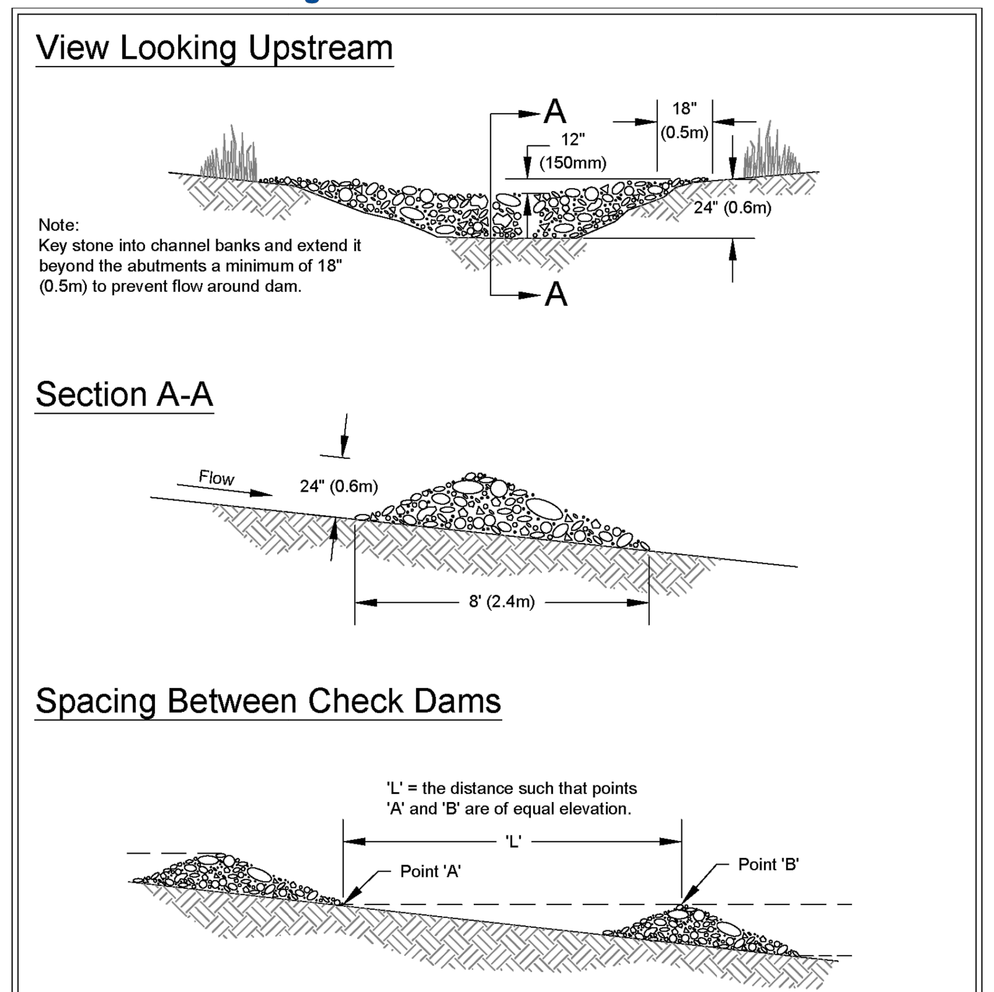
1 EN2.4 **SEDIMENT TRAP**
SCALE: NTS

Figure II-3.16: Rock Check Dam



NOT TO SCALE

DEPARTMENT OF ECOLOGY State of Washington

Rock Check Dam

Revised June 2016

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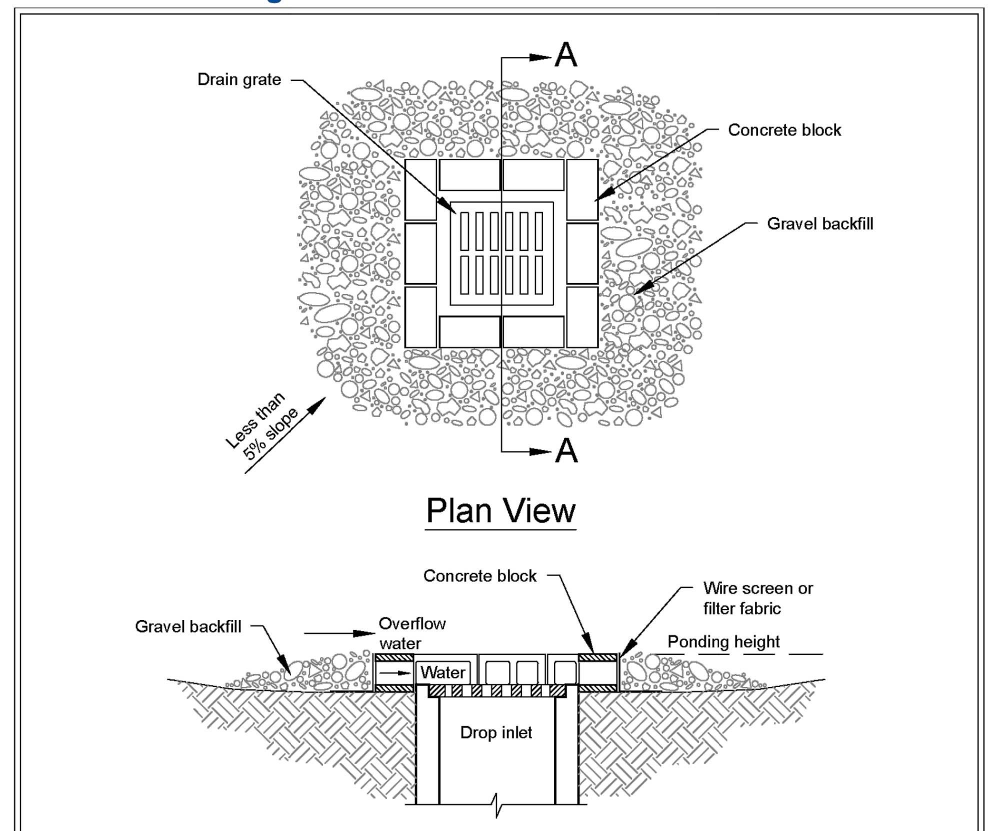
2 EN2.4 **ROCK CHECK DAM**
SCALE: NTS

Figure II-3.17: Block and Gravel Filter



Notes:
1. Drop inlet sediment barriers are to be used for small, nearly level drainage areas. (less than 5%)
2. Excavate a basin of sufficient size adjacent to the drop inlet.
3. The top of the structure (ponding height) must be well below the ground elevation downslope to prevent runoff from bypassing the inlet. A temporary dike may be necessary on the downslope side of the structure.

NOT TO SCALE

DEPARTMENT OF ECOLOGY State of Washington

Block and Gravel Filter

Revised June 2016

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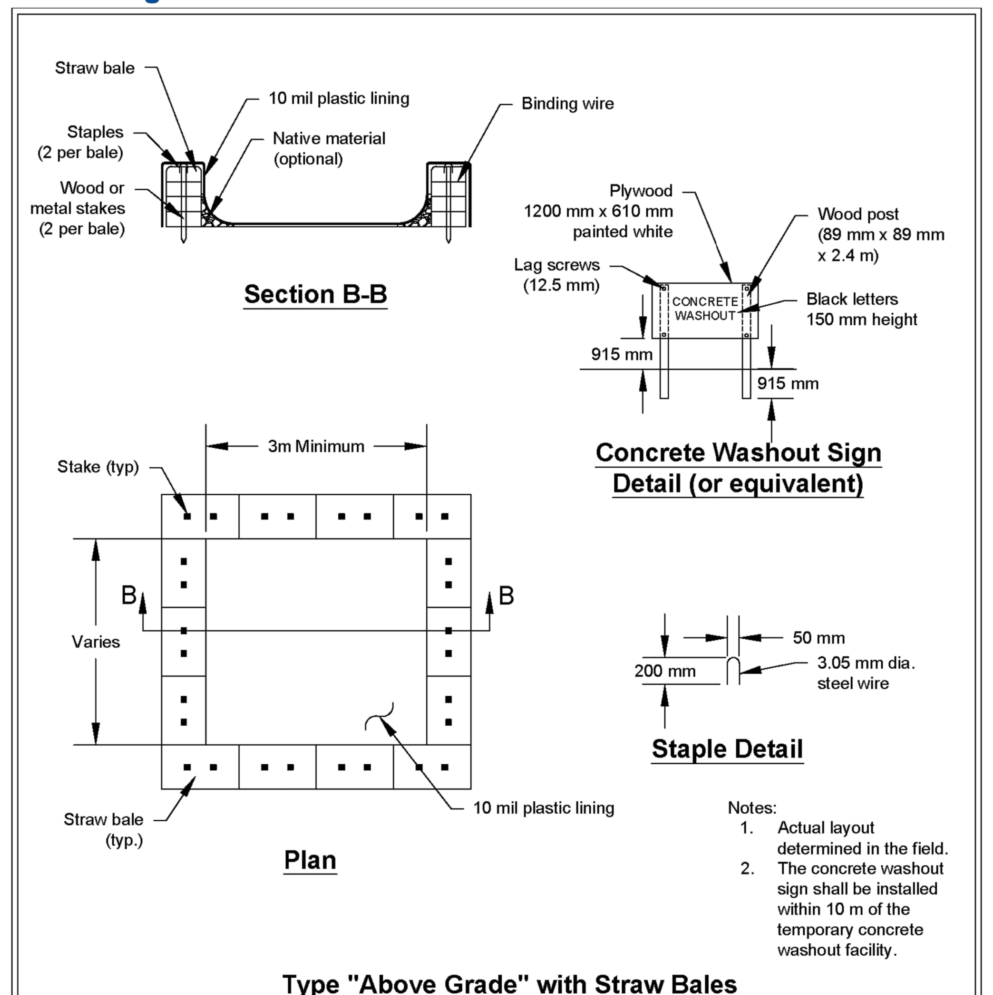
3 EN2.4 **INLET PROTECTION**
SCALE: NTS

Figure II-3.8: Concrete Washout Area with Straw Bales



NOT TO SCALE

DEPARTMENT OF ECOLOGY State of Washington

Concrete Washout Area with Straw Bales

Revised June 2016

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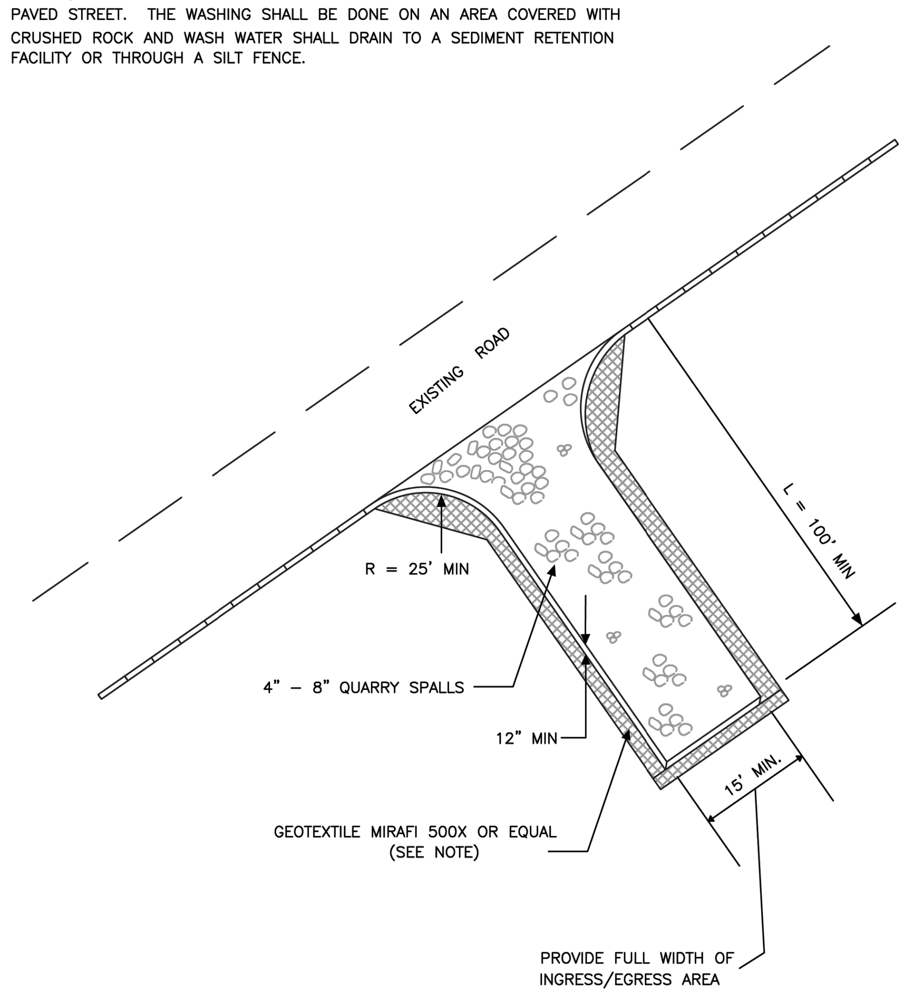
4 EN2.4 **CONCRETE WASHOUT**
SCALE: NTS

NOTE:

1. GEOTEXTILE MIRAFI 500 X OR APPROVED EQUAL SHALL BE PLACED UNDER THE ENTIRETY OF THE TEMPORARY ENTRANCE.
2. ADDITIONAL ROCK SHALL BE ADDED PERIODICALLY TO MAINTAIN PROPER FUNCTION OF THE PAD.
3. IF THE PAD DOES NOT ADEQUATELY REMOVE THE MUD FROM THE VEHICLE'S WHEELS, THE WHEELS SHALL BE HOSED OFF BEFORE THE VEHICLE ENTERS A PAVED STREET. THE WASHING SHALL BE DONE ON AN AREA COVERED WITH CRUSHED ROCK AND WASH WATER SHALL DRAIN TO A SEDIMENT RETENTION FACILITY OR THROUGH A SILT FENCE.

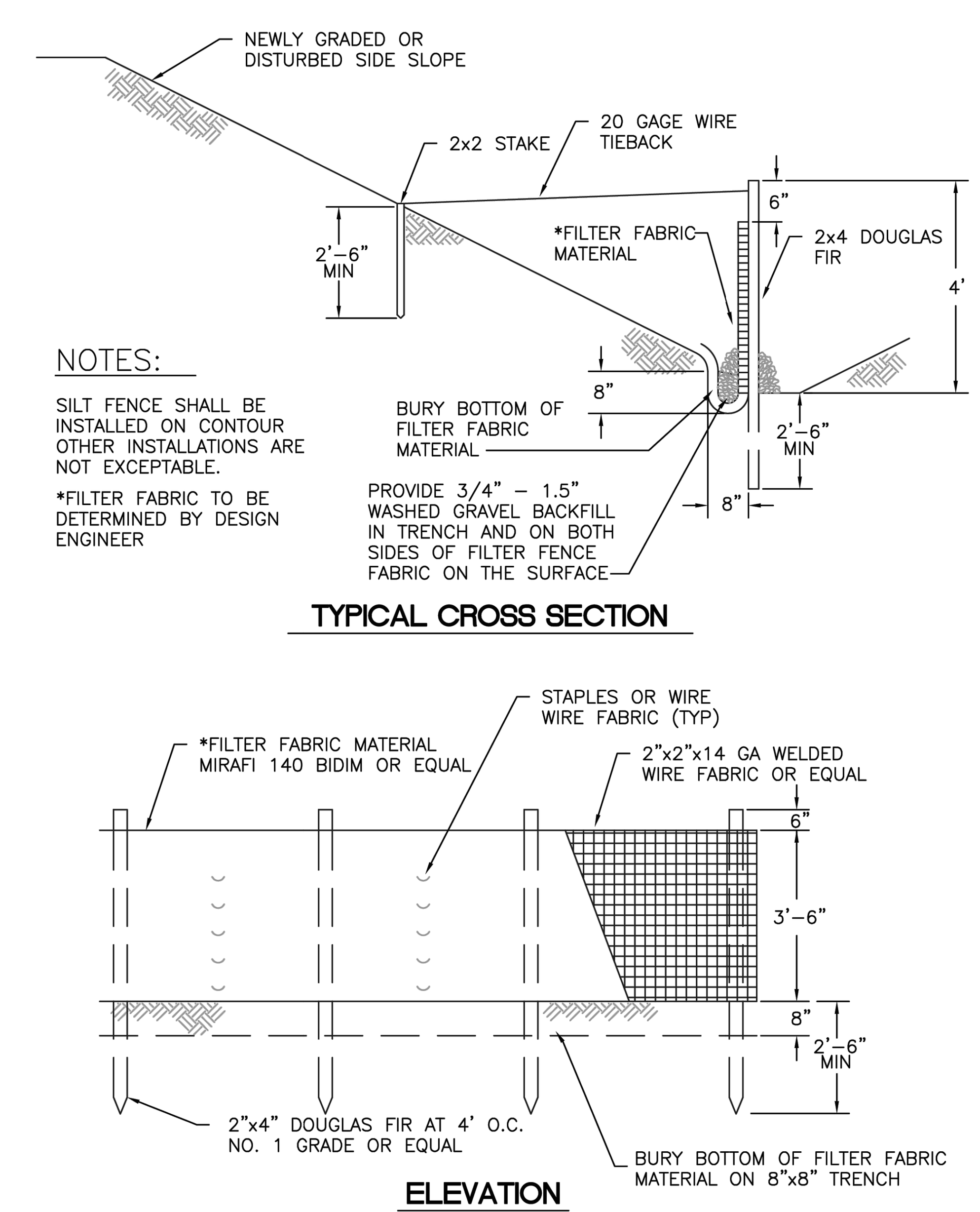


CITY OF PUYALLUP
DEVELOPMENT ENGINEERING and PUBLIC WORKS DEPARTMENTS

TEMPORARY CONSTRUCTION ENTRANCE

CITY STANDARD 05.01.01

5 EN2.4 **STABILIZED CONSTRUCTION ACCESS**
SCALE: NTS



NOTES:

SILT FENCE SHALL BE INSTALLED ON CONTOUR OTHER INSTALLATIONS ARE NOT EXCEPTABLE.

*FILTER FABRIC TO BE DETERMINED BY DESIGN ENGINEER

CITY OF PUYALLUP
DEVELOPMENT ENGINEERING and PUBLIC WORKS DEPARTMENTS

SILTATION FENCE

CITY STANDARD 02.03.02

6 EN2.4 **SILTATION FENCE**
SCALE: NTS

UTILITY CONFLICT NOTE:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING THE LOCATION, DIMENSION, AND DEPTH OF ALL EXISTING UTILITIES WHETHER SHOWN ON THESE PLANS OR NOT BY POTHOLING THE UTILITIES AND SURVEYING THE HORIZONTAL AND VERTICAL LOCATION PRIOR TO CONSTRUCTION. THIS SHALL INCLUDE CALLING UTILITY LOCATE AT 811 48 HOURS IN ADVANCE AND THEN POTHOLING ALL OF THE EXISTING UTILITIES AT LOCATIONS OF NEW UTILITY CROSSINGS TO PHYSICALLY VERIFY WHETHER OR NOT CONFLICTS EXIST. LOCATIONS OF SAID UTILITIES AS SHOWN ON THESE PLANS ARE BASED UPON THE UNVERIFIED PUBLIC INFORMATION AND ARE SUBJECT TO VARIATION. IF CONFLICTS SHOULD OCCUR, THE CONTRACTOR SHALL NOTIFY BARGHAUSEN CONSULTING ENGINEERS, INC. TO RESOLVE ALL PROBLEMS PRIOR TO PROCEEDING WITH CONSTRUCTION.

811 Know what's **below.** **Call** before you dig. Dial 811

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.

CLIENT: bp ARCO BP WEST COAST PRODUCTS, LLC

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

NO.	DATE	REVISION DESCRIPTION
1		
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SEAL: ALEX WHITE, STATE OF WASHINGTON, 1036777, REGISTERED PROFESSIONAL ENGINEER
1/12/24

DEVELOPMENT INFORMATION:
ARCO NTI
3400 am/pm
FUEL CANOPY w/ 6 MPD's

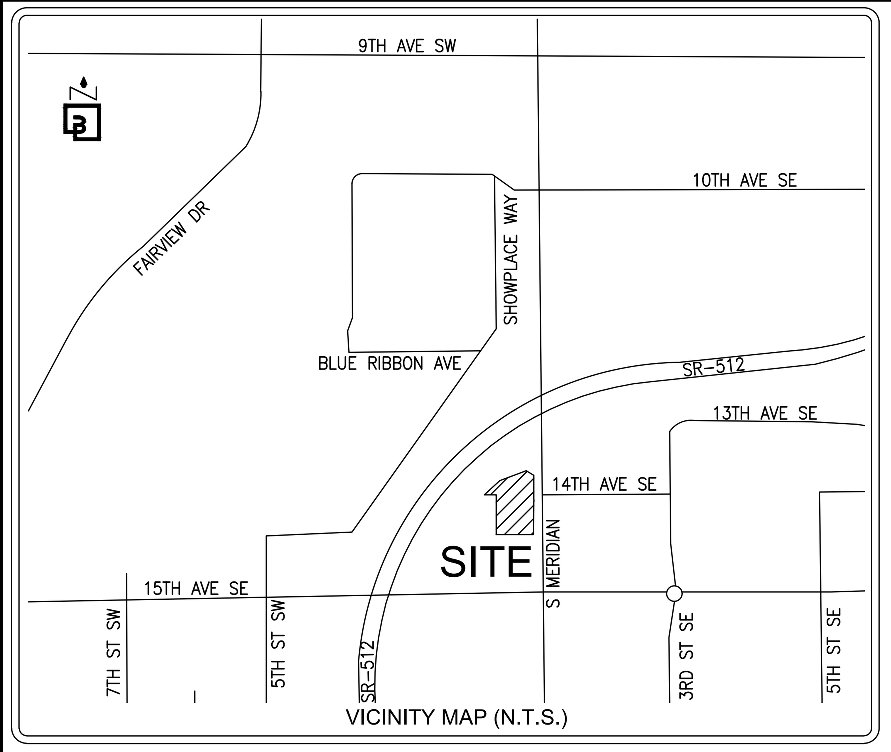
SITE ADDRESS:
1402 S. MERIDIAN
@ HIGHWAY 512
PUYALLUP, WASHINGTON

FACILITY #TBD

DESIGNED BY:	JDF	ALLIANCE Z&OM:	
CHECKED BY:	AW	BP REPM:	
DRAWN BY:	JDF	ALLIANCE PM:	
VERSION:	-	PROJECT NO:	21730

DRAWING TITLE: TESC DETAILS

SHEET NO: EN2.4



VICINITY MAP (N.T.S.)

ALTA/NSPS LAND TITLE SURVEY

SURVEY INFORMATION:

HORIZONTAL DATUM – BASIS OF BEARINGS:
NAD 83/2011 WASHINGTON STATE COORDINATE SYSTEM, SOUTH ZONE, ESTABLISHED BY GPS OBSERVATION UTILIZING THE WASHINGTON STATE REFERENCE NETWORK. THE BASIS OF BEARINGS IS N 00°33'46" E BETWEEN THE FOUND 2" BRASS DISK AT THE INTERSECTION OF S. MERIDIAN ST. & 15TH AVE SW AND THE FOUND 2" IRON PIPE W/TACK IN MONUMENT CASE AT THE INTERSECTION OS S. MERIDIAN ST. & THE ON/OFF RAMP TO SR 512.

VERTICAL DATUM
VERTICAL DATUM FOR THIS SURVEY IS NAVD88 ESTABLISHED FROM WSDOT MONUMENT ID NO. 247. ELEVATION = 80.449' (NAVD88)

LOT AREA
52,078± SF (1.20± AC)

ADDRESS
1402 S. MERIDIAN, PUYALLUP, WA 98371

TAX PARCEL NUMBER
773000-028-1 & 773000-028-8: TITLE PARCEL A
773000-003-1 & 773000-002-1: TITLE PARCEL B

REFERENCE SURVEYS:
1. PIERCE COUNTY SHORT PLAT OF MERIDIAN CENTER – AFN 77-315 (1977)
2. PLAT OF SOURWINE'S ACRE LOTS – VOL 8 PLATS, PAGE 10 (1905)
3. PIERCE COUNTY SHORT PLAT – AFN 8706010381 (1987)
4. WSDOT SR 512 96TH ST TO JCT. SR 167, DATED MAY 23, 1968

DATE OF SURVEY:
THIS SURVEY REPRESENTS VISIBLE PHYSICAL IMPROVEMENT CONDITIONS EXISTING ON MARCH 22, 2022 & JULY 14, 2023. ALL SURVEY CONTROL INDICATED AS "FOUND" WAS RECOVERED FOR THIS PROJECT IN MARCH OF 2022 & JULY OF 2023.

FLOOD INFORMATION:
FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) INFORMATION: FIRM (FLOOD INSURANCE RATE MAP) MAP NO. 53053C0341E PANEL 341 OF 1375, DATED MARCH 7, 2017. THE SUBJECT PROPERTY IS IN ZONE X, AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.

ZONING INFORMATION:
(A ZONING REPORT WAS NOT FURNISHED FOR THIS SITE)

SURVEYOR'S NOTES:

- ALL DISTANCES SHOWN HEREON ARE GROUND MEASUREMENTS IN U.S. SURVEY FEET.
- THE BOUNDARY CORNERS AND LINES DEPICTED ON THIS MAP REPRESENT DEED LINES ONLY, AND DON'T PURPORT TO SHOW OWNERSHIP LINES THAT MAY OTHERWISE BE DETERMINED BY A COURT OF LAW. NO GUARANTEE OF OWNERSHIP IS EXPRESSED OR IMPLIED.
- UNDERGROUND UTILITIES AND FEATURES DEPICTED HEREON ARE BASED ON FIELD OBSERVATION, MARKINGS, DEVELOPMENT PLANS, AND/OR AVAILABLE RECORD DOCUMENTS ONLY. THE TRUE LOCATION, NATURE AND/OR EXISTENCE OF BELOW GROUND FEATURES, DETECTED OR UNDETECTED, SHOULD BE VERIFIED.
- THE LEGAL DESCRIPTION AND SPECIAL EXCEPTIONS SHOWN HEREON ARE PER THE ABOVE REFERENCED TITLE REPORT UNLESS OTHERWISE NOTED.
- THIS SURVEY HAS DEPICTED ALL VISIBLE OCCUPATIONAL INDICATORS (IE. FENCE LINES, BUILDINGS, WALLS, ETC. – SEE MAP FOR PARTICULARS) PER W.A.C. 332-130. LINES OF OCCUPATION, AS DEPICTED, MAY INDICATE AREAS OF POTENTIAL CLAIMS OF UNWRITTEN OWNERSHIP. THIS SURVEY HAS ONLY DEPICTED THE RELATIONSHIP BETWEEN LINES OF OCCUPATION AND DEEDED LINES OF RECORD. NO RESOLUTION OF OWNERSHIP BASED ON UNWRITTEN RIGHTS HAS BEEN MADE BY THIS SURVEY OR BY ANY PERSONNEL OF BARGHAUSEN CONSULTING ENGINEERS, INC.
- THIS IS A FIELD TRAVERSE SURVEY. TOPCON GT AND TOPCON HYPER HR GPS AND DELL TABLET DATA COLLECTOR WERE USED TO MEASURE THE ANGULAR AND DISTANCE RELATIONSHIPS BETWEEN THE CONTROLLING MONUMENTATION AS SHOWN. CLOSURE RATIOS OF THE TRAVERSE MET OR EXCEEDED THOSE SPECIFIED IN W.A.C. 332-130-090. ALL INSTRUMENTS AND EQUIPMENT HAVE BEEN MAINTAINED IN ADJUSTMENT ACCORDING TO MANUFACTURERS' SPECIFICATIONS AND USED BY APPROPRIATELY TRAINED PERSONNEL.
- THIS SURVEY MEETS OR EXCEEDS THE "RELATIVE POSITIONAL PRECISION" REQUIREMENTS SET FORTH IN THE 2021 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS IN SECTION 3(E).
- THE RECORD DESCRIPTION FOR THE SUBJECT PROPERTY MATHEMATICALLY CLOSES.
- ELEMENTS AND FEATURES DEPICTED HEREON SATISFY THE REQUIREMENTS STATED WITHIN W.A.C. 332-130-145 FOR TOPOGRAPHIC MAPS, INCLUDING THE FOLLOWING: THE SOURCE OF THE CONTOURS SHOWN HEREON ARE BASED UPON DIRECT FIELD OBSERVATIONS. THE CONTOUR ACCURACY IS PER NATIONAL MAPPING STANDARDS, ONE HALF OF THE CONTOUR INTERVAL (1'). THE PURPOSE OF THIS SURVEY IS TO MAP THE CURRENT CONDITIONS FOR ENGINEERING DESIGN.
- BARGHAUSEN CONSULTING ENGINEERS, INC. SURVEY CREWS DETECTED NO OBSERVABLE EVIDENCE OF RECENT EARTH MOVING WORK, BUILDING CONSTRUCTION OR BUILDING ADDITIONS ON THE SUBJECT PROPERTY.
- BARGHAUSEN CONSULTING ENGINEERS, INC. SURVEY CREWS DETECTED NO OBSERVABLE EVIDENCE OF SITE USE AS A SOLID WASTE DUMP, SUMP OR SANITARY LANDFILL.
- THERE IS NO VISIBLE EVIDENCE OF ANY CEMETERIES OR BURIAL GROUNDS.
- THERE IS EVIDENCE OF PHYSICAL ACCESS TO PUBLIC RIGHT-OF-WAY.

TITLE INFORMATION:

TITLE COMMITMENT:
ALL TITLE INFORMATION SHOWN ON THIS MAP HAS BEEN EXTRACTED FROM STEWART TITLE GUARANTY COMPANY COMMITMENT NO. 21000200719, DATED JULY 29, 2021 AT 8:00 AM. INCLUDED ARE APPURTENANT EASEMENTS AND ADJOINING DEEDS FOR UNPLATTED LOTS, IF ANY. IN PREPARING THIS MAP, BARGHAUSEN CONSULTING ENGINEERS, INC. HAS CONDUCTED NO INDEPENDENT TITLE SEARCH NOR IS BARGHAUSEN CONSULTING ENGINEERS, INC. AWARE OF ANY TITLE ISSUES AFFECTING THE SURVEYED PROPERTY OTHER THAN THOSE SHOWN ON THE MAP AND DISCLOSED BY SAID COMMITMENT. BARGHAUSEN CONSULTING ENGINEERS, INC. HAS RELIED WHOLLY ON SAID TITLE COMPANY'S REPRESENTATIONS OF THE TITLE'S CONDITION TO PREPARE THIS SURVEY AND THEREFORE BARGHAUSEN CONSULTING ENGINEERS, INC. QUALIFIES THE MAP'S ACCURACY AND COMPLETENESS TO THAT EXTENT.

LEGAL DESCRIPTION
(PER ABOVE REFERENCED TITLE REPORT)
PARCEL A: (773000-028-1 & 773000-028-8)
LOT 1 AND THE NORTH 15 FEET OF THE EAST 178.33 FEET OF "COMMON ACCESS TRACT A", OF PIERCE COUNTY SHORT PLAT RECORDED UNDER RECORDING NO. 77-315, RECORDS OF PIERCE COUNTY WASHINGTON, FORMERLY BEING DESCRIBED AS THE NORTH 161.5 FEET OF THE WEST 178.33 FEET OF THE EAST 188.33 FEET OF LOT 20, SOURWINE'S ACRE LOTS, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 8 OF PLATS, PAGE 10, RECORDS OF PIERCE COUNTY, WASHINGTON;
TOGETHER WITH THAT PORTION OF 14TH AVENUE SW, VACATED BY ORDINANCE NO. 2304 ABUTTING THEREON AND ATTACHED THERETO, RECORDED UNDER RECORDING NO. 9206040385.
PARCEL A1:
RIGHTS TO USE THAT PORTION OF THE WITHIN DESCRIBED PROPERTY LYING WITHIN COMMON ACCESS TRACT "A" OF SIDE SHORT PLAT, FOR INGRESS, EGRESS, AND INSTALLATION AND MAINTENANCE OF UTILITIES, AS SET FORTH AND DELINEATED ON PIERCE COUNTY SHORT PLAT NO. 77-315;
EXCEPT ANY PORTION LYING WITHIN PARCEL A ABOVE.
PARCEL A2:
AN EASEMENT FOR INGRESS AND EGRESS AS SET FORTH IN DOCUMENTS ENTITLED "STATUTORY WARRANTY DEED" AS RECORDED UNDER RECORDING NUMBERS 2741876 AND 2792268.
PARCEL B: (773000-003-1 & 773000-002-1)
LOT 2, SOURWINE'S ACRE LOTS, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 8 OF PLATS, PAGE 10, RECORDS OF PIERCE COUNTY, WASHINGTON;
EXCEPT THAT PORTION LYING WITHIN STATE HIGHWAY NO. SR-512, 96TH STREET TO JUNCTION SR-167;
TOGETHER WITH THAT PORTION OF 14TH AVENUE SW, VACATED BY ORDINANCE NO. 2304 ABUTTING THEREON AND ATTACHED THERETO, RECORDED UNDER RECORDING NO. 9206040385.
SITUATE IN THE COUNTY OF PIERCE, STATE OF WASHINGTON.

SPECIAL EXCEPTIONS:
(PER ABOVE REFERENCED TITLE REPORT)

ITEMS 1 THOUGH 18 ARE NOT SURVEY RELATED.

19. TEMPORARY RIGHT, PERMIT, LICENSE AND EASEMENT TO USE AND OCCUPY A PORTION OF SAID LOT 20 FOR THE PURPOSE OF CONSTRUCTING HIGHWAY SLOPES AND OPERATING ALL NECESSARY MACHINERY AND EQUIPMENT THEREON AT ANY AND ALL TIMES UNTIL COMPLETION OF CONSTRUCTION FOR STATE RAD NO. 512 AS APPROPRIATED BY THE STATE OF WASHINGTON IN PIERCE COUNTY SUPERIOR COURT CAUSE NO. 198127. AFTER COMPLETION OF CONSTRUCTION, ALL RIGHTS OF EASEMENT SHALL BE EXTINGUISHED.
AFFECTS: PARCEL A
(BLANKET IN NATURE)(POTENTIALLY EXTINGUISHED)

20. RELINQUISHMENT OF ACCESS TO STATE HIGHWAY AND OF LIGHT, VIEW AND AIR BY DEED TO THE STATE OF WASHINGTON:
RECORDED: NOVEMBER 19, 1966
RECORDING NO.: 2321816
AFFECTS: PARCEL A
(APPLIES TO OFFSITE ADJACENT PROPERTY)

21. RELINQUISHMENT OF ACCESS TO STATE HIGHWAY AND OF LIGHT, VIEW AND AIR BY DEED TO THE STATE OF WASHINGTON:
RECORDED: OCTOBER 20, 1975
RECORDING NO.: 2632004
AFFECTS: PARCEL B
(BLANKET IN NATURE)

22. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
GRANTEE: PUGET SOUND POWER AND LIGHT COMPANY
PURPOSE: ELECTRIC TRANSMISSION AND/OR DISTRIBUTION SYSTEM
AFFECTS: EAST 10 FEET OF PARCEL A AND INCLUDES OTHER PROPERTY
RECORDED: MAY 26, 1976
RECORDING NO.: 2667305
(PLOTTED HEREON)

23. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
GRANTEE: PUGET SOUND POWER AND LIGHT COMPANY
PURPOSE: ELECTRIC TRANSMISSION AND/OR DISTRIBUTION SYSTEM
AFFECTS: PORTION OF PARCEL A AND INCLUDES OTHER PROPERTY
RECORDED: MAY 26, 1976
RECORDING NO.: 2667306
(BLANKET IN NATURE)

24. COVENANTS, CONDITIONS AND RESTRICTIONS AND EASEMENTS CONTAINED IN SHORT PLAT:
RECORDED: MAY 25, 1977
RECORDING NO.: 77-315
(PLOTTED HEREON)(COMMON ACCESS TRACT "A")

25. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
PURPOSE: INGRESS, EGRESS AND UTILITIES
AFFECTS: PORTION OF TRACT A LYING WITHIN PARCEL A
RECORDED: JANUARY 16, 1958
RECORDING NO.: 2792268
(PLOTTED HEREON)

26. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
PURPOSE: INGRESS AND EGRESS
AFFECTS: TRACT A OF SHORT PLAT 77-315
RECORDED: JUNE 8, 1977
RECORDING NO.: 2741876
(PLOTTED HEREON)

27. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
GRANTEE: CITY OF PUYALLUP
PURPOSE: CONSTRUCTING, INSTALLING, REPAIRING AND MAINTAINING STREET IMPROVEMENTS ACCORDING TO THE PLAN ENTITLED "SOUTH MERIDIAN STREET IMPROVEMENTS"
AFFECTS: PARCEL A
RECORDED: JUNE 10, 1987
RECORDING NO.: 8706100397
(PLOTTED HEREON)

28. MUTUAL MAINTENANCE AGREEMENT AND THE TERMS AND CONDITIONS THEREOF:
RECORDED: MAY 17, 1991
RECORDING NO.: 9105170239
AFFECTS: PARCEL A
(NOT SURVEY RELATED)

29. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
GRANTEE: WASHINGTON NATURAL GAS
PURPOSE: GAS PIPELINE OR PIPELINES
AFFECTS: NORTHERLY PORTION OF PARCEL A
RECORDED: MARCH 30, 1992
RECORDING NO.: 9203300111
(PLOTTED HEREON)

30. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
GRANTEE: CITY OF PUYALLUP
PURPOSE: STORMWATER, SANITARY AND WATERMAIN PIPE LINE AND APPURTENANCES
AFFECTS: SOUTH 30 FEET OF PARCEL B
RECORDED: JUNE 4, 1992
RECORDING NO.: 9206040382
(PLOTTED HEREON)

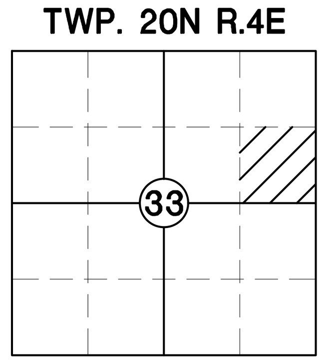
31. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
GRANTEE: CITY OF PUYALLUP
PURPOSE: STORMWATER, SANITARY AND WATERMAIN PIPE LINE AND APPURTENANCES
AFFECTS: NORTH 30 FEET OF PARCEL A
RECORDED: JUNE 4, 1992
RECORDING NO.: 9206040383
(PLOTTED HEREON)(OFFSITE ADJACENT EASEMENT)

32. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
GRANTEE: CITY OF PUYALLUP
PURPOSE: STORMWATER, SANITARY AND WATERMAIN PIPE LINE AND APPURTENANCES
AFFECTS: NORTH 30 FEET OF PARCEL A
RECORDED: JUNE 4, 1992
RECORDING NO.: 9206040384
(PLOTTED HEREON)

33. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
GRANTEE: PUGET SOUND POWER AND LIGHT COMPANY
PURPOSE: ELECTRIC TRANSMISSION AND/OR DISTRIBUTION SYSTEM
AFFECTS: PORTION OF PARCEL B
RECORDED: JULY 28, 1992
RECORDING NO.: 9207280563
(PLOTTED HEREON)(OFFSITE ADJACENT EASEMENT)

34. EASEMENT AND THE TERMS AND CONDITIONS THEREOF:
GRANTEE: PUGET SOUND POWER AND LIGHT COMPANY
PURPOSE: ELECTRIC TRANSMISSION AND/OR DISTRIBUTION SYSTEM
AFFECTS: PORTION OF PARCEL A
RECORDED: JULY 28, 1992
RECORDING NO.: 9207280564
(PLOTTED HEREON)

TWP. 20N R.4E



INDEXING INFORMATION
N.T.S.

SURVEYOR'S CERTIFICATION:

TO: BP PRODUCTS NORTH AMERICA INC., A MARYLAND CORPORATION AND STEWART TITLE GUARANTY COMPANY

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2021 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS AND INCLUDES ITEMS 2, 3, 4, 7(a), 7(b)(1), 7(c), 8, 9, 11, 13, 14, 16, 17, 18, AND 19 OF TABLE A THEREOF. THE FIELDWORK WAS COMPLETED ON MARCH 22, 2022.

DATE OF PLAT OR MAP: JULY 19, 2023.

7/19/2023

MATTHEW K. ABBAS, PLS
WASHINGTON REGISTRATION NO. 20109892
MABBAS@BARGHAUSEN.COM

DATE

No.	Date	By	Ckd.	Appr.	Revision
1	7/18/23	KJR	MKA	MKA	ADDED TOPO AND UTILITIES TO THE ROAD SOUTH OF THE SITE TO 15TH AVE SE

Title: ALTA/NSPS LAND TITLE SURVEY
PTN OF THE SE1/4, OF THE NE1/4 OF SEC. 33,
TWP. 20 N., RGE 4 E., W. M.
CITY OF PUYALLUP, PIERCE COUNTY,
WASHINGTON STATE

For: BP FUELS NA

Scale: Horizontal N/A Vertical

Designed AEF
Drawn MKA
Checked MKA
Approved MKA
Date 7/19/23

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

Job Number 21730

Sheet 1 of 2

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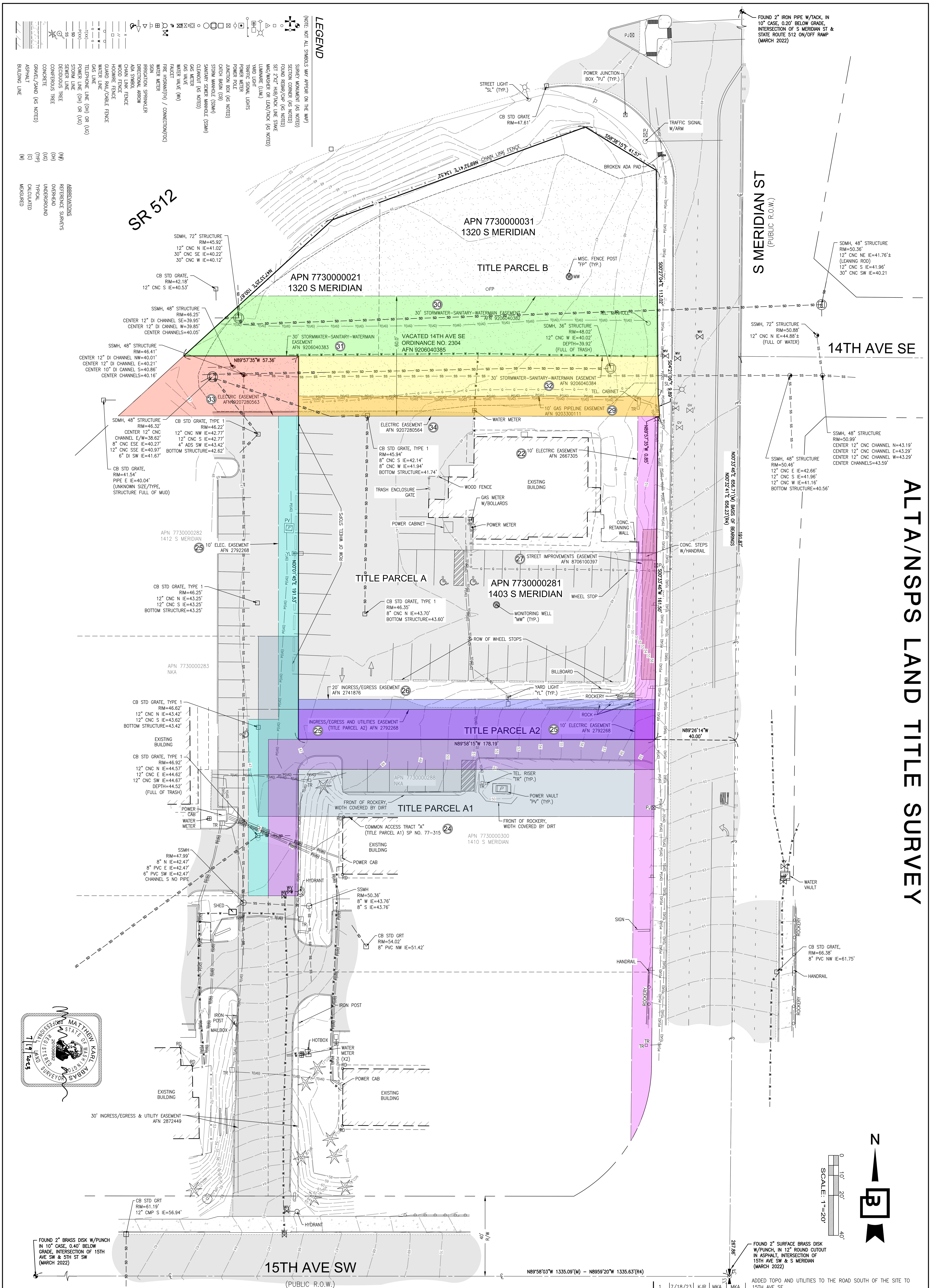

Job Number		Designed		Scale:	For:	Title:
21730	Barghausen Consulting Engineers, Inc.	Drawn AEF		Horizontal 1"=20'	BP FUELS NA	ALTA/NSPS LAND TITLE SURVEY
Sheet	18215 72nd Avenue South	Checked MKA				PTN OF THE SE1/4, OF THE NE1/4 OF SEC. 33,
2 of 2	Kent, WA 98032	Approved MKA		Vertical		TWP. 20 N., RGE 4 E., W. M.
	425.251.6222 barghausen.com	Date 7/19/23				CITY OF PUYALLUP, PIERCE COUNTY, WASHINGTON STATE

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Appendix B
BMP Detail

burying and smothering vegetation.

- Vegetative buffer zones for streams, lakes or other waterways shall be established by the local permitting authority or other state or federal permits or approvals.

Maintenance Standards

Inspect the area frequently to make sure flagging remains in place and the area remains undisturbed. Replace all damaged flagging immediately. Remove all materials located in the buffer area that may impede the ability of the vegetation to act as a filter.

BMP C103: High-Visibility Fence

Purpose

High-visibility fencing is intended to:

- Restrict clearing to approved limits.
- Prevent disturbance of sensitive areas, their buffers, and other areas required to be left undisturbed.
- Limit construction traffic to designated construction entrances, exits, or internal roads.
- Protect areas where marking with survey tape may not provide adequate protection.

Conditions of Use

To establish clearing limits plastic, fabric, or metal fence may be used:

- At the boundary of sensitive areas, their buffers, and other areas required to be left uncleared.
- As necessary to control vehicle access to and on the site.

Design and Installation Specifications

High-visibility plastic fence shall be composed of a high-density polyethylene material and shall be at least four feet in height. Posts for the fencing shall be steel or wood and placed every 6 feet on center (maximum) or as needed to ensure rigidity. The fencing shall be fastened to the post every six inches with a polyethylene tie. On long continuous lengths of fencing, a tension wire or rope shall be used as a top stringer to prevent sagging between posts. The fence color shall be high-visibility orange. The fence tensile strength shall be 360 lbs/ft using the ASTM D4595 testing method.

If appropriate install fabric silt fence in accordance with BMP C233: Silt Fence to act as high-visibility fence. Silt fence shall be at least 3 feet high and must be highly visible to meet the requirements of this BMP.

Metal fences shall be designed and installed according to the manufacturer's specifications.

Metal fences shall be at least 3 feet high and must be highly visible.

Fences shall not be wired or stapled to trees.

Maintenance Standards

If the fence has been damaged or visibility reduced, it shall be repaired or replaced immediately and visibility restored.

BMP C105: Stabilized Construction Access

Purpose

Stabilized construction accesses are established to reduce the amount of sediment transported onto paved roads outside the project site by vehicles or equipment. This is done by constructing a stabilized pad of quarry spalls at entrances and exits for project sites.

Conditions of Use

Construction accesses shall be stabilized wherever traffic will be entering or leaving a construction site if paved roads or other paved areas are within 1,000 feet of the site.

For residential subdivision construction sites, provide a stabilized construction access for each residence, rather than only at the main subdivision entrance. Stabilized surfaces shall be of sufficient length/width to provide vehicle access/parking, based on lot size and configuration.

On large commercial, highway, and road projects, the designer should include enough extra materials in the contract to allow for additional stabilized accesses not shown in the initial Construction SWPPP. It is difficult to determine exactly where access to these projects will take place; additional materials will enable the contractor to install them where needed.

Design and Installation Specifications

See Figure II-3.1: Stabilized Construction Access for details. Note: the 100' minimum length of the access shall be reduced to the maximum practicable size when the size or configuration of the site does not allow the full length (100').

Construct stabilized construction accesses with a 12-inch thick pad of 4-inch to 8-inch quarry spalls, a 4-inch course of asphalt treated base (ATB), or use existing pavement. Do not use crushed concrete, cement, or calcium chloride for construction access stabilization because these products raise pH levels in stormwater and concrete discharge to waters of the State is prohibited.

A separation geotextile shall be placed under the spalls to prevent fine sediment from pumping up into the rock pad. The geotextile shall meet the standards listed in Table II-3.2: Stabilized Construction Access Geotextile Standards.

Table II-3.2: Stabilized Construction Access Geotextile Standards

Geotextile Property	Required Value
Grab Tensile Strength (ASTM D4751)	200 psi min.

Table II-3.2: Stabilized Construction Access Geotextile Standards (continued)

Geotextile Property	Required Value
Grab Tensile Elongation (ASTM D4632)	30% max.
Mullen Burst Strength (ASTM D3786-80a)	400 psi min.
AOS (ASTM D4751)	20-45 (U.S. standard sieve size)

- Consider early installation of the first lift of asphalt in areas that will be paved; this can be used as a stabilized access. Also consider the installation of excess concrete as a stabilized access. During large concrete pours, excess concrete is often available for this purpose.
- Fencing (see BMP C103: High-Visibility Fence) shall be installed as necessary to restrict traffic to the construction access.
- Whenever possible, the access shall be constructed on a firm, compacted subgrade. This can substantially increase the effectiveness of the pad and reduce the need for maintenance.
- Construction accesses should avoid crossing existing sidewalks and back of walk drains if at all possible. If a construction access must cross a sidewalk or back of walk drain, the full length of the sidewalk and back of walk drain must be covered and protected from sediment leaving the site.

Alternative Material Specification

WSDOT has raised safety concerns about the Quarry Spall rock specified above. WSDOT observes that the 4-inch to 8-inch rock sizes can become trapped between Dually truck tires, and then released off-site at highway speeds. WSDOT has chosen to use a modified specification for the rock while continuously verifying that the Stabilized Construction Access remains effective. To remain effective, the BMP must prevent sediment from migrating off site. To date, there has been no performance testing to verify operation of this new specification. Jurisdictions may use the alternative specification, but must perform increased off-site inspection if they use, or allow others to use, it.

Stabilized Construction Accesses may use material that meets the requirements of WSDOT's *Standard Specifications for Road, Bridge, and Municipal Construction* Section 9-03.9(1) (WSDOT, 2016) for ballast except for the following special requirements.

The grading and quality requirements are listed in Table II-3.3: Stabilized Construction Access Alternative Material Requirements.

Table II-3.3: Stabilized Construction Access Alternative Material Requirements

Sieve Size	Percent Passing
2½″	99-100

Table II-3.3: Stabilized Construction Access Alternative Material Requirements (continued)

Sieve Size	Percent Passing
2″	65-100
¾″	40-80
No. 4	5 max.
No. 100	0-2
% Fracture	75 min.

- All percentages are by weight.
- The sand equivalent value and dust ratio requirements do not apply.
- The fracture requirement shall be at least one fractured face and will apply the combined aggregate retained on the No. 4 sieve in accordance with FOP for AASHTO T 335.

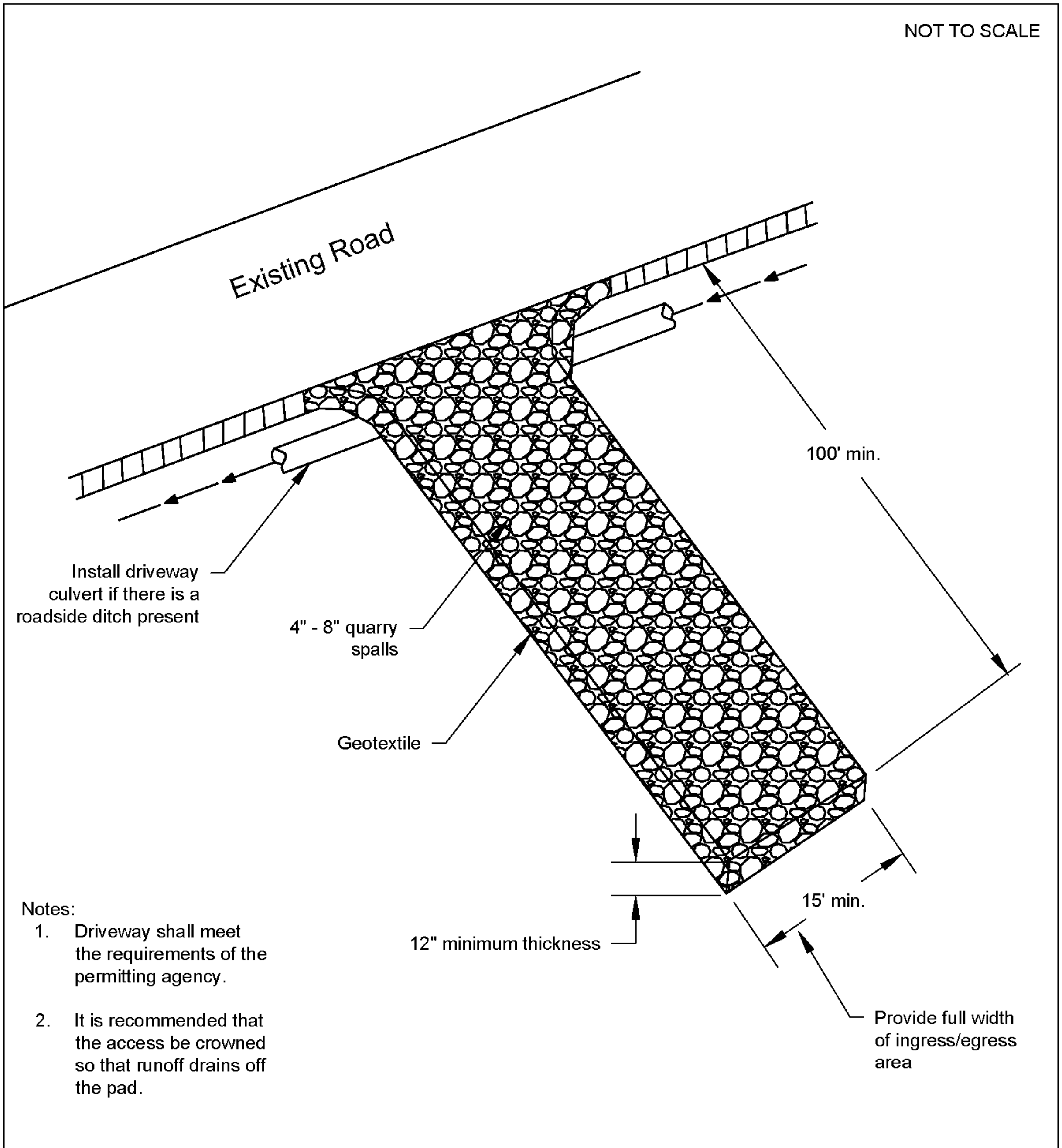
Maintenance Standards

Quarry spalls shall be added if the pad is no longer in accordance with the specifications.

- If the access is not preventing sediment from being tracked onto pavement, then alternative measures to keep the streets free of sediment shall be used. This may include replacement/cleaning of the existing quarry spalls, street sweeping, an increase in the dimensions of the access, or the installation of BMP C106: Wheel Wash.
- Any sediment that is tracked onto pavement shall be removed by shoveling or street sweeping. The sediment collected by sweeping shall be removed or stabilized on site. The pavement shall not be cleaned by washing down the street, except when high efficiency sweeping is ineffective and there is a threat to public safety. If it is necessary to wash the streets, the construction of a small sump to contain the wash water shall be considered. The sediment would then be washed into the sump where it can be controlled.
- Perform street sweeping by hand or with a high efficiency sweeper. Do not use a non-high efficiency mechanical sweeper because this creates dust and throws soils into storm systems or conveyance ditches.
- Any quarry spalls that are loosened from the pad, which end up on the roadway shall be removed immediately.
- If vehicles are entering or exiting the site at points other than the construction access(es), BMP C103: High-Visibility Fence shall be installed to control traffic.

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

Figure II-3.1: Stabilized Construction Access



DEPARTMENT OF ECOLOGY
State of Washington

Stabilized Construction Access

Revised June 2018

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Approved as Functionally Equivalent

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

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

BMP C106: Wheel Wash

Purpose

Wheel washes reduce the amount of sediment transported onto paved roads by washing dirt from the wheels of motor vehicles prior to the motor vehicles leaving the construction site.

Conditions of Use

- Use a wheel wash when BMP C105: Stabilized Construction Access is not preventing sediment from being tracked off site.
- Wheel washing is generally an effective BMP when installed with careful attention to topography. For example, a wheel wash can be detrimental if installed at the top of a slope abutting a right-of-way where the water from the dripping truck can run unimpeded into the street.
- Pressure washing combined with an adequately sized and surfaced pad with direct drainage to a large 10-foot x 10-foot sump can be very effective.
- Wheel wash wastewater is not stormwater. It is commonly called process water, and must be discharged to a separate on-site treatment system that prevents discharge to waters of the State, or to the sanitary sewer with local sewer district approval.
- Wheel washes may use closed-loop recirculation systems to conserve water use.
- Wheel wash wastewater shall not include wastewater from concrete washout areas.
- When practical, the wheel wash should be placed in sequence with BMP C105: Stabilized Construction Access. Locate the wheel wash such that vehicles exiting the wheel wash will enter directly onto BMP C105: Stabilized Construction Access. In order to achieve this, BMP C105: Stabilized Construction Access may need to be extended beyond the standard installation to meet the exit of the wheel wash.

Design and Installation Specifications

Suggested details are shown in Figure II-3.2: Wheel Wash. The Local Permitting Authority may allow other designs. A minimum of 6 inches of asphalt treated base (ATB) over crushed base material or 8 inches over a good subgrade is recommended to pave the wheel wash.

Use a low clearance truck to test the wheel wash before paving. Either a belly dump or lowboy will work well to test clearance.

Keep the water level from 12 to 14 inches deep to avoid damage to truck hubs and filling the truck tongues with water.

Midpoint spray nozzles are only needed in extremely muddy conditions.

Wheel wash systems should be designed with a small grade change, 6- to 12-inches for a 10-foot-wide pond, to allow sediment to flow to the low side of pond to help prevent re-suspension of sediment. A drainpipe with a 2- to 3-foot riser should be installed on the low side of the pond to allow for easy cleaning and refilling. Polymers may be used to promote coagulation and flocculation in a closed-loop system. Polyacrylamide (PAM) added to the wheel wash water at a rate of 0.25 - 0.5 pounds per 1,000 gallons of water increases effectiveness and reduces cleanup time. If PAM is already being used for dust or erosion control and is being applied by a water truck, the same truck can be used to change the wash water.

Maintenance Standards

The wheel wash should start out each day with fresh water.

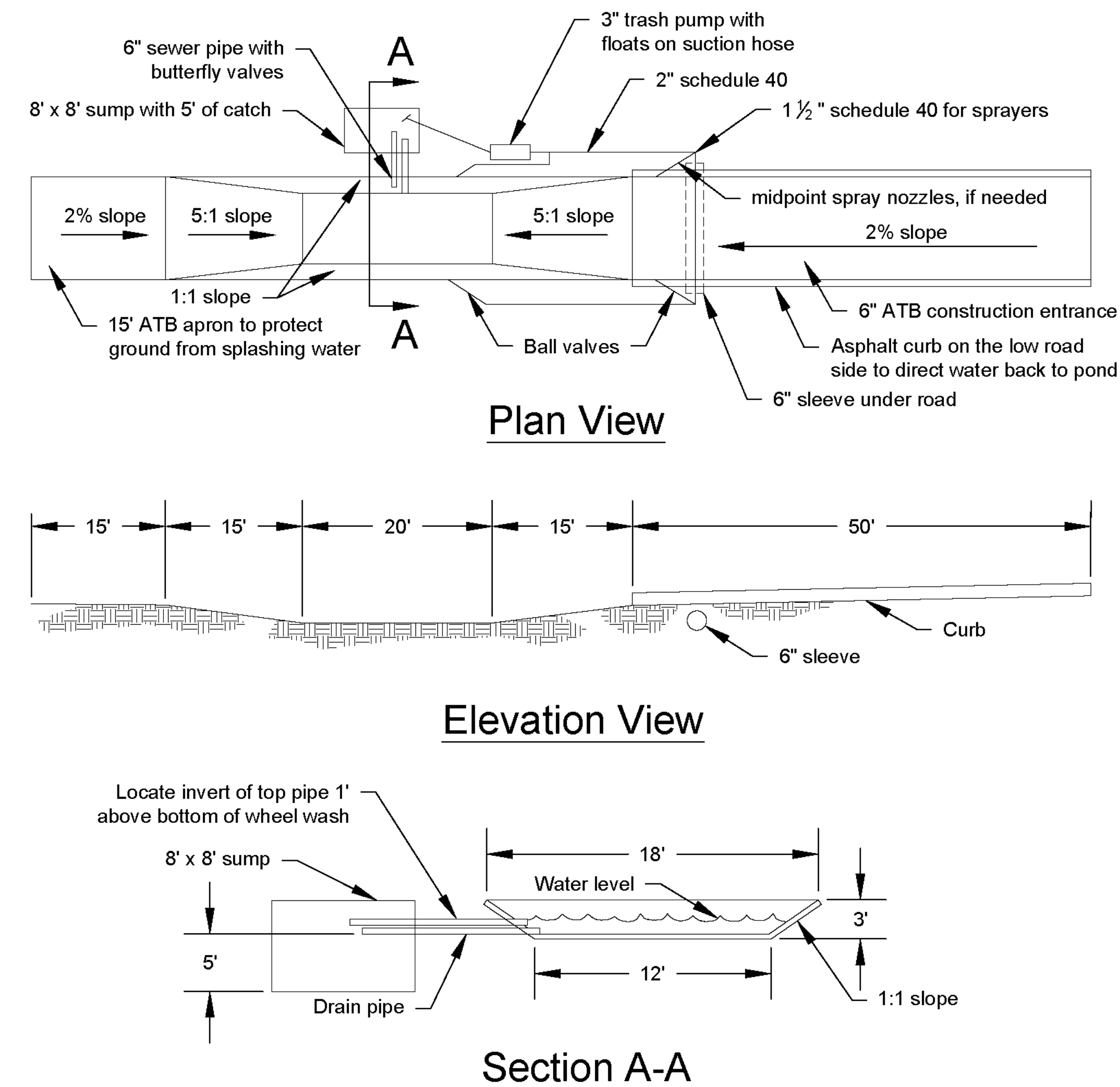
The wheel wash water should be changed a minimum of once per day. On large earthwork jobs where more than 10-20 trucks per hour are expected, the wheel wash water will need to be changed more often.

Approved as Functionally Equivalent

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

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

Figure II-3.2: Wheel Wash



Notes:

1. Build 8' x 8' sump to accomodate cleaning by trackhoe.

NOT TO SCALE

DEPARTMENT OF
ECOLOGY
State of Washington

Wheel Wash

Revised June 2016

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BMP C107: Construction Road / Parking Area Stabilization

Purpose

Stabilizing roads, parking areas, and other on-site vehicle transportation routes immediately after grading reduces erosion caused by construction traffic or stormwater runoff.

Conditions of Use

Roads and parking areas shall be stabilized wherever they are constructed, whether permanent or temporary, for use by construction traffic.

BMP C103: High-Visibility Fence shall be installed, if necessary, to limit the access of vehicles to only those roads and parking areas that are stabilized.

Design and Installation Specifications

- On areas that will receive asphalt as part of the project, install the first lift as soon as possible.
- A 6-inch depth of 2- to 4-inch crushed rock, gravel base, or crushed surfacing base course shall be applied immediately after grading or utility installation. A 4-inch course of asphalt treated base (ATB) may also be used, or the road/parking area may be paved. It may also be possible to use cement or calcium chloride for soil stabilization. If cement or cement kiln dust is used for roadbase stabilization, pH monitoring and BMP C252: Treating and Disposing of High pH Water is necessary to evaluate and minimize the effects on stormwater. If the area will not be used for permanent roads, parking areas, or structures, a 6-inch depth of hog fuel may also be used, but this is likely to require more maintenance. Whenever possible, construction roads and parking areas shall be placed on a firm, compacted subgrade.
- Temporary road gradients shall not exceed 15 percent. Roadways shall be carefully graded to drain. Drainage ditches shall be provided on each side of the roadway in the case of a crowned section, or on one side in the case of a super-elevated section. Drainage ditches shall be directed to a sediment control BMP.
- Rather than relying on ditches, it may also be possible to grade the road so that runoff sheetflows into a heavily vegetated area with a well-developed topsoil. Landscaped areas are not adequate. If this area has at least 50 feet of vegetation that water can flow through, then it is generally preferable to use the vegetation to treat runoff, rather than a sediment pond or trap. The 50 feet shall not include wetlands or their buffers. If runoff is allowed to sheetflow through adjacent vegetated areas, it is vital to design the roadways and parking areas so that no concentrated runoff is created.
- Storm drain inlets shall be protected to prevent sediment-laden water entering the drainage system (see BMP C220: Inlet Protection).

Maintenance Standards

Inspect stabilized areas regularly, especially after large storm events.

Crushed rock, gravel base, etc., shall be added as required to maintain a stable driving surface and to stabilize any areas that have eroded.

Following construction, these areas shall be restored to pre-construction condition or better to prevent future erosion.

Perform street cleaning at the end of each day or more often if necessary.

BMP C120: Temporary and Permanent Seeding

Purpose

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

Conditions of Use

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

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

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

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

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

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

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

Design and Installation Specifications

General

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

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

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

  Both of these approaches will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:
  - Irrigation.
  - Reapplication of mulch.
  - Repair of failed slope surfaces.

  This technique works with standard hydromulch (1,500 pounds per acre minimum) and Bonded Fiber Matrix/ Mechanically Bonded Fiber Matrix (BFM/MBFMs) (3,000 pounds per acre minimum).
- Seed may be installed by hand if:
  - Temporary and covered by straw, mulch, or topsoil.
  - Permanent in small areas (usually less than 1 acre) and covered with mulch, topsoil, or erosion blankets.
- The seed mixes listed in Table II-3.4: Temporary and Permanent Seed Mixes include

recommended mixes for both temporary and permanent seeding.

- Apply these mixes, with the exception of the wet area seed mix, at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used. Apply the wet area seed mix at a rate of 60 pounds per acre.
- Consult the local suppliers or the local conservation district for their recommendations. The appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the local authority may be used, depending on the soil type and hydrology of the area.

Table II-3.4: Temporary and Permanent Seed Mixes

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

Table II-3.4: Temporary and Permanent Seed Mixes (continued)

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

Roughening and Rototilling

- The seedbed should be firm and rough. Roughen all soil no matter what the slope. Track walk slopes before seeding if engineering purposes require compaction. Backblading or smoothing of slopes greater than 4H:1V is not allowed if they are to be seeded.
- Restoration-based landscape practices require deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical, initially rip the subgrade to improve long-term permeability, infiltration, and water inflow qualities. At a minimum,

permanent areas shall use soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches complete the rototilling process in multiple lifts, or prepare the engineered soil system per specifications and place to achieve the specified depth.

Fertilizers

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

Bonded Fiber Matrix and Mechanically Bonded Fiber Matrix

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

BMP C123: Plastic Covering

Purpose

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

Conditions of Use

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

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

Design and Installation Specifications

- Plastic slope cover must be installed as follows:
    1. Run plastic up and down the slope, not across the slope.
    2. Plastic may be installed perpendicular to a slope if the slope length is less than 10 feet.

3. Provide a minimum of 8-inch overlap at the seams.
4. On long or wide slopes, or slopes subject to wind, tape all seams.
5. Place plastic into a small (12-inch wide by 6-inch deep) slot trench at the top of the slope and backfill with soil to keep water from flowing underneath.
6. Place sand filled burlap or geotextile bags every 3 to 6 feet along seams and tie them together with twine to hold them in place.
7. Inspect plastic for rips, tears, and open seams regularly and repair immediately. This prevents high velocity runoff from contacting bare soil, which causes extreme erosion.
8. Sandbags may be lowered into place tied to ropes. However, all sandbags must be staked in place.

- Plastic sheeting shall have a minimum thickness of 0.06 millimeters.
- If erosion at the toe of a slope is likely, a gravel berm, riprap, or other suitable protection shall be installed at the toe of the slope in order to reduce the velocity of runoff.

Maintenance Standards

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

Approved as Functionally Equivalent

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

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

BMP C124: Sodding

Purpose

The purpose of sodding is to establish turf for immediate erosion protection and to stabilize drainage paths where concentrated overland flow will occur.

Conditions of Use

Sodding may be used in the following areas:

- Disturbed areas that require short-term or long-term cover.
- Disturbed areas that require immediate vegetative cover.
- All waterways that require vegetative lining. Waterways may also be seeded rather than sodded, and protected with a net or blanket.

Design and Installation Specifications

Sod shall be free of weeds, of uniform thickness (approximately 1-inch thick), and shall have a dense root mat for mechanical strength.

The following steps are recommended for sod installation:

1. Shape and smooth the surface to final grade in accordance with the approved grading plan. Consider any areas (such as swales) that need to be overexcavated below design elevation to allow room for placing soil amendment and sod.
2. Amend 4 inches (minimum) of compost into the top 8 inches of the soil if the organic content of the soil is less than ten percent or the permeability is less than 0.6 inches per hour. See https://ecology.wa.gov/Waste-Toxics/Reducing-recycling-waste/Organic-materials/Managing-organics-compost for further information.
3. Fertilize according to the sod supplier's recommendations.
4. Work lime and fertilizer 1 to 2 inches into the soil, and smooth the surface.
5. Lay strips of sod beginning at the lowest area to be sodded and perpendicular to the direction of water flow. Wedge strips securely into place. Square the ends of each strip to provide for a close, tight fit. Stagger joints at least 12 inches. Staple on slopes steeper than 3H:1V. Staple the upstream edge of each sod strip.
6. Roll the sodded area and irrigate.
7. When sodding is carried out in alternating strips or other patterns, seed the areas between the sod immediately after sodding.

Maintenance Standards

If the grass is unhealthy, the cause shall be determined and appropriate action taken to reestablish a healthy groundcover. If it is impossible to establish a healthy groundcover due to frequent saturation, instability, or some other cause, the sod shall be removed, the area seeded with an appropriate mix, and protected with a net or blanket.

BMP C140: Dust Control

Purpose

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

Conditions of Use

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

Design and Installation Specifications

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

  Refer to BMP C126: Polyacrylamide (PAM) for Soil Erosion Protection for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body.
- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes

compliance with this BMP.

- Use vacuum street sweepers.
- Remove mud and other dirt promptly so it does not dry and then turn into dust.
- Techniques that can be used for unpaved roads and lots include:
    - Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
    - Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
    - Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
    - Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
    - Encourage the use of alternate, paved routes, if available.
    - Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
    - Limit dust-causing work on windy days.
    - Pave unpaved permanent roads and other trafficked areas.

Maintenance Standards

Respray area as necessary to keep dust to a minimum.

BMP C150: Materials on Hand

Purpose

Keep quantities of erosion prevention and sediment control materials on the project site at all times to be used for regular maintenance and emergency situations such as unexpected heavy rains. Having these materials on-site reduces the time needed to replace existing or implement new BMPs when inspections indicate that existing BMPs are not meeting the Construction SWPPP requirements. In addition, contractors can save money by buying some materials in bulk and storing them at their office or yard.

Conditions of Use

- Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible pipe, sandbags, geotextile fabric and steel “T” posts.

- Materials should be stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or project proponent could keep a stockpile of materials that are available for use on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

Design and Installation Specifications

Depending on project type, size, complexity, and length, materials and quantities will vary. A good minimum list of items that will cover numerous situations includes:

- Clear Plastic, 6 mil
- Drainpipe, 6 or 8 inch diameter
- Sandbags, filled
- Straw Bales for mulching
- Quarry Spalls
- Washed Gravel
- Geotextile Fabric
- Catch Basin Inserts
- Steel "T" Posts
- Silt fence material
- Straw Wattles

Maintenance Standards

- All materials with the exception of the quarry spalls, steel “T” posts, and gravel should be kept covered and out of both sun and rain.
- Re-stock materials as needed.

BMP C151: Concrete Handling

Purpose

Concrete work can generate process water and slurry that contain fine particles and high pH, both of which can violate water quality standards in the receiving water. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate concrete, concrete process water, and concrete slurry from entering waters of the State.

Conditions of Use

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

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

Disposal options for concrete, in order of preference are:

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

Design and Installation Specifications

- Wash concrete truck drums at an approved off-site location or in designated concrete washout areas only. Do not wash out concrete trucks onto the ground (including formed areas awaiting concrete), or into storm drains, open ditches, streets, or streams. Refer to BMP C154: Concrete Washout Area for information on concrete washout areas.
    - Return unused concrete remaining in the truck and pump to the originating batch plant for recycling. Do not dump excess concrete on site, except in designated concrete washout areas as allowed in BMP C154: Concrete Washout Area.
- Wash small concrete handling equipment (e.g. hand tools, screeds, shovels, rakes, floats, trowels, and wheelbarrows) into designated concrete washout areas or into formed areas awaiting concrete pour.
- At no time shall concrete be washed off into the footprint of an area where an infiltration feature will be installed.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow washwater from areas, such as concrete aggregate driveways, to drain directly (without detention or treatment) to natural or constructed stormwater conveyances.
- Contain washwater and leftover product in a lined container when no designated concrete washout areas (or formed areas, allowed as described above) are available. Dispose of contained concrete and concrete washwater (process water) properly.

- Always use forms or solid barriers for concrete pours, such as pilings, within 15-feet of surface waters.
- Refer to BMP C252: Treating and Disposing of High pH Water for pH adjustment requirements.
- Refer to the Construction Stormwater General Permit (CSWGP) for pH monitoring requirements if the project involves one of the following activities:
    - Significant concrete work (as defined in the CSWGP).
    - The use of soils amended with (but not limited to) Portland cement-treated base, cement kiln dust or fly ash.
    - Discharging stormwater to segments of water bodies on the 303(d) list (Category 5) for high pH.

Maintenance Standards

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

BMP C152: Sawcutting and Surfacing Pollution Prevention

Purpose

Sawcutting and surfacing operations generate slurry and process water that contains fine particles and high pH (concrete cutting), both of which can violate the water quality standards in the receiving water. Concrete spillage or concrete discharge to waters of the State is prohibited. Use this BMP to minimize and eliminate process water and slurry created through sawcutting or surfacing from entering waters of the State.

Conditions of Use

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

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

Design and Installation Specifications

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

Maintenance Standards

Continually monitor operations to determine whether slurry, cuttings, or process water could enter waters of the state. If inspections show that a violation of water quality standards could occur, stop operations and immediately implement preventive measures such as berms, barriers, secondary containment, and/or vacuum trucks.

BMP C153: Material Delivery, Storage, and Containment

Purpose

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

Conditions of Use

Use at construction sites with delivery and storage of the following materials:

- Petroleum products such as fuel, oil and grease
- Soil stabilizers and binders (e.g., Polyacrylamide)
- Fertilizers, pesticides and herbicides
- Detergents
- Asphalt and concrete compounds

- Hazardous chemicals such as acids, lime, adhesives, paints, solvents, and curing compounds
- Any other material that may be detrimental if released to the environment

Design and Installation Specifications

- The temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Safety Data Sheets (SDS) should be supplied for all materials stored. Chemicals should be kept in their original labeled containers.
- Hazardous material storage on-site should be minimized.
- Hazardous materials should be handled as infrequently as possible.
- During the wet weather season (Oct 1 – April 30), consider storing materials in a covered area.
- Materials should be stored in secondary containments, such as an earthen dike, horse trough, or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, within secondary containment.
- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids to reduce corrosion. Domed plastic covers are inexpensive and snap to the top of drums, preventing water from collecting.
- Liquids, petroleum products, and substances listed in 40 CFR Parts 110, 117, or 302 shall be stored in approved containers and drums and shall not be overfilled. Containers and drums shall be stored in temporary secondary containment facilities.
- Temporary secondary containment facilities shall provide for a spill containment volume able to contain 10% of the total enclosed container volume of all containers, or 110% of the capacity of the largest container within its boundary, whichever is greater.
- Secondary containment facilities shall be impervious to the materials stored therein for a minimum contact time of 72 hours.
- Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.
- During the wet weather season (Oct 1 – April 30), each secondary containment facility shall be covered during non-working days, prior to and during rain events.
- Keep material storage areas clean, organized and equipped with an ample supply of appropriate spill clean-up material (spill kit).
- The spill kit should include, at a minimum:

- 1-Water Resistant Nylon Bag
- 3-Oil Absorbent Socks 3”x 4’
- 2-Oil Absorbent Socks 3”x 10’
- 12-Oil Absorbent Pads 17”x19”
- 1-Pair Splash Resistant Goggles
- 3-Pair Nitrile Gloves
- 10-Disposable Bags with Ties
- Instructions

Maintenance Standards

- Secondary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as hazardous waste unless testing determines them to be non-hazardous.
- Re-stock spill kit materials as needed.

BMP C154: Concrete Washout Area

Purpose

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

Conditions of Use

Concrete washout areas are implemented on construction projects where:

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

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

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

Design and Installation Specifications

Implementation

- Perform washout of concrete truck drums at an approved off-site location or in designated concrete washout areas only.
- Do not wash out concrete onto non-formed areas, or into storm drains, open ditches, streets, or streams.
- Wash equipment difficult to move, such as concrete paving machines, in areas that do not directly drain to natural or constructed stormwater conveyance or potential infiltration areas.
- Do not allow excess concrete to be dumped on-site, except in designated concrete washout areas as allowed above.
- Concrete washout areas may be prefabricated concrete washout containers, or self-installed structures (above-grade or below-grade).
- Prefabricated containers are most resistant to damage and protect against spills and leaks. Companies may offer delivery service and provide regular maintenance and disposal of solid and liquid waste.
- If self-installed concrete washout areas are used, below-grade structures are preferred over above-grade structures because they are less prone to spills and leaks.
- Self-installed above-grade structures should only be used if excavation is not practical.
- Concrete washout areas shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.

Education

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

Contracts

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

Location and Placement

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

Concrete Truck Washout Procedures

- Washout of concrete truck drums shall be performed in designated concrete washout areas only.
- Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated concrete washout areas or properly disposed of off-site.

Concrete Washout Area Installation

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

Maintenance Standards

Inspection and Maintenance

- Inspect and verify that concrete washout areas are in place prior to the commencement of concrete work.
- Once concrete wastes are washed into the designated washout area and allowed to harden,

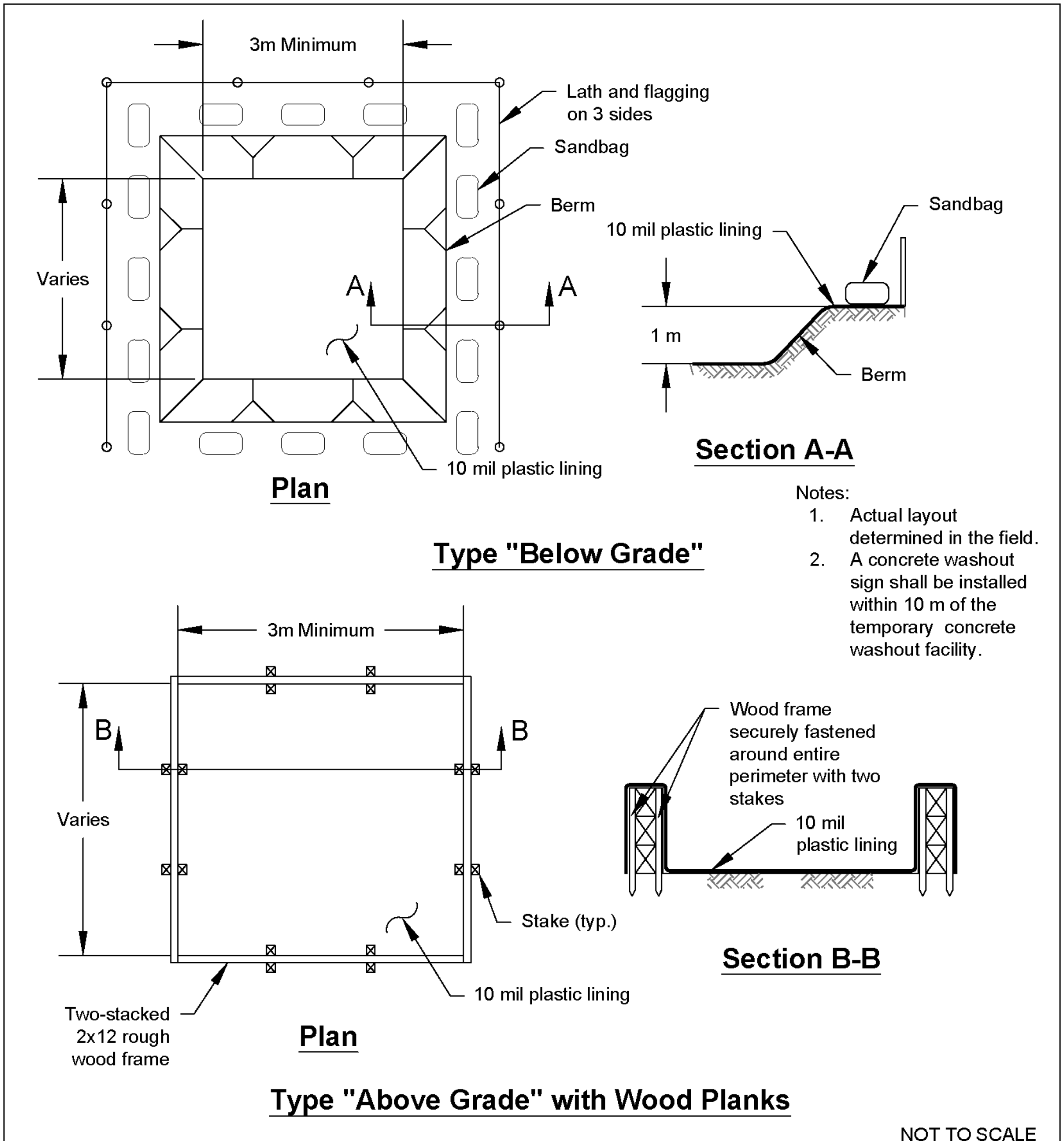
the concrete should be broken up, removed, and disposed of per applicable solid waste regulations. Dispose of hardened concrete on a regular basis.

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

Removal of Concrete Washout Areas

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

Figure II-3.7: Concrete Washout Area with Wood Planks



DEPARTMENT OF ECOLOGY
State of Washington

Concrete Washout Area with Wood Planks

Revised June 2016

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Figure II-3.8: Concrete Washout Area with Straw Bales

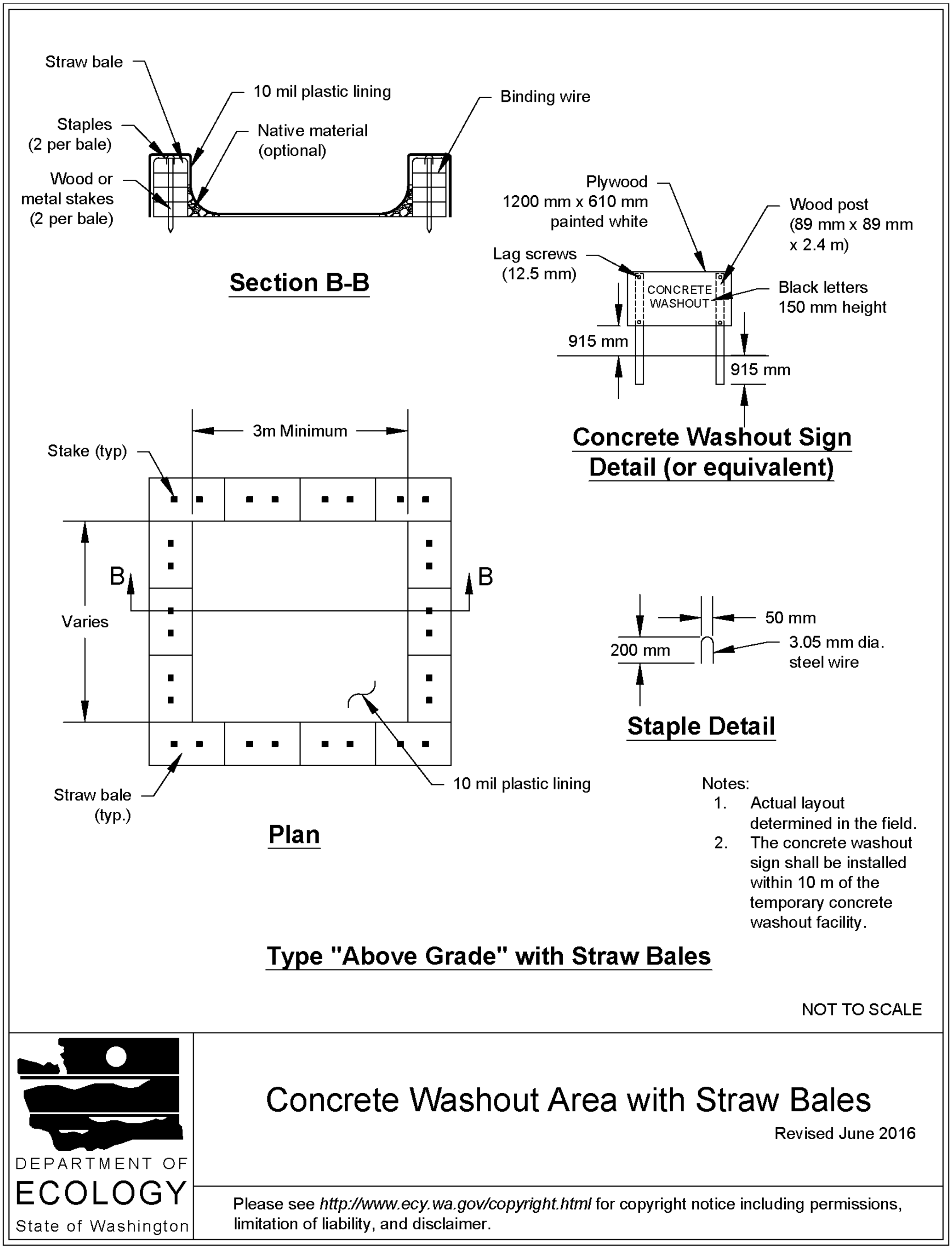
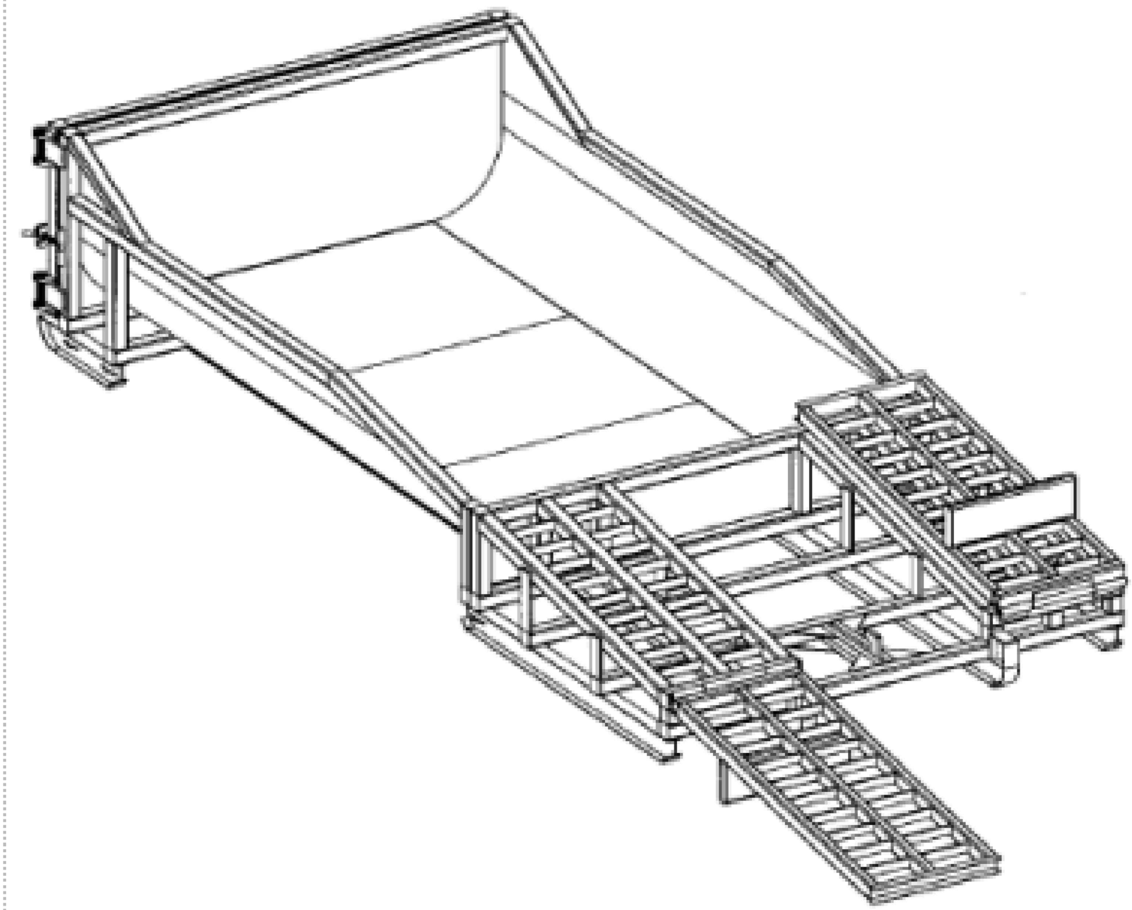


Figure II-3.9: Prefabricated Concrete Washout Container w/Ramp



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DEPARTMENT OF ECOLOGY
State of Washington

Prefabricated Concrete Washout Container w/Ramp

Revised June 2016

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BMP C160: Certified Erosion and Sediment Control Lead

Purpose

The project proponent designates at least one person as the responsible representative in charge of erosion and sediment control (ESC), and water quality protection. The designated person shall be responsible for ensuring compliance with all local, state, and federal erosion and sediment control and water quality requirements. Construction sites one acre or larger that discharge to waters of the State must designate a Certified Erosion and Sediment Control Lead (CESCL) as the responsible representative.

Conditions of Use

A CESCL shall be made available on projects one acre or larger that discharge stormwater to surface waters of the state. Sites less than one acre may have a person without CESCL certification conduct inspections.

The CESCL shall:

- Have a current certificate proving attendance in an erosion and sediment control training course that meets the minimum ESC training and certification requirements established by Ecology.

  Ecology has provided the minimum requirements for CESCL course training, as well as a list of ESC training and certification providers at:

  https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Certified-erosion-sediment-control

  OR

- Be a Certified Professional in Erosion and Sediment Control (CPESC). For additional information go to:

  http://www.envirocertintl.org/cpesc/

Specifications

- CESCL certification shall remain valid for three years.
- The CESCL shall have authority to act on behalf of the contractor or project proponent and shall be available, or on-call, 24 hours per day throughout the period of construction.
- The Construction SWPPP shall include the name, telephone number, fax number, and address of the designated CESCL. See II-2 Construction Stormwater Pollution Prevention Plans (Construction SWPPPs).
- A CESCL may provide inspection and compliance services for multiple construction projects in the same geographic region, but must be on site whenever earthwork activities are

occurring that could generate release of turbid water.

- Duties and responsibilities of the CESCL shall include, but are not limited to the following:
  - Maintaining a permit file on site at all times which includes the Construction SWPPP and any associated permits and plans.
  - Directing BMP installation, inspection, maintenance, modification, and removal.
  - Updating all project drawings and the Construction SWPPP with changes made.
  - Completing any sampling requirements including reporting results using electronic Discharge Monitoring Reports (WebDMR).
  - Facilitate, participate in, and take corrective actions resulting from inspections performed by outside agencies or the owner.
  - Keeping daily logs, and inspection reports. Inspection reports should include:
    - Inspection date/time.
    - Weather information; general conditions during inspection and approximate amount of precipitation since the last inspection.
    - Visual monitoring results, including a description of discharged stormwater. The presence of suspended sediment, turbid water, discoloration, and oil sheen shall be noted, as applicable.
    - Any water quality monitoring performed during inspection.
    - General comments and notes, including a brief description of any BMP repairs, maintenance or installations made as a result of the inspection.
    - A summary or list of all BMPs implemented, including observations of all erosion/sediment control structures or practices. The following shall be noted:
      1. Locations of BMPs inspected.
      2. Locations of BMPs that need maintenance.
      3. Locations of BMPs that failed to operate as designed or intended.
      4. Locations of where additional or different BMPs are required.

BMP C162: Scheduling

Purpose

Sequencing a construction project reduces the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.

Conditions of Use

The construction sequence schedule is an orderly listing of all major land-disturbing activities together with the necessary erosion and sedimentation control measures planned for the project. This type of schedule guides the contractor on work to be done before other work is started so that serious erosion and sedimentation problems can be avoided.

Following a specified work schedule that coordinates the timing of land-disturbing activities and the installation of control measures is perhaps the most cost-effective way of controlling erosion during construction. The removal of ground cover leaves a site vulnerable to erosion. Construction sequencing that limits land clearing, provides timely installation of erosion and sedimentation controls, and restores protective cover quickly can significantly reduce the erosion potential of a site.

Design Considerations

- Minimize construction during rainy periods.
- Schedule projects to disturb only small portions of the site at any one time. Complete grading as soon as possible. Immediately stabilize the disturbed portion before grading the next portion. Practice staged seeding in order to revegetate cut and fill slopes as the work progresses.

II-3.3 Construction Runoff BMPs

BMP C200: Interceptor Dike and Swale

Purpose

Provide a dike of compacted soil or a swale at the top or base of a disturbed slope or along the perimeter of a disturbed construction area to convey stormwater. Use the dike and/or swale to intercept the runoff from unprotected areas and direct it to areas where erosion can be controlled. This can prevent storm runoff from entering the work area or sediment-laden runoff from leaving the construction site.

Conditions of Use

Use an interceptor dike or swale where runoff from an exposed site or disturbed slope must be conveyed to an erosion control BMP which can safely convey the stormwater.

- Locate upslope of a construction site to prevent runoff from entering the disturbed area.
- When placed horizontally across a disturbed slope, it reduces the amount and velocity of runoff flowing down the slope.
- Locate downslope to collect runoff from a disturbed area and direct it to a sediment BMP (e.g. BMP C240: Sediment Trap or BMP C241: Sediment Pond (Temporary)).

Design and Installation Specifications

- Dike and/or swale and channel must be stabilized with temporary or permanent vegetation or other channel protection during construction.
- Steep grades require channel protection and check dams.
- Review construction for areas where overtopping may occur.
- Can be used at the top of new fill before vegetation is established.
- May be used as a permanent diversion channel to carry the runoff.
- Contributing area for an individual dike or swale should be one acre or less.
- Design the dike and/or swale to contain flows calculated by one of the following methods:
    - Single Event Hydrograph Method: The peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 10-year, 24-hour frequency storm for the worst-case land cover condition.

      OR

    - Continuous Simulation Method: The 10-year peak flow rate, as determined by an approved continuous runoff model with a 15-minute time step for the worst-case land cover condition.

  Worst-case land cover conditions (i.e., producing the most runoff) should be used for analysis (in most cases, this would be the land cover conditions just prior to final landscaping).

Interceptor Dikes

Interceptor dikes shall meet the following criteria:

- Top Width: 2 feet minimum.
- Height: 1.5 feet minimum on berm.
- Side Slope: 2H:1V or flatter.
- Grade: Depends on topography, however, dike system minimum is 0.5%, and maximum is 1%.
- Compaction: Minimum of 90 percent ASTM D698 standard proctor.
- Stabilization: Depends on velocity and reach. Inspect regularly to ensure stability.
- Ground Slopes <5%: Seed and mulch applied within 5 days of dike construction (see BMP C121: Mulching).
- Ground Slopes 5 - 40%: Dependent on runoff velocities and dike materials. Stabilization should be done immediately using either sod or riprap, or other measures to avoid erosion.
- The upslope side of the dike shall provide positive drainage to the dike outlet. No erosion shall

occur at the outlet. Provide energy dissipation measures as necessary. Sediment-laden runoff must be released through a sediment trapping facility.

- Minimize construction traffic over temporary dikes. Use temporary cross culverts for channel crossing.
- See Table II-3.8: Horizontal Spacing of Interceptor Dikes Along Ground Slope for recommended horizontal spacing between dikes.

Table II-3.8: Horizontal Spacing of Interceptor Dikes Along Ground Slope

Average Slope	Slope Percent	Flowpath Length
20H:1V or less	3-5%	300 feet
(10 to 20)H:1V	5-10%	200 feet
(4 to 10)H:1V	10-25%	100 feet
(2 to 4)H:1V	25-50%	50 feet

Interceptor Swales

Interceptor swales shall meet the following criteria:

- Bottom Width: 2 feet minimum; the cross-section bottom shall be level.
- Depth: 1-foot minimum.
- Side Slope: 2H:1V or flatter.
- Grade: Maximum 5 percent, with positive drainage to a suitable outlet (such as BMP C241: Sediment Pond (Temporary)).
- Stabilization: Seed as per BMP C120: Temporary and Permanent Seeding, or BMP C202: Riprap Channel Lining, 12 inches thick riprap pressed into the bank and extending at least 8 inches vertical from the bottom.

Maintenance Standards

- Inspect diversion dikes and interceptor swales once a week and after every rainfall. Immediately remove sediment from the flow area.
- Damage caused by construction traffic or other activity must be repaired before the end of each working day.
- Check outlets and make timely repairs as needed to avoid gully formation. When the area below the temporary diversion dike is permanently stabilized, remove the dike and fill and stabilize the channel to blend with the natural surface.

BMP C207: Check Dams

Purpose

Construction of check dams across a swale or ditch reduces the velocity of concentrated flow and dissipates energy at the check dam.

Conditions of Use

Use check dams where temporary or permanent channels are not yet vegetated, channel lining is infeasible, and/or velocity checks are required.

- Check dams may not be placed in streams unless approved by the State Department of Fish and Wildlife.
- Check dams may not be placed in wetlands without approval from a permitting agency.
- Do not place check dams below the expected backwater from any salmonid bearing water between October 1 and May 31 to ensure that there is no loss of high flow refuge habitat for overwintering juvenile salmonids and emergent salmonid fry.

Design and Installation Specifications

- Construct rock check dams from appropriately sized rock. The rock used must be large enough to stay in place given the expected design flow through the channel. The rock must be placed by hand or by mechanical means (do not dump the rock to form the dam) to achieve complete coverage of the ditch or swale and to ensure that the center of the dam is lower than the edges.
- Check dams may also be constructed of either rock or pea-gravel filled bags. Numerous new products are also available for this purpose. They tend to be re-usable, quick and easy to install, effective, and cost efficient.
- Place check dams perpendicular to the flow of water.
- The check dam should form a triangle when viewed from the side. This prevents undercutting as water flows over the face of the check dam rather than falling directly onto the ditch bottom.
- Before installing check dams, impound and bypass upstream water flow away from the work area. Options for bypassing include pumps, siphons, or temporary channels.
- Check dams combined with sumps work more effectively at slowing flow and retaining sediment than a check dam alone. A deep sump should be provided immediately upstream of the check dam.
- In some cases, if carefully located and designed, check dams can remain as permanent installations with very minor regrading. They may be left as either spillways, in which case accumulated sediment would be graded and seeded, or as check dams to prevent further sediment from leaving the site.
- The maximum spacing between check dams shall be such that the downstream toe of the

upstream dam is at the same elevation as the top of the downstream dam.

- Keep the maximum height at 2 feet at the center of the check dam.
- Keep the center of the check dam at least 12 inches lower than the outer edges at natural ground elevation.
- Keep the side slopes of the check dam at 2H:1V or flatter.
- Key the stone into the ditch banks and extend it beyond the abutments a minimum of 18 inches to avoid washouts from overflow around the dam.
- Use filter fabric foundation under a rock or sand bag check dam. If a blanket ditch liner is used, filter fabric is not necessary. A piece of organic or synthetic blanket cut to fit will also work for this purpose.
- In the case of grass-lined ditches and swales, all check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale - unless the slope of the swale is greater than 4 percent. The area beneath the check dams shall be seeded and mulched immediately after dam removal.
- Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blockage from displaced stones.
- See Figure II-3.16: Rock Check Dam.

Maintenance Standards

Check dams shall be monitored for performance and sediment accumulation during and after each rainfall that produces runoff. Sediment shall be removed when it reaches one half the sump depth.

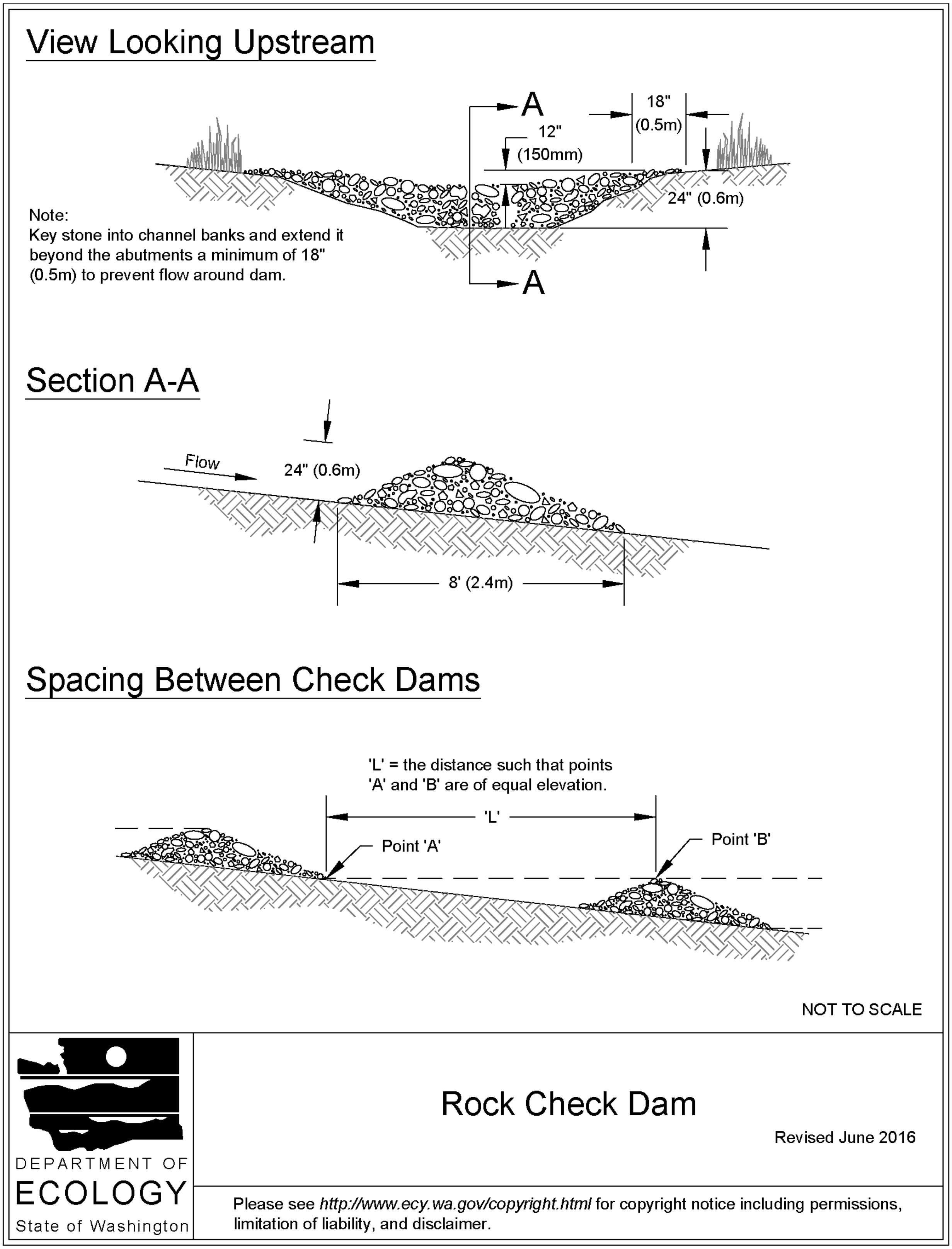
- Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the dam.
- If significant erosion occurs between dams, install a protective riprap liner in that portion of the channel. See BMP C202: Riprap Channel Lining.

Approved as Functionally Equivalent

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

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

Figure II-3.16: Rock Check Dam



BMP C208: Triangular Silt Dike (TSD)

Purpose

Triangular silt dikes (TSDs) may be used as check dams, for perimeter protection, for temporary soil stockpile protection, for drop inlet protection, or as a temporary interceptor dike.

Conditions of Use

- TSDs may be used on soil or pavement with adhesive or staples.
- TSDs have been used to build temporary:
    - BMP C241: Sediment Pond (Temporary);
    - BMP C200: Interceptor Dike and Swale;
    - BMP C154: Concrete Washout Area;
    - BMP C203: Water Bars;
    - BMP C206: Level Spreader;
    - BMP C220: Inlet Protection;
    - BMP C207: Check Dams
    - curbing; and
    - berms.

Design and Installation Specifications

- TSDs are made of urethane foam sewn into a woven geosynthetic fabric.
- TSDs are triangular, 10 inches to 14 inches high in the center, with a 20-inch to 28-inch base. A 2 foot apron extends beyond both sides of the triangle along its standard section of 7 feet. A sleeve at one end allows attachment of additional sections as needed.
- Install with ends curved up to prevent water from flowing around the ends.
- The fabric flaps and check dam units are attached to the ground with wire staples. Wire staples should be No. 11 gauge wire and should be 200 mm to 300 mm in length.
- When multiple units are installed, the sleeve of fabric at the end of the unit shall overlap the abutting unit and be stapled.
- When used as check dams:
    - TSDs should be located and installed as soon as construction will allow.
    - TSDs should be placed perpendicular to the flow of water.
    - The leading edge of the TSD must be secured with rocks, sandbags, or a small key slot

and staples.

  - In the case of grass-lined ditches and swales, check dams and accumulated sediment shall be removed when the grass has matured sufficiently to protect the ditch or swale unless the slope of the swale is greater than 4 percent. The area beneath the check dams shall be seeded and mulched immediately after dam removal.

Maintenance Standards

- Inspect TSDs for performance and sediment accumulation during and after each rainfall that produces runoff. Remove sediment when it reaches one half the height of the TSD.
- Anticipate submergence and deposition above the TSD and erosion from high flows around the edges of the TSD. Immediately repair any damage or any undercutting of the TSD.

BMP C209: Outlet Protection

Purpose

Outlet protection prevents scour at conveyance outlets and minimizes the potential for downstream erosion by reducing the velocity of concentrated stormwater flows.

Conditions of Use

Use outlet protection at the outlets of all ponds, pipes, ditches, or other conveyances that discharge to a natural or manmade drainage feature such as a stream, wetland, lake, or ditch.

Design and Installation Specifications

- The receiving channel at the outlet of a pipe shall be protected from erosion by lining a minimum of 6 feet downstream and extending up the channel sides a minimum of 1–foot above the maximum tailwater elevation, or 1-foot above the crown, whichever is higher. For pipes larger than 18 inches in diameter, the outlet protection lining of the channel shall be four times the diameter of the outlet pipe.
- Standard wingwalls, tapered outlets, and paved channels should also be considered when appropriate for permanent culvert outlet protection (WSDOT, 2015).
- BMP C122: Nets and Blankets or BMP C202: Riprap Channel Lining provide suitable options for lining materials.
- With low flows, BMP C201: Grass-Lined Channels can be an effective alternative for lining material.
- The following guidelines shall be used for outlet protection with riprap:
  - If the discharge velocity at the outlet is less than 5 fps, use 2-inch to 8-inch riprap. Minimum thickness is 1-foot.
  - For 5 to 10 fps discharge velocity at the outlet, use 24-inch to 48-inch riprap. Minimum

thickness is 2 feet.

  - For outlets at the base of steep slope pipes (pipe slope greater than 10 percent), use an engineered energy dissipator.
  - Filter fabric or erosion control blankets should always be used under riprap to prevent scour and channel erosion. See BMP C122: Nets and Blankets.

- Bank stabilization, bioengineering, and habitat features may be required for disturbed areas. This work may require a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife. See I-2.11 Hydraulic Project Approvals.

Maintenance Standards

- Inspect and repair as needed.
- Add rock as needed to maintain the intended function.
- Clean energy dissipator if sediment builds up.

BMP C220: Inlet Protection

Purpose

Inlet protection prevents coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

Conditions of Use

Use inlet protection at inlets that are operational before permanent stabilization of the disturbed areas that contribute runoff to the inlet. Provide protection for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless those inlets are preceded by a sediment trapping BMP.

Also consider inlet protection for lawn and yard drains on new home construction. These small and numerous drains coupled with lack of gutters can add significant amounts of sediment into the roof drain system. If possible, delay installing lawn and yard drains until just before landscaping, or cap these drains to prevent sediment from entering the system until completion of landscaping. Provide 18-inches of sod around each finished lawn and yard drain.

Table II-3.10: Storm Drain Inlet Protection lists several options for inlet protection. All of the methods for inlet protection tend to plug and require a high frequency of maintenance. Limit contributing drainage areas for an individual inlet to one acre or less. If possible, provide emergency overflows with additional end-of-pipe treatment where stormwater ponding would cause a hazard.

Table II-3.10: Storm Drain Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/ Earthen Surfaces	Conditions of Use
Drop Inlet Protection			
Excavated drop inlet protection	Yes, temporary flooding may occur	Earthen	Applicable for heavy flows. Easy to maintain. Large area requirement: 30'x30'/acre
Block and gravel drop inlet protection	Yes	Paved or Earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and wire drop inlet protection	No	Paved or Earthen	Applicable for heavy concentrated flows. Will pond. Can withstand traffic.
Catch basin filters	Yes	Paved or Earthen	Frequent maintenance required.
Curb Inlet Protection			
Curb inlet protection with wooden weir	Small capacity overflow	Paved	Used for sturdy, more compact installation.
Block and gravel curb inlet protection	Yes	Paved	Sturdy, but limited filtration.
Culvert Inlet Protection			
Culvert inlet sediment trap	N/A	N/A	18 month expected life.

Design and Installation Specifications

Excavated Drop Inlet Protection

Excavated drop inlet protection consists of an excavated impoundment around the storm drain inlet. Sediment settles out of the stormwater prior to entering the storm drain. Design and installation specifications for excavated drop inlet protection include:

- Provide a depth of 1-2 ft as measured from the crest of the inlet structure.
- Slope sides of excavation should be no steeper than 2H:1V.
- Minimum volume of excavation is 35 cubic yards.
- Shape the excavation to fit the site, with the longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water.
- Clear the area of all debris.

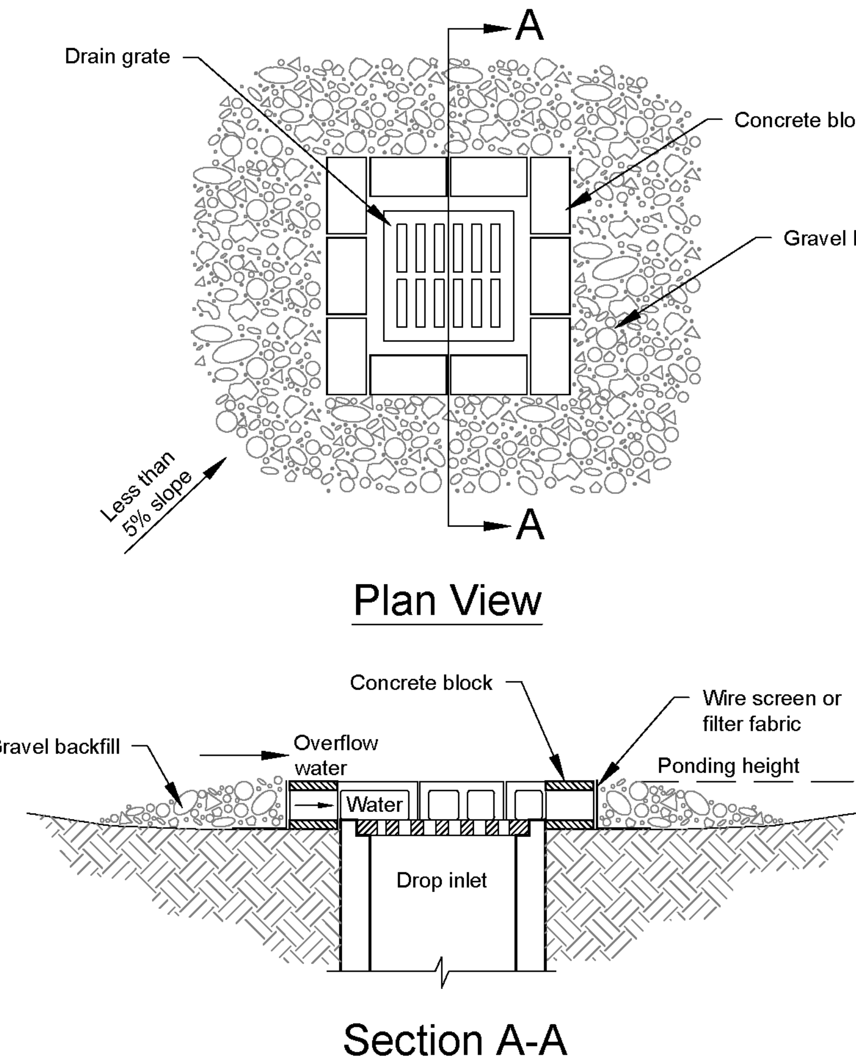
- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.
- Build a temporary dike, if necessary, to the down slope side of the structure to prevent bypass flow.

Block and Gravel Filter

A block and gravel filter is a barrier formed around the inlet with standard concrete blocks and gravel. See Figure II-3.17: Block and Gravel Filter. Design and installation specifications for block gravel filters include:

- Provide a height of 1 to 2 feet above the inlet.
- Recess the first row of blocks 2-inches into the ground for stability.
- Support subsequent courses by placing a pressure treated wood 2x4 through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side to allow for dewatering the pool.
- Place hardware cloth or comparable wire mesh with ½-inch openings over all block openings.
- Place gravel to just below the top of blocks on slopes of 2H:1V or flatter.
- An alternative design is a gravel berm surrounding the inlet, as follows:
  - Provide a slope of 3H:1V on the upstream side of the berm.
  - Provide a slope of 2H:1V on the downstream side of the berm.
  - Provide a 1-foot wide level stone area between the gravel berm and the inlet.
  - Use stones 3 inches in diameter or larger on the upstream slope of the berm.
  - Use gravel ½- to ¾-inch at a minimum thickness of 1-foot on the downstream slope of the berm.

Figure II-3.17: Block and Gravel Filter



Notes:

1. Drop inlet sediment barriers are to be used for small, nearly level drainage areas. (less than 5%)
2. Excavate a basin of sufficient size adjacent to the drop inlet.
3. The top of the structure (ponding height) must be well below the ground elevation downslope to prevent runoff from bypassing the inlet. A temporary dike may be necessary on the downslope side of the structure.

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Block and Gravel Filter

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Gravel and Wire Mesh Filter

Gravel and wire mesh filters are gravel barriers placed over the top of the inlet. This method does not provide an overflow. Design and installation specifications for gravel and wire mesh filters include:

- Use a hardware cloth or comparable wire mesh with ½-inch openings.
    - Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
    - Overlap the strips if more than one strip of mesh is necessary.
- Place coarse aggregate over the wire mesh.
    - Provide at least a 12-inch depth of aggregate over the entire inlet opening and extend at least 18-inches on all sides.

Catch Basin Filters

Catch basin filters are designed by manufacturers for construction sites. The limited sediment storage capacity increases the amount of inspection and maintenance required, which may be daily for heavy sediment loads. To reduce maintenance requirements, combine a catch basin filter with another type of inlet protection. This type of inlet protection provides flow bypass without overflow and therefore may be a better method for inlets located along active rights-of-way. Design and installation specifications for catch basin filters include:

- Provides 5 cubic feet of storage.
- Requires dewatering provisions.
- Provides a high-flow bypass that will not clog under normal use at a construction site.
- Insert the catch basin filter in the catch basin just below the grating.

Curb Inlet Protection with Wooden Weir

Curb inlet protection with wooden weir is an option that consists of a barrier formed around a curb inlet with a wooden frame and gravel. Design and installation specifications for curb inlet protection with wooden weirs include:

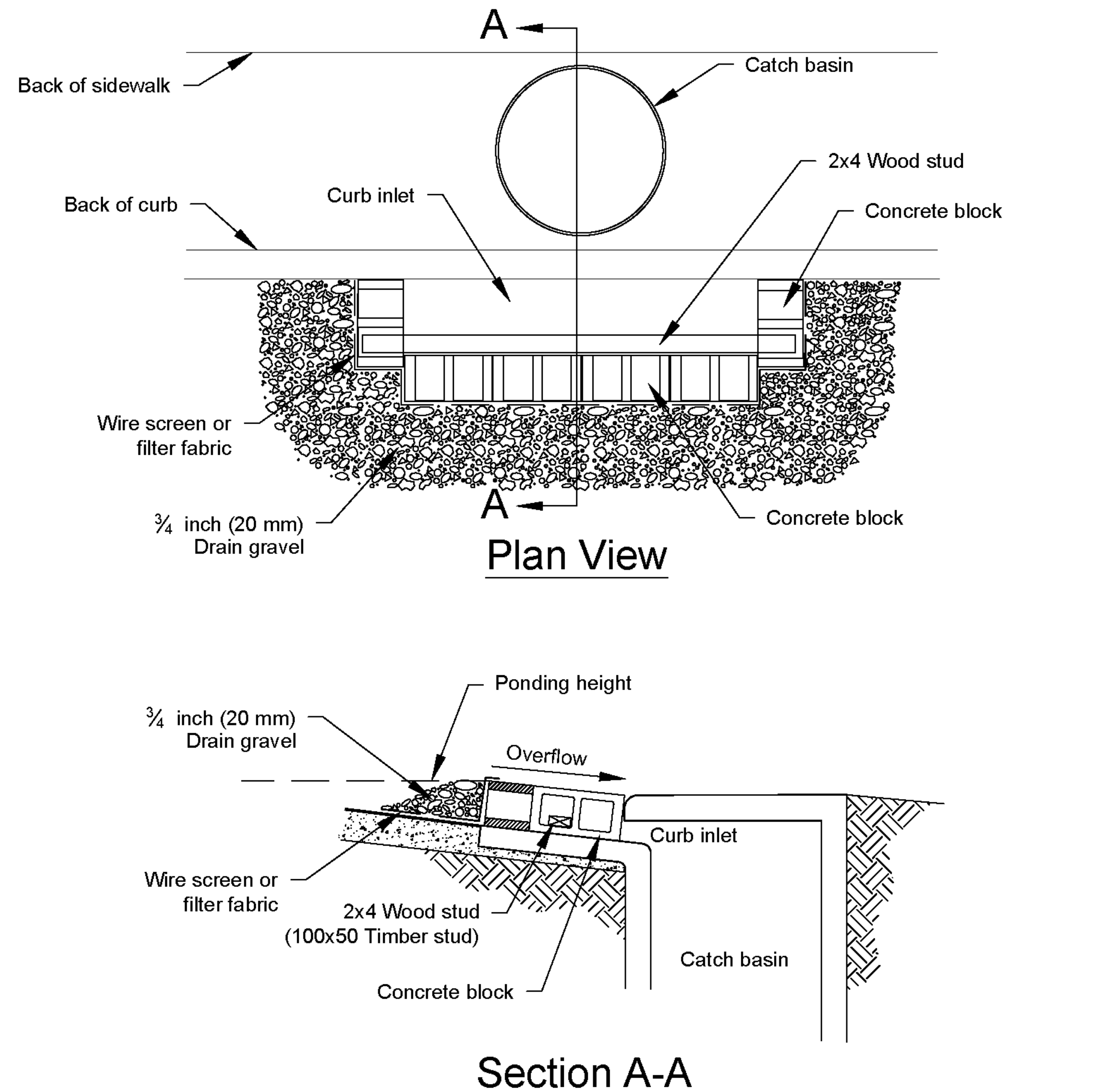
- Use wire mesh with ½-inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

Block and Gravel Curb Inlet Protection

Block and gravel curb inlet protection is a barrier formed around a curb inlet with concrete blocks and gravel. See Figure II-3.18: Block and Gravel Curb Inlet Protection. Design and installation specifications for block and gravel curb inlet protection include:

- Use wire mesh with ½-inch openings.
- Place two concrete blocks on their sides abutting the curb at either side of the inlet opening. These are spacer blocks.
- Place a 2x4 stud through the outer holes of each spacer block to align the front blocks.
- Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
- Place wire mesh over the outside vertical face.
- Pile coarse aggregate against the wire to the top of the barrier.

Figure II-3.18: Block and Gravel Curb Inlet Protection



Notes:

1. Use block and gravel type sediment barrier when curb inlet is located in gently sloping street segment, where water can pond and allow sediment to separate from runoff.
2. Barrier shall allow for overflow from severe storm event.
3. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

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Block and Gravel Curb Inlet Protection

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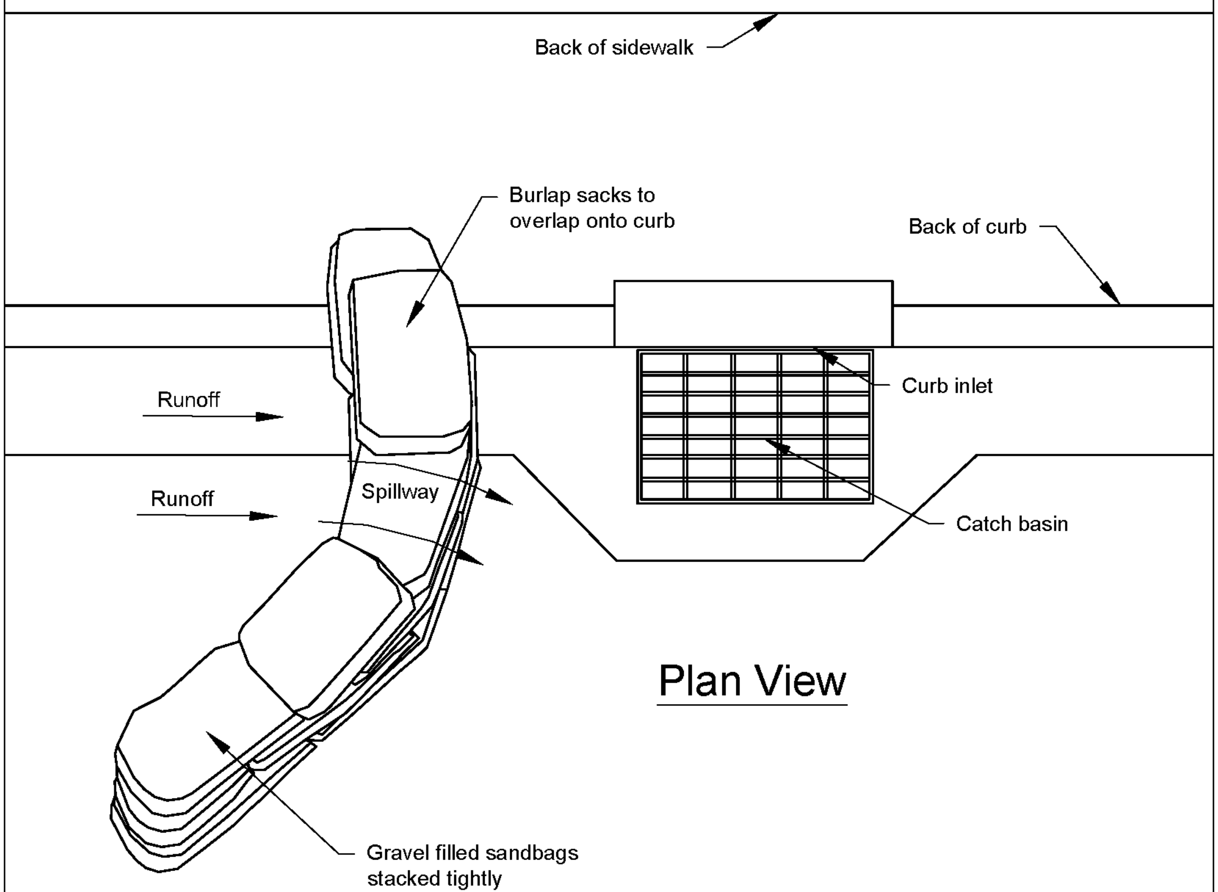
Curb and Gutter Sediment Barrier

Curb and gutter sediment barrier is a sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See Figure II-3.19: Curb and Gutter Barrier. Design and installation specifications for curb and gutter sediment barrier include:

- Construct a horseshoe shaped berm, faced with coarse aggregate if using riprap, 3 feet high and 3 feet wide, at least 2 feet from the inlet.
- Construct a horseshoe shaped sedimentation trap on the upstream side of the berm. Size the trap to sediment trap standards for protecting a culvert inlet.

Figure II-3.19: Curb and Gutter Barrier



Notes:

1. Place curb type sediment barriers on gently sloping street segments, where water can pond and allow sediment to separate from runoff.
2. Sandbags of either burlap or woven 'geotextile' fabric, are filled with gravel, layered and packed tightly.
3. Leave a one sandbag gap in the top row to provide a spillway for overflow.
4. Inspect barriers and remove sediment after each storm event. Sediment and gravel must be removed from the traveled way immediately.

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Curb and Gutter Barrier

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BMP C233: Silt Fence

Purpose

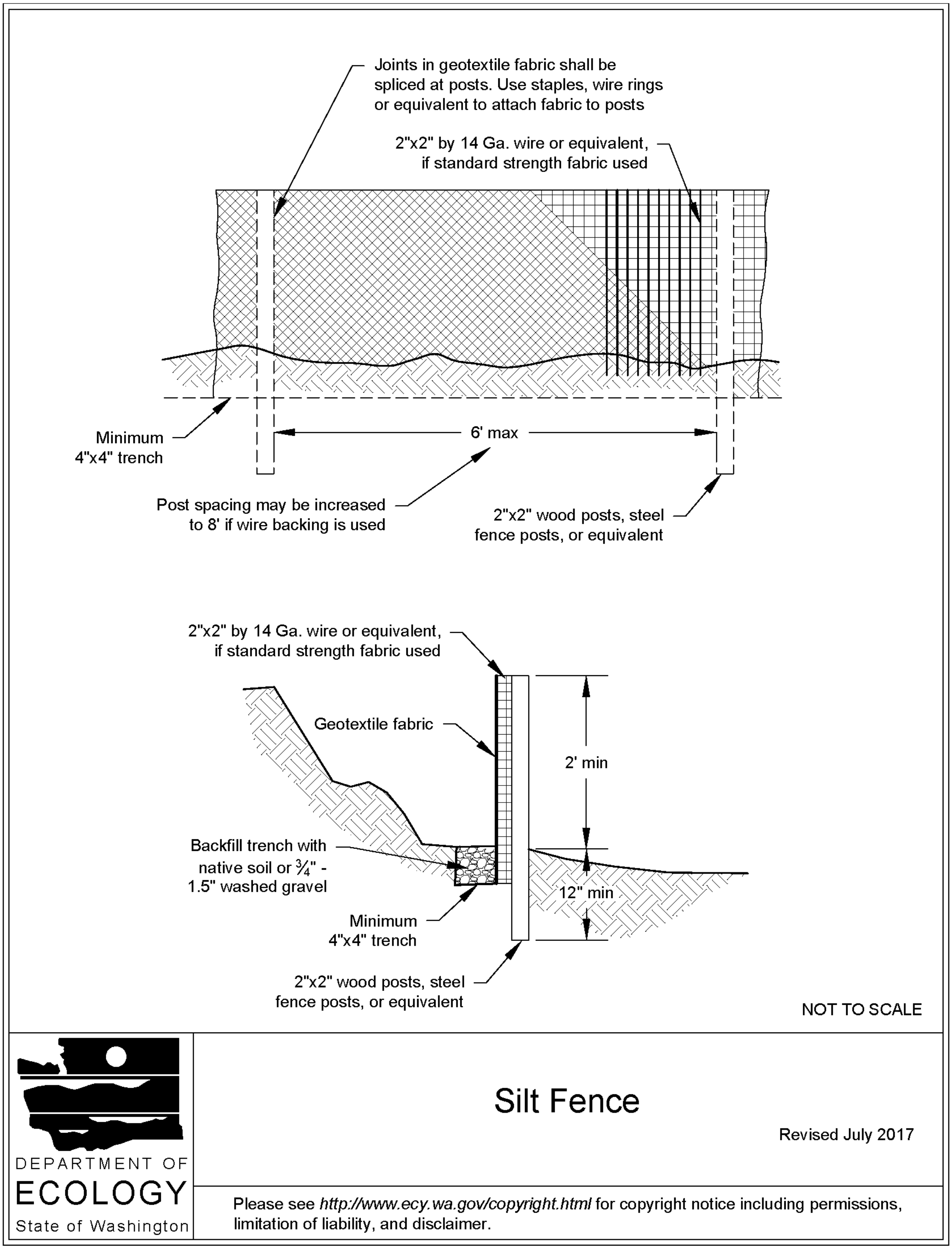
Silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

Silt fence may be used downslope of all disturbed areas.

- Silt fence shall prevent sediment carried by runoff from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Convey any concentrated flows through the drainage system to a sediment trapping BMP.
- Do not construct silt fences in streams or use in V-shaped ditches. Silt fences do not provide an adequate method of silt control for anything deeper than sheet or overland flow.

Figure II-3.22: Silt Fence



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Design and Installation Specifications

- Use in combination with other construction stormwater BMPs.
- Maximum slope steepness (perpendicular to the silt fence line) 1H:1V.
- Maximum sheet or overland flow path length to the silt fence of 100 feet.
- Do not allow flows greater than 0.5 cfs.
- Use geotextile fabric that meets the following standards. All geotextile properties listed below are minimum average roll values (i.e., the test result for any sampled roll in a lot shall meet or exceed the values shown in Table II-3.11: Geotextile Fabric Standards for Silt Fence):

Table II-3.11: Geotextile Fabric Standards for Silt Fence

Geotextile Property	Minimum Average Roll Value
Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for slit film woven (#30 sieve). 0.30 mm maximum for all other geotextile types (#50 sieve). 0.15 mm minimum for all fabric types (#100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec^{-1} minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. Minimum for extra strength fabric. 100 lbs minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

- Support standard strength geotextiles with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the geotextile. Silt fence materials are available that have synthetic mesh backing attached.
- Silt fence material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F.
- One-hundred percent biodegradable silt fence is available that is strong, long lasting, and can be left in place after the project is completed, if permitted by the local jurisdiction.
- Refer to Figure II-3.22: Silt Fence for standard silt fence details. Include the following Standard Notes for silt fence on construction plans and specifications:
  1. The Contractor shall install and maintain temporary silt fences at the locations shown in the Plans.
  2. Construct silt fences in areas of clearing, grading, or drainage prior to starting those activities.

3. The silt fence shall have a 2-feet min. and a 2½-feet max. height above the original ground surface.
4. The geotextile fabric shall be sewn together at the point of manufacture to form fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can be overlapped, provided that the overlap is long enough and that the adjacent silt fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.
5. Attach the geotextile fabric on the up-slope side of the posts and secure with staples, wire, or in accordance with the manufacturer's recommendations. Attach the geotextile fabric to the posts in a manner that reduces the potential for tearing.
6. Support the geotextile fabric with wire or plastic mesh, dependent on the properties of the geotextile selected for use. If wire or plastic mesh is used, fasten the mesh securely to the up-slope side of the posts with the geotextile fabric up-slope of the mesh.
7. Mesh support, if used, shall consist of steel wire with a maximum mesh spacing of 2-inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 lbs. grab tensile strength. The polymeric mesh must be as resistant to the same level of ultraviolet radiation as the geotextile fabric it supports.
8. Bury the bottom of the geotextile fabric 4-inches min. below the ground surface. Backfill and tamp soil in place over the buried portion of the geotextile fabric, so that no flow can pass beneath the silt fence and scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the ground 3-inches min.
9. Drive or place the silt fence posts into the ground 18-inches min. A 12–inch min. depth is allowed if topsoil or other soft subgrade soil is not present and 18-inches cannot be reached. Increase fence post min. depths by 6 inches if the fence is located on slopes of 3H:1V or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading.
10. Use wood, steel or equivalent posts. The spacing of the support posts shall be a maximum of 6-feet. Posts shall consist of either:
    - Wood with minimum dimensions of 2 inches by 2 inches by 3 feet. Wood shall be free of defects such as knots, splits, or gouges.
    - No. 6 steel rebar or larger.
    - ASTM A 120 steel pipe with a minimum diameter of 1-inch.
    - U, T, L, or C shape steel posts with a minimum weight of 1.35 lbs./ft.
    - Other steel posts having equivalent strength and bending resistance to the post sizes listed above.
11. Locate silt fences on contour as much as possible, except at the ends of the fence,

where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.

12. If the fence must cross contours, with the exception of the ends of the fence, place check dams perpendicular to the back of the fence to minimize concentrated flow and erosion. The slope of the fence line where contours must be crossed shall not be steeper than 3H:1V.

    - Check dams shall be approximately 1-foot deep at the back of the fence. Check dams shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence.

    - Check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. Check dams shall be located every 10 feet along the fence where the fence must cross contours.

- Refer to Figure II-3.23: Silt Fence Installation by Slicing Method for slicing method details. The following are specifications for silt fence installation using the slicing method:

    1. The base of both end posts must be at least 2- to 4-inches above the top of the geotextile fabric on the middle posts for ditch checks to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.

    2. Install posts 3- to 4-feet apart in critical retention areas and 6- to 7-feet apart in standard applications.

    3. Install posts 24-inches deep on the downstream side of the silt fence, and as close as possible to the geotextile fabric, enabling posts to support the geotextile fabric from upstream water pressure.

    4. Install posts with the nipples facing away from the geotextile fabric.

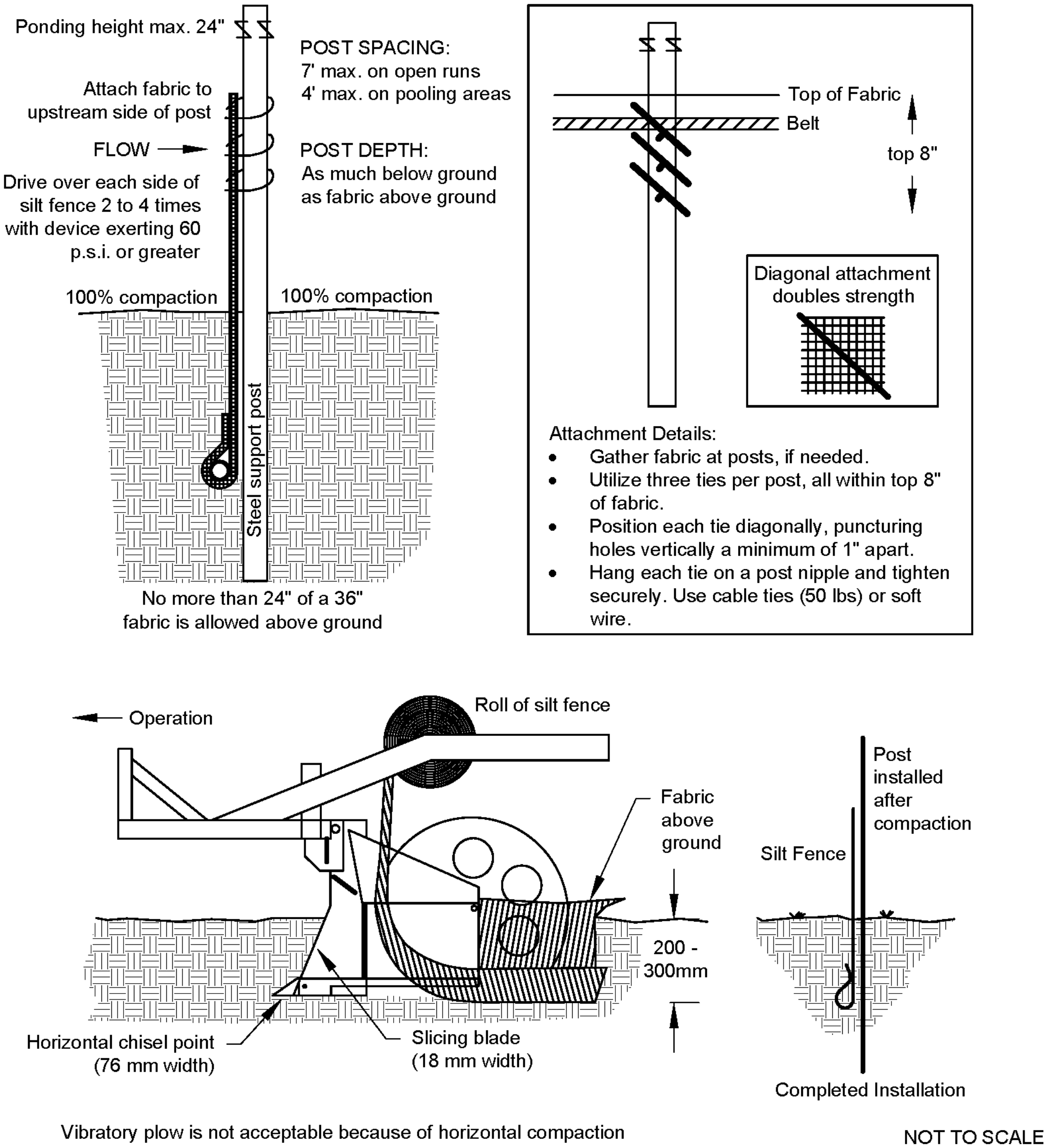
    5. Attach the geotextile fabric to each post with three ties, all spaced within the top 8-inches of the fabric. Attach each tie diagonally 45 degrees through the fabric, with each puncture at least 1-inch vertically apart. Each tie should be positioned to hang on a post nipple when tightening to prevent sagging.

    6. Wrap approximately 6-inches of the geotextile fabric around the end posts and secure with 3 ties.

    7. No more than 24-inches of a 36-inch geotextile fabric is allowed above ground level.

    8. Compact the soil immediately next to the geotextile fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of four trips. Check and correct the silt fence installation for any deviation before compaction. Use a flat-bladed shovel to tuck the fabric deeper into the ground if necessary.

Figure II-3.23: Silt Fence Installation by Slicing Method



DEPARTMENT OF ECOLOGY State of Washington

Silt Fence Installation by Slicing Method

Revised June 2016

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Maintenance Standards

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment trapping BMP.
- Check the uphill side of the silt fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence and remove the trapped sediment.
- Remove sediment deposits when the deposit reaches approximately one-third the height of the silt fence, or install a second silt fence.
- Replace geotextile fabric that has deteriorated due to ultraviolet breakdown.

BMP C234: Vegetated Strip

Purpose

Vegetated strips reduce the transport of coarse sediment from a construction site by providing a physical barrier to sediment and reducing the runoff velocities of overland flow.

Conditions of Use

- Vegetated strips may be used downslope of all disturbed areas.
- Vegetated strips are not intended to treat concentrated flows, nor are they intended to treat substantial amounts of overland flow. Any concentrated flows must be conveyed through the drainage system to BMP C241: Sediment Pond (Temporary) or other sediment trapping BMP. The only circumstance in which overland flow can be treated solely by a vegetated strip, rather than by a sediment trapping BMP, is when the following criteria are met (see Table II-3.12: Contributing Drainage Area for Vegetated Strips):

Table II-3.12: Contributing Drainage Area for Vegetated Strips

Average Contributing Area Slope	Average Contributing Area Percent Slope	Max Contributing area Flowpath Length
1.5H : 1V or flatter	67% or flatter	100 feet
2H : 1V or flatter	50% or flatter	115 feet
4H : 1V or flatter	25% or flatter	150 feet
6H : 1V or flatter	16.7% or flatter	200 feet
10H : 1V or flatter	10% or flatter	250 feet

Design and Installation Specifications

- The vegetated strip shall consist of a continuous strip of dense vegetation with topsoil for a minimum of a 25-foot length along the flowpath. Grass-covered, landscaped areas are generally not adequate because the volume of sediment overwhelms the grass. Ideally, vegetated strips shall consist of undisturbed native growth with a well-developed soil that allows for infiltration of runoff.
- The slope within the vegetated strip shall not exceed 4H:1V.
- The uphill boundary of the vegetated strip shall be delineated with clearing limits.

Maintenance Standards

- Any areas damaged by erosion or construction activity shall be seeded immediately and protected by mulch.
- If more than 5 feet of the original vegetated strip width has had vegetation removed or is being eroded, sod must be installed.
- If there are indications that concentrated flows are traveling across the vegetated strip, stormwater runoff controls must be installed to reduce the flows entering the vegetated strip, or additional perimeter protection must be installed.

BMP C235: Wattles

Purpose

Wattles are temporary erosion and sediment control barriers consisting of straw, compost, or other material that is wrapped in netting made of natural plant fiber or similar encasing material. They reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment.

Conditions of Use

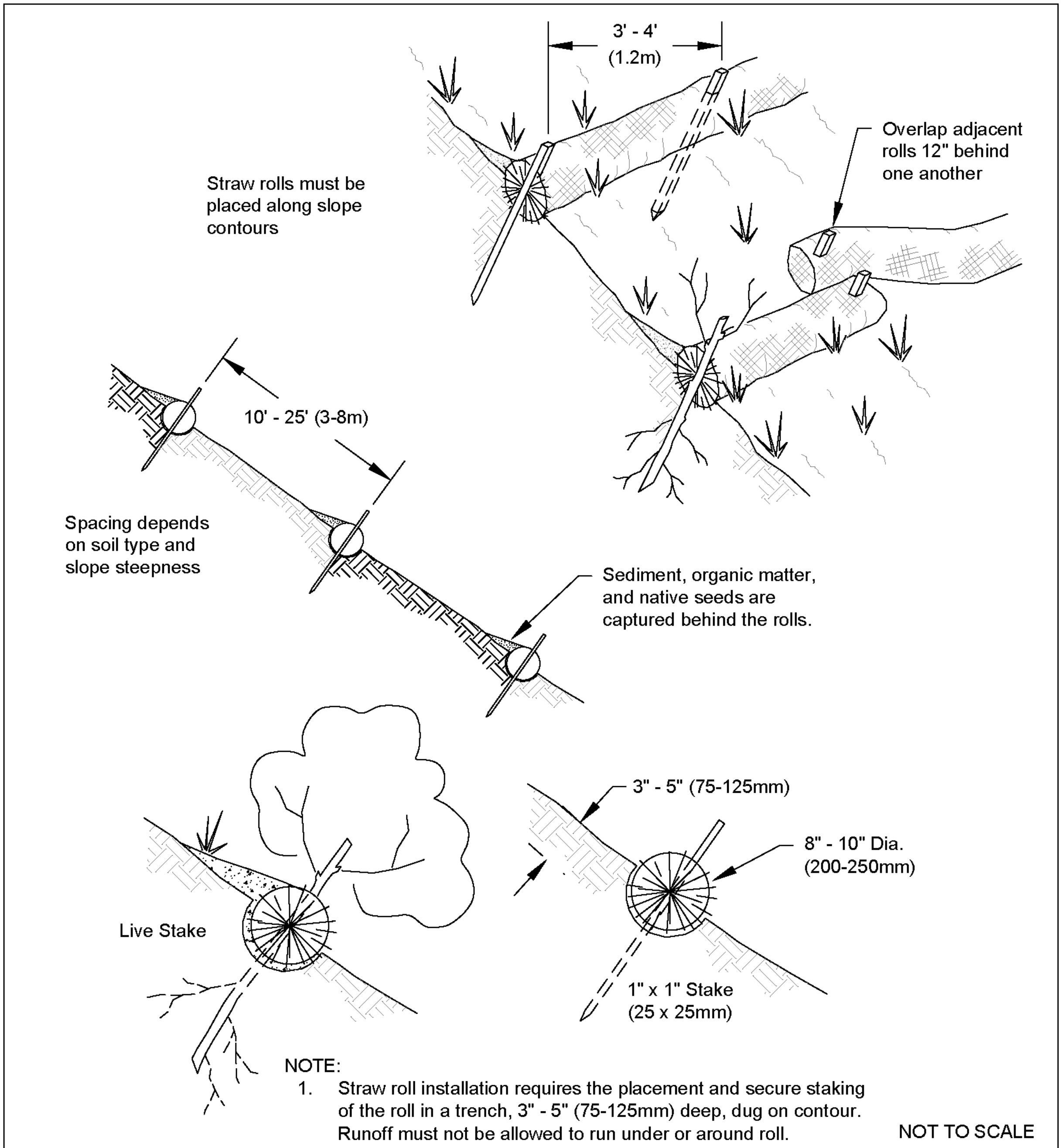
- Wattles shall consist of cylinders of plant material such as weed-free straw, coir, wood chips, excelsior, or wood fiber or shavings encased within netting made of natural plant fibers unaltered by synthetic materials.
- Use wattles:
  - In disturbed areas that require immediate erosion protection.
  - On exposed soils during the period of short construction delays, or over winter months.
  - On slopes requiring stabilization until permanent vegetation can be established.
- The material used dictates the effectiveness period of the wattle. Generally, wattles are effective for one to two seasons.

- Prevent rilling beneath wattles by entrenching and overlapping wattles to prevent water from passing between them.

Design Criteria

- See Figure II-3.24: Wattles for typical construction details.
- Wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length.
- Install wattles perpendicular to the flow direction and parallel to the slope contour.
- Place wattles in shallow trenches, staked along the contour of disturbed or newly constructed slopes. Dig narrow trenches across the slope (on contour) to a depth of 3- to 5-inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, the trenches should be dug to a depth of 5- to 7- inches, or 1/2 to 2/3 of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Spread excavated material evenly along the uphill slope and compact it using hand tamping or other methods.
- Construct trenches at intervals of 10- to 25-feet depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the trenches.
- Install the wattles snugly into the trenches and overlap the ends of adjacent wattles 12 inches behind one another.
- Install stakes at each end of the wattle, and at 4-foot centers along entire length of wattle.
- If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.
- Wooden stakes should be approximately 0.75 x 0.75 x 24 inches min. Willow cuttings or 3/8-inch rebar can also be used for stakes.
- Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.

Figure II-3.24: Wattles



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State of Washington

Wattles

Revised December 2016

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Maintenance Standards

- Wattles may require maintenance to ensure they are in contact with soil and thoroughly entrenched, especially after significant rainfall on steep sandy soils.
- Inspect the slope after significant storms and repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

Approved as Functionally Equivalent

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

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

BMP C236: Vegetative Filtration

Purpose

Vegetative filtration as a BMP is used in conjunction with detention storage in the form of portable tanks or BMP C241: Sediment Pond (Temporary), BMP C206: Level Spreader, and a pumping system with surface intake. Vegetative filtration improves turbidity levels of stormwater discharges by filtering runoff through existing vegetation where undisturbed forest floor duff layer or established lawn with thatch layer are present. Vegetative filtration can also be used to infiltrate dewatering waste from foundations, vaults, and trenches as long as runoff does not occur.

Conditions of Use

- For every five acres of disturbed soil use one acre of grass field, farm pasture, or wooded area. Reduce or increase this area depending on project size, ground water table height, and other site conditions.
- Wetlands shall not be used for vegetative filtration.
- Do not use this BMP in areas with a high ground water table, or in areas that will have a high seasonal ground water table during the use of this BMP.
- This BMP may be less effective on soils that prevent the infiltration of the water, such as hard till.
- Using other effective source control measures throughout a construction site will prevent the generation of additional highly turbid water and may reduce the time period or area need for this BMP.
- Stop distributing water into the vegetated filtration area if standing water or erosion results.

- On large projects that phase the clearing of the site, areas retained with native vegetation may be used as a temporary vegetative filtration area.

Design Criteria

- Find land adjacent to the project site that has a vegetated field, preferably a farm field, or wooded area.
- If the site does not contain enough vegetated field area consider obtaining permission from adjacent landowners (especially for farm fields).
- Install a pump and downstream distribution manifold depending on the project size. Generally, the main distribution line should reach 100 to 200-feet long (large projects, or projects on tight soil, will require systems that reach several thousand feet long with numerous branch lines off of the main distribution line).
- The manifold should have several valves, allowing for control over the distribution area in the field.
- Install several branches of 4-inch diameter schedule 20 polyvinyl chloride (PVC), swaged-fit common septic tight-lined sewer line, or 6-inch diameter fire hose, which can convey the turbid water out to various sections of the field. See Figure II-3.25: Manifold and Branches in a Wooded, Vegetated Spray Field.
- Determine the branch length based on the field area geography and number of branches. Typically, branches stretch from 200-feet to several thousand feet. Lay the branches on contour with the slope.
- On uneven ground, sprinklers perform well. Space sprinkler heads so that spray patterns do not overlap.
- On relatively even surfaces, a level spreader using 4-inch perforated pipe may be used as an alternative option to the sprinkler head setup. Install drain pipe at the highest point on the field and at various lower elevations to ensure full coverage of the filtration area. Place the pipe with the holes up to allow for gentle weeping evenly out all holes. Leveling the pipe by staking and using sandbags may be required.
- To prevent over saturating of the vegetative filtration area, rotate the use of branches or spray heads. Repeat as needed based on monitoring the spray field.

Table II-3.13: Flowpath Guidelines for Vegetative Filtration

Average Slope	Average Area % Slope	Estimated Flowpath Length (ft)
1.5H:1V	67%	250
2H:1V	50%	200
4H:1V	25%	150
6H:1V	16.7%	115
10H:1V	10%	100

Figure II-3.25: Manifold and Branches in a Wooded, Vegetated Spray Field

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Manifold and Branches in a Wooded, Vegetated Spray Field

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Maintenance Standards

- Monitor the spray field on a daily basis to ensure that over saturation of any portion of the field doesn't occur at any time. The presence of standing puddles of water or creation of concentrated flows visually signify that over saturation of the field has occurred.
- Monitor the vegetated spray field all the way down to the nearest surface water, or farthest spray area, to ensure that the water has not caused overland or concentrated flows, and has not created erosion around the spray nozzle(s).
- Do not exceed water quality standards for turbidity.
- Ecology recommends that a separate inspection log be developed, maintained and kept with the existing site logbook to aid the operator conducting inspections. This separate "Field Filtration Logbook" can also aid in demonstrating compliance with permit conditions.
- Inspect the spray nozzles daily, at a minimum, for leaks and plugging from sediment particles.
- If erosion, concentrated flows, or over saturation of the field occurs, rotate the use of branches or spray heads or move the branches to a new field location.
- Check all branches and the manifold for unintended leaks.

BMP C240: Sediment Trap

Purpose

A sediment trap is a small temporary ponding area with a gravel outlet used to collect and store sediment from sites during construction. Sediment traps, along with other perimeter controls, shall be installed before any land disturbance takes place in the drainage area.

Conditions of Use

- Sediment traps are intended for use on sites where the tributary drainage area is less than 3 acres, with no unusual drainage features, and a projected build-out time of six months or less. The sediment trap is a temporary measure (with a design life of approximately 6 months) and shall be maintained until the tributary area is permanently protected against erosion by vegetation and/or structures.
- Sediment traps are only effective in removing sediment down to about the medium silt size fraction. Runoff with sediment of finer grades (fine silt and clay) will pass through untreated, emphasizing the need to control erosion to the maximum extent first.
- Projects that are constructing permanent Flow Control BMPs, or Runoff Treatment BMPs that use ponding for treatment, may use the rough-graded or final-graded permanent BMP footprint for the temporary sediment trap. When permanent BMP footprints are used as temporary sediment traps, the surface area requirement of the sediment trap must be met. If the surface area requirement of the sediment trap is larger than the surface area of the permanent BMP, then the sediment trap shall be enlarged beyond the permanent BMP footprint to comply with the surface area requirement.

- A floating pond skimmer may be used for the sediment trap outlet if approved by the Local Permitting Authority.
- Sediment traps may not be feasible on utility projects due to the limited work space or the short-term nature of the work. Portable tanks may be used in place of sediment traps for utility projects.

Design and Installation Specifications

- See Figure II-3.26: Cross Section of Sediment Trap and Figure II-3.27: Sediment Trap Outlet for details.
- To determine the sediment trap geometry, first calculate the design surface area (SA) of the trap, measured at the invert of the weir. Use the following equation:

  $$SA = FS(Q_2/V_s)$$

  where

  Q_2 =

  - Option 1 - Single Event Hydrograph Method:

    Q_2 = Peak volumetric flow rate calculated using a 10-minute time step from a Type 1A, 2-year, 24-hour frequency storm for the developed condition. The 10-year peak volumetric flow rate shall be used if the project size, expected timing and duration of construction, or downstream conditions warrant a higher level of protection.
  - Option 2 - For construction sites that are less than 1 acre, the Rational Method may be used to determine Q_2.

  V_s = The settling velocity of the soil particle of interest. The 0.02 mm (medium silt) particle with an assumed density of 2.65 g/cm3 has been selected as the particle of interest and has a settling velocity (Vs) of 0.00096 ft/sec.

  FS = A safety factor of 2 to account for non-ideal settling.

  Therefore, the equation for computing sediment trap surface area becomes:

  $$SA = 2 \times Q_2/0.00096$$

  or

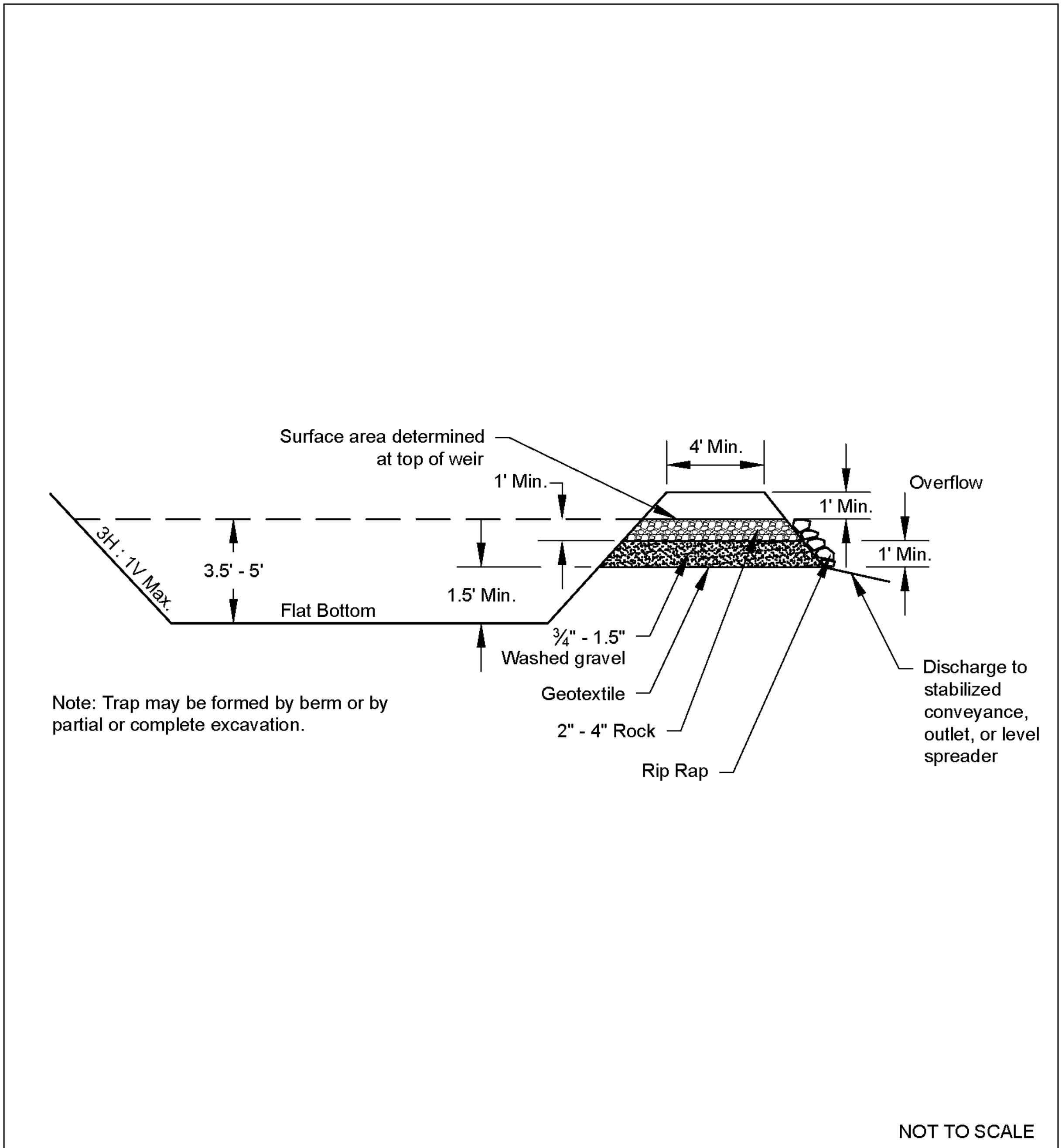
  2080 square feet per cfs of inflow
- Sediment trap depth shall be 3.5 feet minimum from the bottom of the trap to the top of the overflow weir.
- To aid in determining sediment depth, all sediment traps shall have a staff gauge with a prominent mark 1-foot above the bottom of the trap.

- Design the discharge from the sediment trap by using the guidance for discharge from temporary sediment ponds in BMP C241: Sediment Pond (Temporary).

Maintenance Standards

- Sediment shall be removed from the trap when it reaches 1-foot in depth.
- Any damage to the trap embankments or slopes shall be repaired.

Figure II-3.26: Cross Section of Sediment Trap



Cross Section of Sediment Trap

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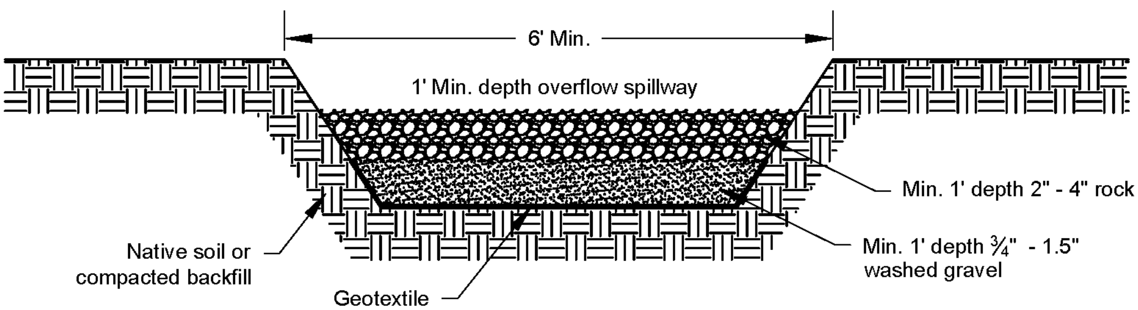
Figure II-3.27: Sediment Trap Outlet



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Sediment Trap Outlet

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Appendix C
Site Inspection Form

Construction Stormwater Site Inspection Form

Project Name ____________ Permit # ____________ Inspection Date ____________ Time ________

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

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

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

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

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

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

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

C. Questions:

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

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

____

____

____

____

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

Sampling Results: Date: ______________________

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

Construction Stormwater Site Inspection Form

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

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

Construction Stormwater Site Inspection Form

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

Construction Stormwater Site Inspection Form

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

E. Check all areas that have been inspected. ✔

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

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

Element #	Description and Location	Action Required	Completion Date	Initials

Attach additional page if needed

<u>Sign the following certification:</u>

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

Inspected by: (print) ______________________ (Signature) ____________________________ Date: ________________

Title/Qualification of Inspector: ____

Appendix D Engineering Calculations

SEDIMENT POND SIZING CALCULATIONS

Project Name:	Arco Puyallup	**Date:**	01/12/24
Street Location:	1402 South Meridian	**Our Job No.:**	21730
Municipality:	Puyallup		
Engineer:	James Fleharty		

$$SA = 2 \text{ x } Q_2/0.00096$$

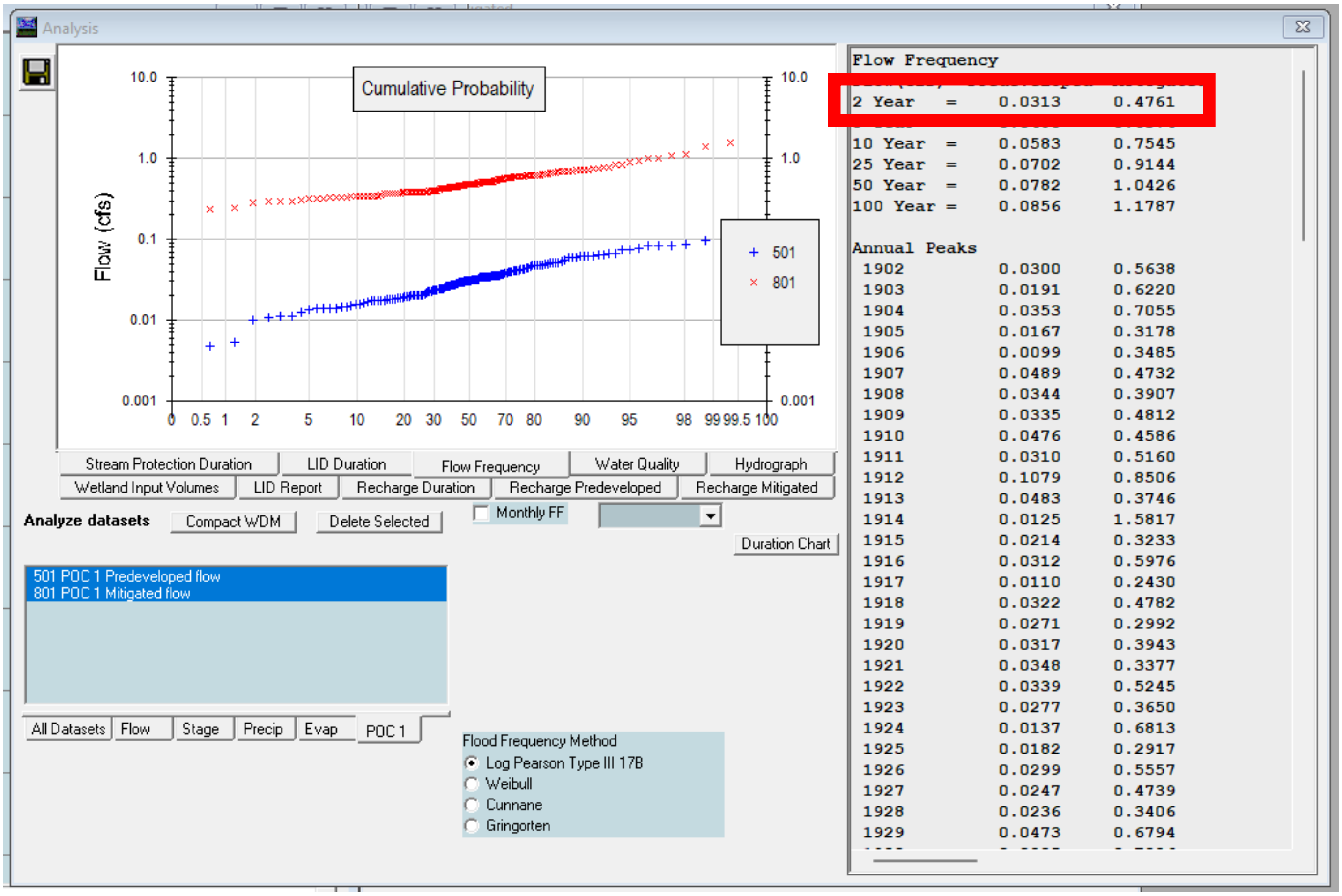
OR

2,080 square feet per cubic feet per second of inflow

FS =	2		
Q_2 =	0.4761	cfs	WWHM
V_S =	0.00096	ft/s	
SA =	991.88	ft^2	

Minimum Area of Sediment Trap = 1,000 ft^2

Analysis


Analysis
Cumulative Probability
Flow (cfs)
10.0
1.0
0.1
0.01
0.001
0 0.5 1 2 5 10 20 30 50 70 80 90 95 98 99 99.5 100
501
801
Stream Protection Duration
LID Duration
Flow Frequency
Water Quality
Hydrograph
Wetland Input Volumes
LID Report
Recharge Duration
Recharge Predeveloped
Recharge Mitigated
Analyze datasets
Compact WDM
Delete Selected
Monthly FF
Duration Chart
501 POC 1 Predeveloped flow
801 POC 1 Mitigated flow
All Datasets
Flow
Stage
Precip
Evap
POC 1
Flood Frequency Method
Log Pearson Type III 17B
Weibull
Cunnane
Gringorten
Flow Frequency
2 Year = 0.0313 0.4761
10 Year = 0.0583 0.7545
25 Year = 0.0702 0.9144
50 Year = 0.0782 1.0426
100 Year = 0.0856 1.1787
Annual Peaks
1902 0.0300 0.5638
1903 0.0191 0.6220
1904 0.0353 0.7055
1905 0.0167 0.3178
1906 0.0099 0.3485
1907 0.0489 0.4732
1908 0.0344 0.3907
1909 0.0335 0.4812
1910 0.0476 0.4586
1911 0.0310 0.5160
1912 0.1079 0.8506
1913 0.0483 0.3746
1914 0.0125 1.5817
1915 0.0214 0.3233
1916 0.0312 0.5976
1917 0.0110 0.2430
1918 0.0322 0.4782
1919 0.0271 0.2992
1920 0.0317 0.3943
1921 0.0348 0.3377
1922 0.0339 0.5245
1923 0.0277 0.3650
1924 0.0137 0.6813
1925 0.0182 0.2917
1926 0.0299 0.5557
1927 0.0247 0.4739
1928 0.0236 0.3406
1929 0.0473 0.6794

	Temp. Swale Calc.	
Q_WWHM	0.4761 cfs	(From WWHM)
Manning n	0.02	Bare Soil
Area, A	7.5 ft2	Area of A Trapezoid
Hydraulic Radius, R	1 ft2	Assumed Full Flow therefore R = 1
Slope	0.005 ft/ft	
Q_Max	39.50959 cfs	

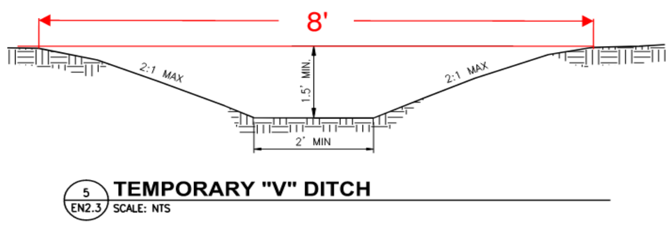
Manning's Equation:

$$Q = VA = \left(\frac{1.49}{n}\right) A R^{\frac{2}{3}} \sqrt{S} \quad [U.S.]$$

$$Q = VA = \left(\frac{1.00}{n}\right) A R^{\frac{2}{3}} \sqrt{S} \quad [SI]$$

Where:

Q = Flow Rate, (ft^3/s)
v = Velocity, (ft/s)
A = Flow Area, (ft^2)
n = Manning's Roughness Coefficient
R = Hydraulic Radius, (ft)
S = Channel Slope, (ft/ft)



Base	2 ft	
Hieght	1.5 ft	
Base	8 ft	
Q_WWHM	<	Q_MAX

Tab 7.0

7.0 SPECIAL REPORTS AND STUDIES

The Geotechnical Engineering Investigation by Krazan & Associates, Inc, dated May 6, 2022, has been provided within this report; see Figure 7.1.

Figure 7.1 Geotchnical Engineering Investigation prepared by Krazan & Associates, Inc. dated May 6, 2022

Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED ARCO AMPM FUELING FACILITY
1402 S MERIDIAN AVENUE
PUYALLUP, WASHINGTON

PROJECT NO. 062-22010
MAY 6, 2022

Prepared for:

BP PRODUCTS NORTH AMERICA, INC.
30 SOUTH WACKER DRIVE, SUITE 900
CHICAGO, IL 60606

Prepared by:

KRAZAN & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING DIVISION
825 CENTER STREET, STE A
TACOMA, WASHINGTON 98409
(253) 939-2500

May 6, 2022 KA Project No. 062-22010

BP Products North America Inc.
30 South Wacker Drive, Suite 900
Chicago, IL 60606

Attn: Mr. Randall Arnold
Email: randall.arnold@sevansolutions.com
Tel: (206) 310.1851

Reference: Geotechnical Engineering Investigation
Proposed ARCO ampm Fueling Facility
1402 S Meridian Avenue
Puyallup, WA

Dear Mr. Arnold,

In accordance with your request, we have completed a Geotechnical Engineering Investigation for the referenced site. The results of our investigation are presented in the attached report.

If you have any questions, or if we can be of further assistance, please do not hesitate to contact our office.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Theresa R. Nunan

Theresa R. Nunan
Project Manager

Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

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May 6, 2022 KA Project No. 062-22010

GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED ARCO AMPM FUELING FACILITY
1402 S MERIDIAN AVENUE
PUYALLUP, WASHINGTON

INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the Proposed ARCO ampm Fueling Facility located at 1402 S Meridian Avenue in Puyallup, Washington, as shown on the Vicinity Map in Figure 1. Discussions regarding site conditions are presented in this report, together with conclusions and recommendations pertaining to site preparation, excavations, foundations, structural fill, utility trench backfill, concrete slabs and exterior flatwork, drainage, erosion control, and pavements.

A site plan showing the approximate locations of the test pits is presented following the text of this report in Figure 2. A description of the field investigation and laboratory testing, as well as the test pit and Cone Penetration Test (CPT) logs, are presented in Appendix A. Appendix B contains a guide to aid in the development of earthwork specifications. Pavement design guidelines are presented in Appendix C. The recommendations in the main text of the report have precedence over the more general specifications in the appendices.

PURPOSE AND SCOPE

This investigation was conducted to evaluate the subsurface soil and groundwater conditions at the site, to develop geotechnical engineering recommendations for use in design of specific construction elements, and to provide criteria for site preparation and earthwork construction.

Our scope of services for this project was performed in general accordance with our proposal number G22018WAT dated March 24, 2022, and included the following:

- Exploration of the subsurface soil and groundwater conditions by conducting six (6) CPT borings to depths of about 27.0 to 46.3 feet below existing ground surface (bgs)using subcontracted rig and operator under the direction of a Krazan geotechnical engineer;

- Conduct two (2) small-scale Pilot Infiltration Tests (PITs), utilizing a subcontracted excavator and operator to dig the test pits and a rented water wagon for the water source;

- A Site Plan showing the CPT and PIT locations;

- Comprehensive CPT and test pit logs, including soil stratification and classification, and groundwater levels where applicable;

- Conduct laboratory testing on samples obtained from the explorations;
- Liquefaction analysis based on the data acquired from the CPTs;
- Recommendations for seismic design considerations including site coefficient and ground acceleration based on the 2018 IBC assuming that the structure will have a fundamental period of vibration equal to or less than 0.5 sec or if non-liquefiable soils are encountered in our explorations;
- Provide opinions and recommendations regarding stormwater infiltration feasibility and a design infiltration rate as per the 2014 Department of Ecology (DOE) Stormwater Management Manual for Western Washington (SWMMWW);
- Evaluation of the two (2) City of Puyallup mapped "landslide hazard" areas indicated on the Preliminary Site Plan, prepared by Barghausen Consulting Engineers, Inc. (Barghausen) dated July 8, 2021;
- Shallow foundation recommendations for the proposed structure, including allowable soil bearing pressure, anticipated settlements (both total and differential), coefficient of horizontal friction for footing design, and frost penetration depth;
- Deep foundation recommendations, if applicable based on the subsurface conditions encountered in the CPTs;
- Recommendations for design of slabs-on-grade, as well as subgrade preparation, slab drainage, capillary break, and/or moisture barriers;
- Recommendations for static and seismic active and passive lateral earth pressures for below grade and retaining structures, including surcharge loadings;
- Recommendations for structural fill materials, placement, and compaction;
- Recommendations for suitability of onsite soils as structural fill;
- Recommendations for temporary excavations including shoring;
- Recommendations for site drainage and erosion control; and
- Recommendations for asphalt and concrete pavement sections, including subgrade preparation recommendations for truck loading and pavement areas.

Environmental services, such as chemical analysis of soil and groundwater for possible environmental contaminants, were not included in our geotechnical engineering scope of services for this project.

PROPOSED CONSTRUCTION

Based on the Preliminary Site Plan, Sheet SP-5, dated July 8, 2021, and the Request for Proposal (RFP) for Geotechnical Services document dated March 10, 2022, which were prepared by Barghausen, we understand that the proposed development will include construction of a 3,349 square foot, single-story ampm building at the northern end of the site, a canopy fuel island structure with eight multi-product dispensers (MPDs) in the middle of the site, with underground storage tanks planned south of the fuel island, and a 24-foot by 28-foot car wash structure located at the southern end of the site. Other site improvements include paved access drives and parking areas, paved entry driveways from S Meridian Avenue, landscaped areas, and installation of associated utilities.

We understand a typical dead load reaction of 4 kips and live load reaction of 16 kips is anticipated for each canopy column, and independent pier foundations at each column are preferred for support of the canopy structure. Although no loading information was provided for the ampm building or the carwash structure, we have assumed typical column and wall loads for these structures will not exceed 30 kips and 3 kips per lineal foot, respectively, for our soil bearing capacity and settlement analyses. We have also assumed that the existing site grades are at or within a foot of the planned finish grades.

SITE LOCATION AND DESCRIPTION

The subject property consists of four parcels (APNs 770000021, -31, -281, and -288) that encompass 1.18 acres of land located at 1402 S Meridian Avenue in Puyallup. The site is bordered by Highway 512 to the north, and entry drive and commercial development to the south, S Meridian Avenue to the east, and commercial development and Highway 512 to the west. Historical aerial photos indicate the site was agricultural farmland from at least 1940 to around the mid-70's. The existing one-story restaurant building was constructed in 1976 based on parcel information presented on the Pierce County Parcel and Property Information web portal. The remainder of the site is asphalt paved parking areas and access drives, with the exception of the northernmost portion of the site which served as gravel surfaced overflow parking. Numerous underground utilities are located within the site, and especially within the utility corridor transecting the southern half of the gravel-surfaced lot in an east-west direction.

We have reviewed the Land Title Survey, prepared by Barghausen, dated April 19, 2022. The site is relatively level with the ground surface generally sloping east to west, and ranging from Elev. 47 to 49 feet. The land surrounding the general vicinity of the site is generally higher in elevation and slopes towards the project site. There is an isolated slope in the southeast corner of the site, at the access drive to the site from S Meridian Ave., which is roughly 8 feet in height and has an inclination of about 30 degrees (58 percent). This slope is partially supported by stacked rock boulders that showed signs of erosion and instability. There is another isolated slope near the northwestern property line (outside the site boundary, Highway 512 off-ramp embankment), which is roughly 7 feet in height and has an inclination of about 14 degrees (25 percent). Signs of significant erosion or slope instability were not observed along the northwestern slope during our site visit. A drainage ditch is situated between Hwy 512 and the northern side of the site. Water was observed over a portion of this drainage ditch to a depth of 1-foot or less during our field work on March 28, 2022.

Two existing monitoring wells were observed on the property. One monitoring well is located within the northeastern portion of the gravel lot, and a second monitoring well (DOE # BJI 189) is located in the paved parking area south of the existing building.

GEOLOGIC SETTING

The site lies within the Puget Lowland, a north-south trending depression bounded by the Cascade Mountain Range in the east, and the Olympic Mountains in the west. The surficial geology of the Puget Lowland has been shaped by glacial activity that deposited sediments during numerous cycles of advance and retreat over the past 2 million years.

The Washington Department of Natural Resources (DNR) Geologic Information Portal website indicates that the property is located in an area that is predominantly underlain by Quaternary alluvium (Qa) consisting of “unconsolidated or semiconsolidated alluvial clay, silt, sand, gravel, and (or) cobble deposits; locally includes peat, muck, and diatomite”. The southern portion of the site, extending south from about the southern side of the existing restaurant building, is mapped as Continental Glacial Drift (Qgd) consisting of “till and outwash clay, silt, sand, gravel, cobbles, and boulders deposited or originating from continental glaciers; locally includes peat, nonglacial sediments, modified land, and artificial fill”.

FIELD INVESTIGATION

Six (6) Cone Penetration Tests (CPTs) were completed to evaluate the subsurface soil and groundwater conditions at the project location. The CPTs were conducted on March 30, 2022, using a subcontracted test rig and operator under the direction of a Krazan geotechnical engineer. The CPTs, designated CPT-1 through CPT-5 and CPT-2B, were advanced to depths of 27.0 to 46.3 feet bgs. The CPT method consists of pushing an instrumented cone into the ground at a controlled rate and recording measured soil parameters, such as tip resistance, friction ration, and pore pressure. In addition, shear wave testing was also conducted every 3 feet in CPT-2B, CPT-4, and CPT-5. These measured parameters are used to determine geotechnical engineering properties of the soils encountered and to delineate soil stratigraphy, particularly for use with seismic and liquefaction analyses, and to develop seismic design parameters. Soil samples are not obtained with cone penetration testing.

Infiltration Testing: Two infiltration test pits, designated IP-1 and IP-2, were excavated at the site on March 28, 2022, at the locations indicated on the Site Plan, Figure 2, to conduct small scale PITs. Test pits IP-1 and IP-2 were excavated to depths of 7.1 and 4.7 feet bgs and to a bottom area of 18.5 and 13.0 sf, respectively. The subsurface soil and groundwater conditions encountered in the test pits are described in the following section of this report. Based on the subsurface conditions encountered, infiltration testing was not conducted in the test pits or at any other location on the site.

A detailed description of the field investigation is presented in Appendix A. The logs for the CPTs depict soil stratigraphy based on published correlations of the measured cone tip resistance and side friction with soil types. The test pit and CPT logs are also included in Appendix A. The approximate locations of the test pits and CPTs are shown on the Site Plan in Figure 2.

SOIL PROFILE AND SUBSURFACE CONDITIONS

Our field investigation exposed undocumented fill underlain by native alluvial and glacial soil deposits to the termination depths of the test pits and CPT explorations. The relative density and/or consistency of the soils described below are based on either observation of the excavation effort of the equipment used to conduct the test pits, or on the measured tip resistances of the cone for the CPTs.

Asphalt Pavement and Undocumented Fill: CPT-4, CPT-5, and IP-2 were conducted within the paved areas of the site and encountered 3 to 3.5 inches of asphalt pavement underlain by 6 to 7.5 inches of moist, brown, silty sand (SM) with gravel base course material. Up to roughly 3 feet of undocumented fill was encountered beneath the base course material and at the ground surface in the remaining explorations.

Native Alluvial and Glacial Soils: The undocumented fill was underlain by highly compressible, very soft to medium stiff organic silt, peat, sandy silt, and clay followed by very loose to medium dense sand with varying silt content to a depth of about 20 to 23 feet bgs. The compressible alluvial soils ranged from about 2 feet thick in CPT-2 and CPT-2B to up to 9.5 feet thick in CPT-1 conducted within the northeastern portion of the site, to occasional layers up to 1-foot thick in the explorations conducted within the southern part of the site (CPT-3, CPT-4, and CPT-5).

An approximately 12-foot thick layer of dense to very dense sand with gravel to gravel with sand was encountered beneath the loose alluvial sands in CPT-2 and CPT-2B, and extended to depths of 27 to 33 feet bgs in the remaining CPTs due to refusal of the cone to further penetration in this dense soil layer.

The dense sand in CPT-2 and CPT-2B was underlain by another stratum of very loose to medium dense alluvial sand ranging from about 5.5 to 12 feet thick, followed by dense to very dense glacial sand and gravel soils to their termination depths at about 39.1 and 46.3 feet bgs, respectively.

Groundwater: Porewater pressure dissipation tests conducted on March 30, 2022 in the CPTs indicated a groundwater level ranging between 1.2 to 3.7 feet bgs. Shallow groundwater was also encountered in the test pits; however, after waiting 3 hours the water level was still rising so the test pits were backfilled for safety reasons. Two monitoring wells installed by others, one near CPT-1 and the other near CPT-4, indicated water levels at 4.6 and 1.5 feet bgs. A manhole cover for the communications line at the northeast side of the site was removed during our March 28, 2022 site visit and the water level was measured at a depth of about 5.5 feet bgs.

It should be recognized that groundwater elevations generally fluctuate with time. The groundwater level will be dependent upon seasonal precipitation, irrigation, land use, climatic conditions, as well as other factors. Therefore, groundwater levels at the time of our field investigation may be different from those encountered during the construction phase of the project. <u>The evaluation of such factors was beyond the scope of this report.</u> Design and operation of temporary dewatering systems to remove or lower groundwater to facilitate construction should be the responsibility of the contractor.

The subsurface soils encountered in the test pits and CPTs were in general agreement with the mapped geology for the project area. Groundwater conditions were consistent with the available DOE well data in the site vicinity.

Shear Wave Velocity: Shear wave velocity were obtained from the CPT-2B, CPT-4, and CPT-5, which were advanced to depths of about 27.0 to 46.3 feet bgs. The shear wave velocities were measured to the maximum explored depth, and we have assumed similar site conditions continue below the explored depth. The measured shear wave velocities to the maximum explored depth ranged from about 333 feet per second to 1680 feet per second. The average measured shear wave velocities in the upper 100 feet were estimated to be in the range of 778 to 1217 <u>feet per second</u>.

GEOLOGIC HAZARDS

Erosion Concern/Hazard

The USDA Natural Resources Conservation Services (NRCS) map for Pierce County Area, Washington (WA653), classifies the soils in the site area as Shalcar muck (38A), 0 to 1 percent slopes. These soils are formed from organic material over alluvium deposited in flood plains, and are considered very poorly drained. The typical shallow soil profile consists of muck and peat over silty clay and fine sandy loam. The NRCS Soil Survey indicates that the Shalcar muck soils belong to Hydrologic Soil Group D, whereby surface runoff is slow, and the erosion hazard is very low due to flowing water or wind. The majority of the site is presently gravel-surfaced or asphalt paved, with the sloping ground along the northern, southern, and eastern sides of the property covered with grass, landscaping, and trees. Measures to address potential erosion during construction are presented in the Erosion and Sediment Control (ESC) section of this report.

Steep Slope Hazard

Review of the City of Puyallup Hazards Map website indicate that there is an isolated slope in the northwestern corner of the site, which has been mapped as moderate susceptibility to deep seated landslide. There are slopes near the southeastern portion of the site that have been mapped as moderate susceptibility to deep seated landslide as well. During our site visit we did not observe signs of recent slide scarps, tension cracks, or slumps within the site that would indicate current deep-seated instability on the slopes within or near the property. Signs of shallow soil movement and soil creep, such as curved tree trunks, were not observed on either of the slope areas. Based on our exploration and surficial site reconnaissance, it is our opinion the mapped landslide hazard areas should not have an adverse effect on the proposed site development or vice-versa.

Although the southeastern slope does not show signs of shallow or deep-seated hazard, this man-made embankment does show signs of construction-related issues with regard to erosion and instability. Rock boulders in a sand matrix appear to support the southern slope embankment from the corner near the intersection of S Meridian Ave. extending westward. Loose sand was noted between some of the rock boulders and a steel T-probe was able to penetrate to a depth of at least 3.5 feet bgs, while voids were noted at other locations between the rock boulders. Signs of erosion were evident in the bare section of the embankment, and it appears rebar rods have been inserted into the ground near the top of slope at this location possibly as a measure to hinder lateral movement. We recommend the erosion and instability concerns for this constructed embankment slope be addressed by either 1) re-constructing the access road embankment from its intersection with S Meridian Ave. down to the site level or 2) injecting high strength grout into this portion of the embankment through a series of horizontal and vertical holes. All bare areas should then be properly vegetated following remediation of this portion of the southeaster slope.

Seismic Hazard

The 2018 International Building Code (IBC), Section 1613.3.2, refers to Chapter 20 of ASCE 7-16 for Site Class Definitions. The site soil conditions encountered in CPT-2B, CPT-4 and CPT-5 correspond to "Site Class F" based on their liquefaction potential and, therefore, require a site-specific response analysis as per Section 20.3.1 of ASCE 7-16, unless the structure's fundamental period of vibration is equal to or less than 0.5 seconds. <u>We have assumed that the structure will have a fundamental period of vibration of equal to or less than 0.5 seconds.</u> Therefore, a site response analysis was not performed. Based on this exception, the site class was determined as per Section 20.3 of ASCE 7-16. The spectral accelerations were determined as per Sections 11.4.4 and 11.4.5 of ASCE 7-16.

The mapped Risk-Targeted Maximum Considered Earthquake (MCER) spectral response parameters for short periods and at 1 second (S_S *and* S_1) were obtained from the Applied Technology Council (ATC) Hazards website, which utilizes the most updated published data on seismic conditions from the United States Geological Survey. The site coefficients (F_a *and* F_v) for "Site Class D" were selected based on the estimated average shear wave velocity of 1217, 778, and 899 feet per second in the upper 100 feet of cone penetration tests CPT-2B, CPT-4, and CPT-5, respectively. The spectral response acceleration parameters (S_{MS}, S_{DS}, S_{M1}, S_{D1}) and short period (*Ts*) were determined as per Sections 11.4.4. 11.4.5, and 11.4.6 of ASCE 7-16. The seismic design parameters for this site are based on a Risk Category II for the proposed structure and are presented in Table 1:

Table 1: Seismic Design Parameters*

(Reference: 2018 IBC Section 1613.2.2, ASCE 7-16, and ATC)

Seismic Item	Value
Site Coefficient F_a	1.000
S_s	1.268
S_{MS}	0.1.268
S_{DS}	0.846
Site Coefficient F_v	1.863
S_1	0.437
S_{M1}	0.814
S_{D1}	0.543
Ts	0.642

*Based on Equivalent Lateral Force (ELF) Design Procedure being used.

Note: If the structure's fundamental period of vibration exceeds 0.5 seconds, a site response analysis will be required, which is beyond the scope of this report.

Additional seismic considerations include liquefaction potential and amplification of ground motions by loose/soft soil deposits. The liquefaction potential is highest for loose sand with a high groundwater table. Soil liquefaction is a state where soil particles lose contact with each other and become suspended in a viscous fluid. This suspension of the soil grains results in a complete loss of strength as the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. However, liquefaction has occurred in soils other than clean sand. Liquefaction usually occurs under vibratory conditions such as those induced by seismic events.

We have reviewed the Washington DNR Geologic Information web-portal interactive map, the liquefaction Susceptibility Map of Pierce County, Washington (Palmer et al., 2004), and the USDA Soil Survey Map (WA653) with regards to soils and liquefaction susceptibility. The maps indicate that the site is underlain by alluvial soils with the surface soils generally consisting of Shalcar muck (an organic, peat type soil). The Shalcar muck is not susceptible to liquefaction but may experience large displacements during an earthquake event. The alluvial soils are highly susceptible to liquefaction. The Hazard Zones are based on the combined effects of ground shaking amplification, liquefaction, and earthquake-induce landslides. At the request of our client, we have conducted a site-specific liquefaction analysis for this project.

To evaluate the liquefaction potential of the site, we analyzed the following factors:

1) Soil type
2) Groundwater depth
3) Relative soil density
4) Initial confining pressure
5) Maximum anticipated intensity and duration of ground shaking

Liquefaction Analysis: The commercially available liquefaction analysis software, NovoCPT from NovoTech, was used to evaluate the liquefaction potential and the possible liquefaction induced settlement for the site soil and groundwater conditions based on our explorations. The analysis was performed using the information from seismic cone penetration tests CPT-2B and CPT-5. The Maximum Considered Earthquake (MCE) was selected in accordance with the 2018 International Building Code (IBC) Chapter 16 and the U.S. Geological Survey (USGS) Earthquake Hazards Program website. For this analysis, a maximum earthquake magnitude of 7.1 and peak horizontal ground surface acceleration of 0.70g were used.

We ran our analyses for groundwater at a depth of 1-foot bgs during the earthquake. Our analyses indicated that the soils from the depth that groundwater was encountered to about 14 feet bgs were liquefiable under the maximum earthquake magnitude of 7.1. The maximum liquefaction induced settlement for this type of seismic event is estimated to be on the order of approximately 1.3 to 2.4 inches (total settlement). The dynamic differential settlement is estimated to be on the order of about ¼ to 1-inch over 50 feet.

The CPT data revealed two zones of liquefiable soils at the site. The upper zone encountered interbedded liquefiable layers ranging from 1 to 4 feet thick between a depth of about 4 to 21.5 feet bgs. A second deeper zone contained frequent liquefiable soil layers up to 1-foot thick from a depth of about 33 to 43 feet bgs. The deeper liquefaction zone accounted for roughly sixty percent of the total dynamic settlement.

Liquefaction-induced lateral spreading is lateral displacement of gently sloping ground as a result of pore pressure build-up or liquefaction in shallow deposits during an earthquake. The conditions conducive to lateral spreading include gentle surface slope, shallow water table, and liquefiable cohesionless soils. Based on the relatively shallow groundwater level and sand soils encountered in the explorations, about 4 to 10 inches of lateral spreading could occur as a result of a 7.1 magnitude earthquake event.

The liquefaction analysis plots showing the factor of safety, vertical settlement, and lateral displacement are presented in Appendix A.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion from a geotechnical standpoint that the site is compatible with the planned development, **provided that the geotechnical recommendations presented in this report are included in the project design and implemented during construction**.

Our field explorations at this site encountered very loose to medium dense sands with varying silt content, as well as highly compressible, very soft to soft organic silt/peat (Shalcar muck), clay, and sandy silt soils to a depth of about 23 feet bgs. These soils are considered unsuitable bearing soils for support of the proposed ampm building on a shallow foundation system. In addition, our liquefaction analyses indicated that the soils within the upper 21.5 feet of the site, as well as the soils encountered in a deeper zone between a depth of roughly 33 to 43 feet bgs, are liquefiable under a maximum earthquake magnitude of 7.1. The maximum liquefaction induced settlement for this type of seismic event is estimated to be on the order of approximately 1.3 to 2.4 inches (total settlement), with dynamic differential settlement estimated to be on the order of about ¼ to 1-inch over 50 feet. Therefore, a deep foundation system is recommended for support of the proposed ampm building. A shallow foundation system may be considered for the fuel canopy and car wash structures, provided a portion of the unsuitable soils are over-excavated and replaced with structural fill and the risks associated with seismic-induced settlement are deemed acceptable. Recommendations for shallow and deep foundations are presented in the Foundations section of this report.

Due to the shallow groundwater level and very loose to medium dense soils encountered at the proposed location of the USTs, temporary dewatering and shoring of the excavation sidewalls is anticipated to allow for installation of the tanks.

The subsurface soils encountered on this site during our field exploration are considered extremely moisture-sensitive and may disturb easily in wet conditions. We recommend that construction take place during the drier summer months, if possible. In our opinion, the onsite undocumented fill and native soils are considered unsuitable for re-use as structural fill, and the cost to import structural fill should be included in the project budget.

Stormwater Infiltration

The City of Puyallup Municipal Code has adopted the 2014 (DOE) SWMMWW. The SWMMWW references the small-scale PIT for field infiltration testing. We excavated two test pits, IP-1 and IP-2, at the site to conduct infiltration testing. However, due to the presence of undocumented fill material, organic silt/peat (Shalcar muck) and clay, and shallow groundwater, field infiltration tests were not conducted. Based on the subsurface soil and groundwater conditions encountered at the site, it is our opinion that onsite management of stormwater by infiltration is not considered feasible.

Site Preparation

General site clearing should include removal of topsoil material, asphaltic concrete, abandoned utilities, and structures including foundations, slabs, rubble, and trash, down to native suitable soils. In addition, any buried structures, such as grease traps, septic tanks, underground storage tanks, debris pits, cesspools, or similar structures, should be completely removed and backfilled with structural fill.

The undocumented fill and the native very loose sands and very soft to medium stiff organic silt/peat, clay, and sandy or clayey silt encountered in our field explorations are considered unsuitable for support of the ampm building, fuel canopy structure, car wash structure, floor slabs and exterior slabs-on-grade, and pavement loads. Based on the shallow groundwater levels encountered in our explorations conducted in March 2022, temporary dewatering measures will likely be required to conduct the over-excavation of unsuitable soils, especially if construction takes place during the "wet weather" season.

We recommend the undocumented fill and unsuitable native soils be over-excavated to a depth of at least 2 feet below the footing bearing level for shallow foundations or the planned subgrade elevation for slabs-on-grade or pavements. Deeper excavations may be required if soft and yielding soil conditions are exposed at the bottom of the over-excavation. A layer of rock spalls should be placed on the excavation bottom and tamped in-place to provide a stable working surface for placement of structural fill. We recommend a high-strength geotextile separation fabric, such as Mirafi 600X or equivalent, then be placed over the rock spalls. After the fabric is placed, the area should be filled to the planned pavement subgrade elevation with structural fill. The structural fill should be compacted to at least 95 percent of the maximum dry density (ASTM D1557) and to within 2 percent of the optimum moisture content. In-place density tests should be performed to verify proper moisture content and adequate compaction levels are achieved in the structural fill.

An existing restaurant building is located within the eastern central portion of the property where the Canopy and fuel pumps are planned, and extends into part of the proposed area of the future USTs. The debris from demolition of the existing building should be hauled off-site. As-built records for the existing building were not available at the time of this report. Assuming the restaurant is supported on a shallow foundation system, then existing concrete footings should be completely removed within the footprint of the canopy structure, and to a depth of at least 1-foot below the planned subgrade elevation in new pavement or exterior slab-on-grade areas. If the existing building is pile supported, the type and location of the piles will need to be evaluated prior to or during construction as information becomes available to determine if the piles should be left in-place, or partially or completely removed.

Krazan & Associates should be onsite full-time during the demolition activities to document that all below-grade structures have been properly removed and backfilled with properly placed and compacted structural fill, and that the resulting debris from the demolition activities has been hauled off-site and not re-used as fill at any location on the property.

All existing utilities should be completely removed from within planned structure areas. For any utility line to be considered acceptable to remain, i.e. be abandoned in-place, within the structure footprint, the utility line must be completely filled with grout or sand-cement slurry, the ends outside the building area capped with concrete, and the existing trench backfill removed and replaced with properly placed and compacted structural fill. Assessment of the level of risk posed by a particular utility line to the structure will determine whether the utility may be abandoned in-place or needs to be completely removed. The risks associated with abandoning utilities in-place include the potential for future differential settlement of existing trench fills and/or potential ground loss into utility lines that are not completely filled with grout if the abandonment requirements stated above are not followed.

Based on our field explorations, the near surface soils expected to be encountered at the site during construction are considered extremely moisture sensitive and will likely disturb easily in wet conditions. During wet weather conditions, subgrade stability problems and grading difficulties may develop due to the excess moisture, disturbance of sensitive soils, shallow groundwater levels, and/or the presence of perched groundwater. Construction during extended periods of wet weather could result in the need to remove wet disturbed soils if they cannot be suitably compacted due to elevated moisture contents. The prepared subgrade should be protected from construction traffic and surface water should be diverted around the prepared subgrade. Soils that have become unstable may require over-excavation, or drying and recompaction. Selective drying may be accomplished by scarifying or windrowing surficial material during extended periods of dry, warm weather (typically during the summer months). If the soils cannot be dried back to a workable moisture condition, removal of the unstable soils or the use of remedial measures may be required. These remedial measures could include placement of a blanket of rock spalls to protect the exposed subgrade and construction traffic areas. The lateral extent and depth of rock spalls, if required, should be determined based on evaluation of the near surface soil conditions at the time of construction.

General project site winterization should consist of the placement of aggregate base and the protection of exposed soils during the construction phase. It should be understood that even if Best Management Practices (BMP’s) for wintertime soil protection are implemented and followed there is a significant chance that moisture disturbed soil mitigation work will still be required.

A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation are an integral part of our services, as acceptance of earthwork construction is dependent upon compaction and stability of the material. The geotechnical engineer may reject any material that does not meet compaction and stability requirements. Further recommendations, contained in this report, are predicated upon the assumption that earthwork construction will conform to the recommendations set forth in this section and in the Structural Fill Section.

Dewatering

Excavations will be required for installation of the USTs and site utilities, as well as for over-excavations required for construction of the slabs-on-grade, pavements, and structures supported on shallow foundations. Based on the anticipated excavation depths and the shallow groundwater level encountered at the site, the excavations will extend below the groundwater table and thus require some method of dewatering.

Sump pit and pumping methods may be able to handle groundwater encountered in shallow excavations depending on the time of year construction takes place, the planned excavation depth, and the soils encountered within the excavation. The test pits conducted for this exploration encountered groundwater as shallow as 1.5 feet bgs, and cave-in of the pit sidewalls occurred in the very loose to loose soils at about the level groundwater was encountered.

Deeper excavations, such as for installation of the USTs, will require more a more aggressive dewatering method, such as well points. To maintain the stability of the excavation bottom, groundwater levels should be drawn down a minimum of 2 feet below the lowest portion of the excavation. The groundwater level should be maintained below the recommended level until the backfill has been placed and compacted.

Analysis of contractor dewatering needs or the design of contractor dewatering systems was not within the scope of our services. A competent dewatering contractor should provide these services. However, we have included some discussion of potential dewatering methods in the following paragraphs. Krazan and Associates should review the contractor's dewatering design for consistency with the geotechnical recommendations contained in this report.

The method of dewatering ultimately selected is dependent on a number of factors, e.g. quantity of groundwater to be removed, cone of depression (zone of influence) of dewatering measures within the excavation, stability of the undocumented fill and native soils, the presence of seepage zones, and cost to name a few.

Lowering the water table could induce settlements of the dewatered and underlying soils. The dewatering engineer should evaluate the potential for dewatering-related settlement, and mitigation measures should be taken, as necessary. If structures or utilities are located within the anticipated cone of depression, groundwater levels, settlement, and deflections at and near the structure or utility should be monitored during dewatering to observe if the groundwater level is changing and movement is occurring. Dewatering should stop and appropriate corrective action should be taken if settlement or changes in groundwater levels are noted at these locations.

Temporary Excavations

The onsite soils have variable friction and cohesion strengths, therefore the safe angles to which these materials may be cut for temporary excavations is variable, as the soils may be prone to caving and slope failures in temporary excavations deeper than about 2 feet or at the level where groundwater is encountered. Temporary excavations in the fill material and underlying native soils should be sloped no steeper than 2H:1V (horizontal to vertical) where room permits. Depending on site soil and groundwater conditions, it may be necessary to flatten the side slopes of the excavation and lower the groundwater level as necessary to achieve stable conditions. Slope cuts into excavations greater than 20 feet in depth should be designed by a professional engineer for the contractor.

All temporary cuts should be in accordance with Washington Administrative Code (WAC) Part N, Excavation, Trenching, and Shoring. The temporary slope cuts should be visually inspected daily by a qualified person during construction work activities and the results of the inspections should be included in daily reports. The contractor is responsible for maintaining the stability of the temporary cut slopes and minimizing slope erosion during construction. The temporary cut slopes should be covered with plastic sheeting to help minimize erosion during wet weather and the slopes should be closely monitored as the area is backfilled.

A Krazan & Associates geotechnical engineer should observe, at least periodically, the temporary cut slopes during the excavation work. The reason for this is that all soil conditions may not be fully delineated by the limited testing at the site. In the case of temporary slope cuts, the existing soil conditions may not be fully revealed until the excavation work exposes the soil. Typically, as excavation work progresses, the maximum inclination of the temporary slope will need to be evaluated by the geotechnical engineer so that supplemental recommendations can be made. Soil and groundwater conditions can be highly variable. If any variations or undesirable conditions are encountered during construction, Krazan & Associates should be notified so that supplemental recommendations can be made.

Underground Storage Tanks (USTs)

The specific plans for installation of the two new tanks were not available at the time of this report. However, we have assumed installation of the new tanks will generally follow the Underground Storage Tank Standards Element TP01 V-14.0 2019 Series Core drawings prepared by Barghausen Consulting Engineers, Inc. and dated January 25, 2019. Based on these drawings and side by side tank installations, we anticipate the excavation will extend to a minimum depth of about 16 to 20 feet bgs. We anticipate excavations for fuel lines, vent lines, and other utilities will generally be less than 4 feet deep. Therefore, some type of temporary shoring system will be necessary to support the excavation sidewalls. Due to the high groundwater level encountered at the site and the very loose to medium dense soils to be retained, we do not recommend the use of a soldier pile retaining wall system for support of the UST Excavation. Recommendations for a temporary sheet pile shoring system are provided below.

Lateral Earth Pressures: The parameters presented in Table 2 may be used for design of a temporary shoring and/or bracing system.

Table 2 - SOIL PARAMETERS FOR TEMPORARY SHORING DESIGN

Material Description	Depth (ft.)	Angle of Internal Friction (degrees)	Cohesion (psf)	Moist Unit Weight (pcf)	Active Earth Pressure Coefficient (K_a)	Passive Earth Pressure Coefficient (K_p)
Soil Layer 1: very loose to medium dense Sands	0 - 22	22	0	105	0.45	2.20
Soil Layer 2 (Native Soils): Dense to very dense Silty Sand, Gravelly Sand, or Sandy Gravel	22 to 33	40	50	135	0.22	4.60

The temporary shoring should be designed to resist the full hydrostatic pressure over the entire depth of the excavation. The excavation support system may also be subjected to surcharge loads due to construction equipment, storage of materials, temporary storage of the tanks near the excavation, or loading of the tanks onto trucks for transport offsite. We recommend the temporary shoring system be designed for a uniform lateral surcharge pressure of 300 pounds per square foot (psf) to account for these surcharge loads. In addition, outriggers for cranes may impose point loads adjacent to the excavation and these loads should be included in design of the shoring system. The shoring design should also consider loads from any structures, foundations, or existing utilities located within the zone of influence, which is taken as a 1 Horizontal to1 Vertical (1H:1V) line projected upwards from the bottom of the excavation. Excavations for installation of the USTs will require dewatering as discussed in the previous section of this report.

The temporary sheet pile retaining wall should be designed by an experienced structural engineer licensed in the state of Washington. In many cases, the contractor may have qualified structural engineers on board, or have a working relationship with qualified wall designers. In any case, the wall designer should be provided a copy of our report, and we should be retained to review the geotechnical aspects of the shoring wall design prior to construction.

If the shoring wall is allowed to yield at the top at least one thousandth of the height of the above ground portion of the wall, the wall should be designed for an active loading condition. If the wall is restrained from yielding by external bracing, tiebacks, or wall stiffness, the wall should be designed for an at-rest loading condition. Active or at-rest pressure acting on the cantilevered sheet piles should be calculated based on a triangular pressure distribution using the soil parameters provided in Table 2. Single- or multiple-braced walls should be designed using a trapezoidal earth pressure distribution. A factor of safety of 1.5 should be applied to the calculated passive resistance.

Our explorations did not encounter boulders. However, boulders may be present in glacial soils and may cause obstruction. Additionally, there may be obstructions in unexplored areas of the site. The contractor should be prepared to penetrate or remove obstructions if they are encountered.

***Dewatering*: -** Porewater pressure dissipation tests conducted in the CPTs indicated groundwater levels at the time of testing in March 2022 at a depth of 1.5 to 3.7 feet bgs. Installation of monitoring wells, piezometers, or conducting slug tests to evaluate site specific groundwater levels and pumping rates for dewatering analysis <u>was not included</u> in our scope of services for this project. Analysis of contractor dewatering needs or the design of contractor dewatering systems was also not within the scope of our services.

***Excavation Subgrade:* -** Based on the referenced standard tank drawings, we understand that the new tanks will bear on a minimum of 12 inches of pea gravel placed over the native soils. Based on the CPT results, the soils at the anticipated excavation bottom will likely consist of dense to very dense sand and gravel soils. The contractor should be prepared to remove any accumulations of soft soils due to standing water in the excavation prior to placement of the pea gravel base layer. Any over-excavation to remove soft soils should be backfilled with pea gravel meeting the requirements of the Structural Fill section of this report.

***Construction Considerations:* -** The excavation and backfilling activities associated with installation of the new tanks may cause ground movement. Prior to conducting the excavation activities, a pre-construction survey should be conducted on existing structures within a horizontal distance of at least 17 feet from the edges of the excavation. The pre-construction survey should include elevation measurements as well as photos of the existing structures. Additional elevation measurements should be obtained at a reasonable frequency, but not less than once per week, to monitor movements during the excavation and backfilling process.

The new tanks should be designed to resist hydrostatic uplift forces. Concrete deadmen with straps could be utilized to provide additional uplift resistance for the fuel tank system.

<u>Utility Trenches and Backfill</u>

Excavations of up to 4 feet in depth are anticipated to install utilities associated with the new fuel tanks. Deeper excavations may be required to install site utilities. The temporary excavations for installation of utilities should follow the recommendations of the Temporary Excavations section of this report.

All utility trench backfill should consist of structural engineered fill as per the Structural Fill section of this report. The onsite undocumented fill and native soils are considered unsuitable for re-use as trench backfill. Trench backfill lifts should be placed in equal measures on each side of the utility pipe to the top of the pipe. Trench backfill lifts should not exceed 8 inches in loose thickness prior to compaction, with the exception that the first lift placed over the pipe may be up to 14 inches in loose thickness. Each lift of trench backfill should be moisture conditioned to within 2 percent of its optimum moisture content and compacted to the required relative density prior to placement of additional fill lifts.

A firm and unyielding subgrade (i.e. bearing soils at bottom of trench) should allow for the proper placement of subsurface utilities. If unstable soils are encountered at the utility trench bottom, we recommend placement of geotextile and quarry rock (rock spalls) on the bottom of utility trenches prior to placement of pipe bedding to provide a stable subgrade for placement of the pipe bedding, utility, and trench backfill. The thickness of the rock spall layer will depend on the instability of the subgrade soils at the time of excavation. Pipe bedding should be in accordance with the pipe manufacturer's recommendations.

Utility trench backfill placed within or adjacent to buildings and exterior slabs should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. It is recommended that utility trenches located within the building pad be compacted, as specified above, to minimize the transmission of moisture through the utility trench backfill. The upper 5 feet of utility trench backfill placed in pavement areas should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Below 5 feet, utility trench backfill in pavement areas should be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. Pipe bedding should be in accordance with the pipe manufacturer's recommendations.

The contractor is responsible for removing all moisture-sensitive soils from the trenches regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

Structural Fill

Fill placed beneath foundations, pavement, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician under the direction of the geotechnical engineer. Field monitoring procedures would include the performance of a representative number of in-place density tests on the soils to document the attainment of the desired degree of relative compaction and moisture content. The area to receive the fill should be suitably prepared as described in the Site Preparation subsection of this report prior to beginning fill placement.

Best Management Practices (BMP’s) should be followed when considering the suitability of the existing materials for use as structural fill. Based on our field exploration, the undocumented fill and native soils that will be encountered within roughly the upper 10 feet during site development are considered unsuitable for re-use as structural fill material due to their high fines content (percent silt and/or clay material passing the No. 200 Sieve), as well as organic content for the Shalcar muck encountered in our explorations. These soils are considered extremely moisture-sensitive and will likely disturb easily in wet conditions. Also, debris was observed in the undocumented fill within the test pits.

An allowance for importing structural fill should be incorporated into the construction cost of the project. If deeper excavations, such as for installation of site utilities, are extended into the sands encountered beneath the organic silt/peat, clayey silt or clay soils, the sands may be re-used as structural fill provided that they can be dried back to near their optimum moisture content to attain the required level of compaction and they are separated from the organic silt, clayey silt, layers encountered within the sand stratum. During excavations, the sand and sandy silt soils should be stockpiled separately if plans are to try to re-use the sand as structural fill material. If soil types other than those revealed during our field exploration are encountered during construction, then we should be consulted regarding the suitability of these soils for use as structural fill.

Imported fill material should be <u>all-weather</u> structural fill consisting of well-graded gravel or a sand and gravel mixture with a maximum grain size of 3 inches and less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve). Structural fill may also consist of crushed rock, rock spalls, or Controlled Density Fill (CDF). All structural fill material should be submitted for approval to the geotechnical engineer at least 48 hours prior to delivery to the site.

Fill soils should be placed in horizontal lifts not exceeding 8 inches loose thickness, moisture-conditioned as necessary (<u>moisture content of soil shall not vary by more than ±2 percent of its optimum moisture content</u>), and compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557 (Modified Proctor). In-place density tests should be performed on all structural fill to document proper moisture content and adequate compaction levels have been attained. Additional fill lifts should not be placed if the previous lift did not meet the compaction requirements or if soil conditions are not considered stable. Placing several lifts of fill and then potholing down to each lift to conduct compaction testing <u>is not acceptable</u>, and will require complete removal of the fill down to the first lift. Ponding or jetting the soil is not an approved method of soil compaction.

Foundation Recommendations

Liquefiable soils were encountered throughout the site and consideration of the risks associated with constructing on such soils should be considered when selecting a particular foundation system for support of a structure. Our liquefaction analyses indicated that the soils within the upper 21.5 feet of the site, as well as the soils encountered in a deeper zone between a depth of roughly 33 to 43 feet bgs, are liquefiable under a maximum earthquake magnitude of 7.1. The maximum liquefaction induced settlement for this type of seismic event is estimated to be on the order of approximately <u>1.3 to 2.4 inches (total settlement)</u>, with dynamic differential settlement estimated to be on the order of about ¼ to 1-inch over 50 feet. The following sections discuss the subsurface conditions anticipated at the ampm building, fuel canopy and pump stations, and car wash structure, and discusses the recommended foundation system for each of these structures.

ampm Building: The proposed ampm building will be located within the northeastern portion of the site. CPT-1, conducted within the footprint of the building, encountered undocumented fill overlying highly compressible organic silts, peat, and clay and loose sands to a depth of about 20 feet bgs. The subsurface conditions are not considered suitable for foundation support on typical spread footings for both static and dynamic case scenario. Therefore, a deep foundation system is recommended to completely penetrate through liquefiable zones and transfer the building loads through the undocumented fill and compressible native soils to be supported on the underlying dense to very dense native sand and gravel soils.

Pin Piles: A deep foundation system consisting of pin piles bearing at a minimum depth of 20 feet bgs is recommended for support of the ampm building, **provided that the potential for liquefaction induced settlements of the deeper soils is considered acceptable**. Installation recommendations and allowable pile loads for 2-, 3-, and 4-inch diameter pipe piles are provided below. The pile capacities stated are based on pile center to center spacing of at least 3 pile diameters to avoid group effects.

For 2-inch diameter pipe piles driven to refusal using a hand-held, 90-pound jackhammer, we recommend a design axial compression capacity of three tons for each pile. The refusal criterion for this pile and hammer size is defined as less than one inch of pile penetration during 60 seconds of continuous driving. We recommend using extra strong (Schedule 80) galvanized steel pipe for the 2-inch diameter pipe piles.

We recommend that the 3-inch diameter pipe piles be driven using a hydraulic hammer with a weight class of at least 850 lbs. For this pile diameter and hammer size, we recommend a design axial compression capacity of six tons for each pile driven to refusal. The refusal criterion for this pile and hammer size is defined as less than one inch of pile penetration during 20 seconds of continuous driving.

We recommend that the 4-inch diameter pipe piles be driven using a hydraulic hammer, with a weight class of at least 1,100 lbs. For this pile and hammer size, we recommend a design capacity of ten tons for each pile driven to refusal. The refusal criterion for this pile and hammer size is defined as less than one inch of pile penetration during 20 seconds of continuous driving.

The above design capacities are based on theoretical numerical pile driving analysis. We should be retained to review final plans, monitor installation of the piles, and evaluate pile refusal. The pin piles should penetrate a minimum of 4 feet into the dense to very dense sand and gravel encountered at a depth of 20 feet bgs in order to develop the design capacity. Piles that do not meet this minimum embedment criterion or piles that are obstructed on debris in the fill should be rejected, and replacement piles should be driven after consulting with the structural engineer regarding the new pile locations. Due to the relatively small slenderness ratio of pin piles, maintaining pin pile confinement and lateral support is essential to preventing pile buckling. Pin piles should not stick above the finished ground surface.

Although pin piles bearing at a depth of at least 20 feet bgs will mitigate the dynamic settlements anticipated from the liquefiable soils within the upper zone, it **will not** reduce the seismic induced settlements anticipated due to the deeper liquefiable soils. It is estimated that about sixty percent of the dynamic settlement is attributed to the deeper liquefiable soils encountered at a depth of about 33 to 43 feet bgs in our explorations. It is anticipated that the pin piles will encounter refusal within the dense to very dense sand and gravel layer encountered at a depth of about 20 to 33 feet bgs.

Steel Pipe or Auger Cast Piles: In order to mitigate the magnitude of seismic-induced settlement associated with the deeper liquefiable soils, open-ended steel pile piles or auger cast piles, extending below the deeper liquefiable soils to bear at a minimum of 4 feet into the dense to very dense sand and gravel encountered at a depth of about 43 feet bgs, are recommended for support of the ampm building.

Driven open-ended pile piles may be used to support the anticipated 30-kip foundation loads for the ampm building. The allowable axial pile capacity for 8 and 10-inch diameter pipe pile are provided in Table 3. A factor of safety of 3.0 was used in the axial pile capacity calculations.

Table 3: Pipe Pile Capacities

PILE DIAMETER (Inch)	PILE CAPACITY (Kips)
8	25
10	38

Auger cast piles may also be used to support the ampm building. Auger cast piles are constructed with a hollow stem auger drilled to the desired depth. After reaching the minimum recommended penetration into bearing soils, a pressure head is created when grout is pumped through the hollow stem of the auger and into the borehole before starting withdrawal of the auger. After the head is developed, withdrawal of the auger is timed to maintain the grout pressure head and limit intrusion of loose soil into the sides of the pile excavation or discontinuity or "necking' of the pile. The actual volume of the grout pumped into each pile is recorded and compared to the theoretical volume of the pile. Piles with a ratio of actual to theoretical volume less than 1.1 should be re-drilled. Due to the loose/soft conditions of the near surface soils on this site, we recommend that the auger cast piles be allowed to cure for at least 12 hours prior to the installation of the adjacent piles or maintain at least 12 feet of horizontal distance.

Table 4 lists the allowable capacity for 10 and 12-inch diameter auger cast piles. For design purposes, we recommend that these piles penetrate a minimum of 4 feet into the dense to very dense sand and gravel deposits encountered at a depth of 43 feet below the existing ground surface to provide adequate bearing.

Table 4: Auger Cast Pile Capacities

PILE DIAMETER (Inches)	ALLOWABLE PILE CAPACITY (Kips)
10	41
12	60

General **-** Final pile depths should be expected to vary somewhat and will depend on the actual depth of the existing fill and loose/soft native soils, and the nature of the underlying competent bearing soils. Debris consisting of chunks asphalt pavement and broken clay pipe was present in the undocumented fill encountered in test pits IP-1 and IP-2, and may be encountered within the proposed building footprint. There is a possibility some piles may be obstructed. There should be contingencies in the budget and design for removal of obstructions and/or additional/relocated piles to replace piles that may be obstructed by debris in the fill. A structural engineer should prepare the structural design of the pile foundation system.

The pile capacities listed in Tables 3 and 4 do not account for the effects of down drag forces. Since finish grades are anticipated to be at or near existing grades, we do not anticipate that down drag will have an appreciable effect on the capacity of the deep foundation system provided our site preparation and foundation recommendations are followed.

We recommend dynamic testing be conducted on at least one (1) indicator test pile installed within the building area in order to observe the installation characteristics of the piles, evaluate the suitability of the pile installation methods and equipment, and evaluate potential differences in the elevation that bearing soils are encountered, as well as the condition of the competent bearing soils. The indicator test pile should be installed and tested prior to driving the production piles to obtain the installation driving criteria and provide a better indication of the optimum pile length of production piles. Indicator test pile length and location should be selected by the geotechnical engineer, in conjunction with the structural engineer and contractor. We recommend that the dynamic testing consist of taking measurements using a Pile Driving Analyzer (PDA) during driving, as well as during a re-strike of the indicator test pile following a minimum of 24 hours of driving, if necessary. The purpose of the re-strike testing with the PDA is to determine the amount of additional pile capacity achieved once the pore pressures from pile driving have dissipated.

The indicator pile length should allow extra length for attachment of the PDA transducers and additional driving, if necessary due to soil conditions. We should be retained to review final plans, monitor installation of the indicator and production piles (including recording of blows counts, depth to bearing soils, and embedment within competent bearing soils), and evaluate the PDA tests results. The contractor should use the same equipment to install both the indicator and production piles, unless the results of the PDA testing indicates otherwise.

We recommend a baseline survey of the nearby structures, consisting of photo documentation of the existing condition of the buildings, be conducted prior to the start of construction activities. We also recommend the nearby existing structures be monitored for movement during pile driving activities. A system of survey points should be established and baseline readings should be established prior to commencing with the pile driving activities. Readings should be taken periodically until the piles are installed and these readings should be compared to the original baseline measurements.

Deep Foundation Alternative - As an alternative to supporting the ampm building on a deep foundation system, consideration could be given to locating the proposed building within the southern portion of the site where more suitable subsurface conditions were encountered in terms of anticipated total static settlement. However, dynamic settlement due to liquefiable soils would still be present at this alternative location, and the risks associated with seismic-induced settlements would have to be acceptable in order to support the building on a shallow foundation system. In addition, some over-excavation of the undocumented fill and loose/soft native soils and replacement with structural fill would still be required to provide a stable bearing surface for the anticipated foundation loads. Shallow foundation recommendations for this alternative would be similar to those presented in the following subsection for Canopy and Car Wash Structures.

***Canopy and Car Wash Structures*:** We have assumed that design of the foundation system for the proposed canopy and car wash structures does not require consideration of seismic-induced dynamic settlements. Therefore, these structures may be supported on a shallow foundation system provided that the recommendations stated in this section are followed during design and construction of the foundations.

Based on CPT-3, CPT-4, and CPT-5, conducted within and near the locations of the proposed fuel canopy and car wash structures, the near surface soils within a depth of 10 feet bgs are anticipated to be undocumented fill underlain by loose native sands, with occasional soft silt or clay layers up to 1-foot thick. The near surface soils are not considered suitable for support of the foundation loads. We recommend that the undocumented fill and loose/soft native soils be removed to a depth of two (2) feet beneath the footings, with the over-excavation extending laterally from the outside edges of the footing a horizontal distance of one-half the width of the footing. A layer of rock spalls or a high strength geotextile fabric should be placed over the soils at the bottom of the over-excavation. The resulting excavation should then be backfilled with properly placed and compacted structural fill up to the planned footing subgrade elevations. Shallow foundations for the fuel canopy and car wash structures may then be supported on the structural fill.

Based on the size of the structures and the minimum over-excavation requirements, it may be economical to remove the unsuitable bearing soils to a depth of two (2) feet below the bottom of the footings (bearing level) throughout the entire footprint of each structure, and extending a horizontal distance of 12 inches beyond the perimeter of the canopy or car wash foundations. A representative of Krazan and Associates should evaluate the over-excavation grade and observe structural fill placement.

New utilities should not be located within the load influence zone of the footing defined as an imaginary line extending out at 1 horizontal to 1 vertical (1H:1V) from the bottom outside edge of the footing. Depending on the location of the utility, it may be necessary to deepen the planned footing elevation such that the utility pipe is located above the footing zone of influence so the footing does not impose a surcharge load on the utility.

We recommend that exterior footings bear a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower, for frost protection and bearing capacity considerations. Interior footings should have a minimum depth of 12 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Footing widths should be based on the anticipated loads and allowable soil bearing pressure, but should not be less than 12 inches wide regardless of load. Additionally, footings should conform to current International Building Code (IBC) guidelines. Water should not be allowed to accumulate in footing trenches. All loose or disturbed soil should be removed from the foundation excavation prior to placing concrete.

For foundations constructed as outlined above, we recommend that an allowable bearing capacity of **1,500 pounds per square foot (psf)** be used for foundation design for this project. A representative of Krazan and Associates should evaluate the foundation bearing soil prior to footing form construction and evaluate all structural fill subgrade and monitor all structural fill placement.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.35 acting between the bases of foundations and the supporting subgrade. Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 300 pounds per cubic foot (pcf) <u>for granular structural fill</u> acting against the appropriate vertical footing faces (neglecting the upper 12 inches). The allowable friction factor and allowable equivalent fluid passive pressure values include a factor of safety of 1.5. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. A 1/3 increase in the above values may be used for short duration wind and seismic loads.

For foundations constructed as recommended, the total static settlement is not expected to exceed 1-inch. Differential settlement should be less than ½ inch. Most settlement is expected to occur during construction, as the loads are applied.

Up to 2.4 inches of total seismic settlement and about ¼ to 1-inch of differential settlement could occur during and/or following a seismic event. The foundation elements, i.e. spread and wall footings, could be structurally tied together to create a stiffer structure. It should be noted that although this may reduce the damage associated with the anticipated seismic settlement, particularly that caused by differential settlement, it would not mitigate the anticipated total seismic settlement. If the anticipated magnitude of the seismic settlement is deemed unacceptable, a deep foundation system could also be considered for support of either of these structures. The deep foundation recommendations presented for the ampm building would be applicable for the fuel canopy or car wash if seismic-induced dynamic settlements are to be considered in design of the foundation system.

Seasonal rainfall, water run-off, and the normal practice of watering trees and landscaping areas around the proposed structures should not be permitted to flood and/or saturate foundation subgrade soils. To prevent the build-up of water within the footing areas, continuous footing drains (with cleanouts) should be provided at the base of footings. The footing drains should consist of a minimum 4-inch diameter rigid perforated PVC pipe, sloped to drain, with perforations placed near the bottom and enveloped in all directions by washed rock and wrapped with filter fabric to limit the migration of silt and clay into the drain.

Drilled Pier Alternative for Fuel Canopy Foundation - As an alternative to spread footings, the fuel canopy columns may be supported on drilled piers. Drilled pier foundations are constructed by augering through the soils down to the design depth, installing steel reinforcement in the shaft, and then backfilling the shaft with concrete. Typical drilled pier diameters for support of the lightly loaded fuel canopy structure generally range from 18 to 48 inches in diameter. The drilled pier foundation supported on competent native alluvial soils may be designed with the following soil design parameters:

- Estimated angle of internal friction: 30 degrees.
- Estimated moist unit weight: 125 pounds per cubic foot (pcf).
- Allowable fluid passive resistance: 350 pcf (neglecting the upper 24 inches and includes 1.5 factor of safety).

Krazan & Associates should observe construction of the drilled piers to verify that the suitable bearing soils have been encountered at the bottom of the shaft prior to placement of steel reinforcement and concrete.

Due to the shallow groundwater conditions encountered at the site, the use of temporary casing will likely be required to prevent caving of the surrounding soil during construction of the drilled piers. Alternatively, construction of the drilled piers may use a slurry to maintain the integrity of the shaft during drilling and backfilling with concrete. The reinforcement and concrete should be placed immediately following excavation of the drilled shaft. The concrete should be placed by tremie method and a head of at least 2 feet of concrete should be maintained above the bottom of the casing during withdrawal from the shaft.

Floor Slabs and Exterior Flatwork

Based on the results of this investigation, undocumented fill and loose/soft native soils are anticipated to be encountered in the floor slabs and exterior flatwork subgrade. The floor slab and exterior flatwork subgrade should be prepared in accordance with the recommendations presented in the **Site Preparation** section of this report, and may be designed using a modulus of subgrade reaction value of k = 150 pounds per cubic inch (pci) for slabs supported on structural fill extending to the native soils.

In areas where it is desired to reduce floor dampness, such as areas covered with moisture sensitive floor coverings, we recommend that concrete slab-on-grade floors be underlain by a water vapor retarder system. According to ASTM guidelines, the water vapor retarder should consist of a vapor retarder sheeting underlain by a minimum of 6-inches of compacted clean (less than 5 percent passing the U.S. Standard No. 200 Sieve) open-graded coarse rock of ¾-inch maximum size. The vapor retarder sheeting should be protected from puncture damage. In addition, ventilation of the structure may be prudent to reduce the accumulation of interior moisture.

The exterior floors should be placed separately in order to act independently of the walls and foundation system.

Lateral Earth Pressures and Retaining Walls

It is not anticipated that permanent retaining walls will be required for this project. However, in case retaining walls will be incorporated into the project design, we have developed criteria for the design of retaining or below grade walls. Our design parameters are based on retention of the in-place soils and/or imported granular structural fill. The parameters are also based on level, well-drained wall backfill conditions. If other wall slope configurations are planned, we should be contacted to evaluate and provide additional recommendations for these cases.

Walls may be designed as “restrained” retaining walls based on “at-rest” earth pressures, plus any surcharge on top of the walls as described below, if the walls are braced to restrain movement and/or movement is not acceptable. Unrestrained walls may be designed based on “active” earth pressures, if the walls are not part of the building and some movement of the retaining walls is acceptable. Acceptable lateral movement equal to at least 0.2 percent of the wall height would warrant the use of “active” earth pressure values for design. We recommend that walls supporting horizontal backfill and not subjected to hydrostatic forces be designed using a triangular earth pressure distribution equivalent to that exerted by a fluid with a density of 35 pcf for yielding (active condition) walls, and 55 pcf for non-yielding (at-rest condition) walls.

If vehicular loads are expected to act on the surface of the wall backfill within a horizontal distance of less than or equal to one-half of the wall height behind the back face of the wall, a live load surcharge should be applied for the design. In this case, we recommend the addition of vehicle surcharges of 70 psf and 100 psf to the active and at-rest earth pressures, respectively.

The stated lateral earth pressures do not include the effects of hydrostatic pressure generated by water accumulation behind the retaining walls or loads imposed by construction equipment, slopes, foundations, or roadways adjacent to the wall (surcharge loads). To minimize the lateral earth pressure and prevent the build-up of water pressure against the walls, continuous footing drains should be provided at the base of walls. The footing drains should consist of a minimum 4-inch diameter perforated pipe, sloped to drain, and with perforations placed near the bottom. The drainpipe should be enveloped by 6 inches of washed gravel in all directions wrapped in filter fabric to prevent the migration of silt and clay into the drain. Below grade structures should be designed to withstand hydrostatic pressures due to the shallow groundwater encountered at the site.

The backfill placed adjacent to the wall and extending a lateral distance of at least 2 feet behind the wall should consist of free-draining granular material. All free-draining backfill should contain less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve) with at least 30 percent of the material retained on the U.S. Standard No. 4 Sieve. Alternatively, a drainage composite may be used. It should be realized that the primary purpose of the free-draining material is the reduction of hydrostatic pressure. Some potential for the moisture to contact the back face of the wall may exist, even with treatment, which may require that more extensive waterproofing be specified for walls that require interior moisture sensitive finishes.

We recommend that backfill placed within a lateral distance of 3 feet behind the wall be compacted to between 92 and 95 percent of the maximum dry density based on ASTM D1557 Test Method to limit stressed on the retaining wall from compaction of the backfill. In-place density tests should be performed to verify adequate compaction and moisture content. Soil compaction equipment places transient surcharge loads on the backfill. Consequently, only light, hand-operated equipment is recommended for fill compaction within a 3-foot horizontal distance of the wall so that excessive stress is not imposed on the wall. Backfill placed greater than 3 feet from the wall should be compacted to at least 95 percent relative density in accordance with ASTM D1557, which may be conducted using conventional compaction equipment.

Erosion and Sediment Control

Erosion and sediment control (ESC) is used to minimize the transportation of sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be taken and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features of the site:

1) Phase the soil, foundation, utility, and other work, requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMPs), grading activities can be undertaken during the wet season (generally October through April). It should be noted that this typically increases the overall project cost.

2) All site work should be completed and stabilized as quickly as possible.

3) Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.

4) Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

It has been our experience that soil erosion potential can be minimized by limiting the amount of bare areas exposed during construction activities, frequently wetting the surface soils during construction, and with proper landscaping of the site following completion of construction. Construction activities can alter the erosion potential of soils due to water. Typically, erosion of exposed soils will be most noticeable during periods of rainfall and may be mitigated by the use of temporary erosion control measures, such as silt fences, hay bales, straw wattles, mulching, control ditches or diversion trenching, and contour furrowing. The walls of excavations should be covered with plastic sheeting during periods of rainfall. Erosion control measures should be in place before the onset of wet weather.

Groundwater Influence on Structures and Earthwork Construction

Groundwater was encountered at depths of ranging between 1.5 to 3.7 feet bgs based on observations during excavation of the test pits and pore water dissipations tests conducted in the CPTs. It should be recognized that groundwater elevations may fluctuate with time. The groundwater level will be dependent upon seasonal precipitation, irrigation, land use, and climatic conditions, as well as other factors. Therefore, groundwater levels at the time of the field investigation may be different from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

If earthwork is performed during or soon after periods of precipitation, the subgrade soils may become saturated. These soils may not respond to densification techniques due to the excessive moisture. Typical remedial measures include: disking and aerating the soil during dry weather; mixing the soil with drier materials; removing and replacing the soil with an approved fill material. Krazan & Associates should be consulted prior to implementing remedial measures to observe the unstable subgrade conditions and provide appropriate recommendations.

Due to the shallow groundwater encountered at the site, below grade structures such as the USTs, should be designed to result uplift pressures.

Drainage and Landscaping

The ground surface should slope away from building pads and pavement areas, toward appropriate drop inlets or other surface drainage devices. It is recommended that adjacent exterior grades be sloped a minimum of 2 percent for a minimum distance of 5 feet away from structures. Roof drains should be tight lined away from foundations. Roof drains should not be connected to the footing drains, but may use the same outfall piping if connected well away from the structure and with enough fall such that roof water will not back-up into the footing drains.

Subgrade soils in pavement areas should be inclined at a minimum of 1 percent and drainage gradients should be maintained to carry all surface water to collection facilities, and suitable outlets. These grades should be maintained for the life of the project.

Water should not be allowed to collect adjacent to the structures. Excessive irrigation within landscaped areas adjacent to the structure should not be allowed to occur.

Pavement Design

The undocumented fill and native soils encountered at the site are unsuitable for support of pavement loads. The pavement subgrade should be prepared in accordance with the recommendations presented in the Site Preparation section of this report. Traffic loads were not provided, however, based on our knowledge of the proposed project, we expect the traffic to range from light duty (passenger automobiles) to heavy duty (fire trucks and delivery trucks). The following tables show the minimum recommended pavement sections for both light and heavy-duty traffic loads.

ASPHALTIC CONCRETE (FLEXIBLE) PAVEMENT

Asphaltic Concrete	Aggregate Base*
3.0 in.	6.0 in.

PORTLAND CEMENT CONCRETE (RIGID) PAVEMENT
4000 psi with FIBER MESH

Min. PCC Depth	Aggregate Base*
6.0 in.	6.0 in.

** 95% compaction based on ASTM Test Method D1557*

The asphaltic concrete depth in the flexible pavement tables should be a surface course type asphalt, such as Washington Department of Transportation (WSDOT) ½-inch Hot Mix Asphalt (HMA). The pavement specification in Appendix C provides additional recommendations including aggregate base material. The rigid pavement design is based on a Portland Cement Concrete (PCC) mix that has a 28-day compressive strength of 4,000 pounds per square inch (psi) with a fiber mesh. The design is also based on a concrete flexural strength or modulus of rupture of 575 psi.

Testing and Inspection

A representative of Krazan & Associates, Inc. should be present at the site during the earthwork activities to confirm that actual subsurface conditions, including foundation bearing soils, are consistent with those exposed during our exploratory field work. This activity is an integral part of our services as acceptance of earthwork construction is dependent upon compaction testing and stability of the material. This representative can also verify that the intent of our recommendations has been incorporated into the project design and construction. Krazan & Associates, Inc. will not be responsible for grades or staking, since this is the responsibility of the Prime Contractor. Furthermore, Krazan & Associates is not responsible for the contractor’s procedures, methods, scheduling, or management of the work site.

LIMITATIONS

Geotechnical engineering is one of the newest divisions of Civil Engineering. This branch of Civil Engineering is constantly improving as new technologies and understanding of earth sciences improves. Although your site was analyzed using the most appropriate current techniques and methods, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to improvements in the field of geotechnical engineering, physical changes in the site either due to excavation or fill placement, new agency regulations, or possible changes in the proposed structure after the time of completion of the soils report may require the soils report to be professionally reviewed. In light of this, the owner should be aware that there is a practical limit to the usefulness of this report without critical review. Although the time limit for this review is strictly arbitrary, it is suggested that two years be considered a reasonable time for the usefulness of this report.

This report has been prepared for the exclusive use of BP Products North America Inc. and their assigns, for the specific application to the subject site. Foundation and earthwork construction are characterized by the presence of a calculated risk that soil and groundwater conditions have been fully revealed by the original geotechnical investigation. This risk is derived from the practical necessity of basing interpretations and design conclusions on limited sampling of the earth. Our report, design conclusions, and interpretations should not be construed as a warranty of the subsurface conditions. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report.

The recommendations made in this report are based on the assumption that soil conditions do not vary significantly from those encountered during our field investigation. The findings and conclusions of this report can be affected by the passage of time, seasonal weather conditions, manmade influences such as construction on or adjacent to the site, and natural events such as earthquakes, slope instability, flooding, or groundwater fluctuations. If any variations or undesirable conditions are encountered during construction, the geotechnical engineer should be notified so that supplemental recommendations can be made.

The conclusions of this report are based on the information provided regarding the proposed construction. If the proposed construction is relocated or redesigned, the conclusions in this report may not be valid. The geotechnical engineer should be notified of any changes so that the recommendations can be reviewed and re-evaluated.

Misinterpretations of this report by other design team members can result in project delays and cost over-runs. These risks can be reduced by having Krazan & Associates, Inc. involved in the design team's meetings and discussions prior to and following submission of the geotechnical report. Krazan & Associates, Inc. should also be retained to review pertinent elements of the design team's plans and specifications. To reduce the risk of contractors misinterpreting the recommendations of this report, Krazan & Associates should participate in pre-bid and preconstruction meetings, and provide construction observations and testing during the site work.

This report is a geotechnical engineering investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our geotechnical engineering services did not include any environmental site assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater or atmosphere, or the presence of wetlands. Any statements, or absence of statements, in this report or on any test pit or CPT logs regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessments.

The geotechnical information presented herein is based upon professional interpretation utilizing standard engineering practices and a degree of conservatism deemed proper for this project. It is not warranted that such information and interpretation cannot be superseded by future geotechnical developments. We emphasize that this report is valid for this project as outlined above, and should not be used for any other site. Our report is prepared for the exclusive use of our client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (253) 939-2500.

Respectfully submitted,

KRAZAN & ASSOCIATES, INC.

5/6/2022

VIJAY CHAUDHARY
STATE OF WASHINGTON
51061
REGISTERED
PROFESSIONAL ENGINEER

Theresa R. Nunan
Project Manager

Vijay Chaudhary, P.E.
Assistant Regional Engineering Manager

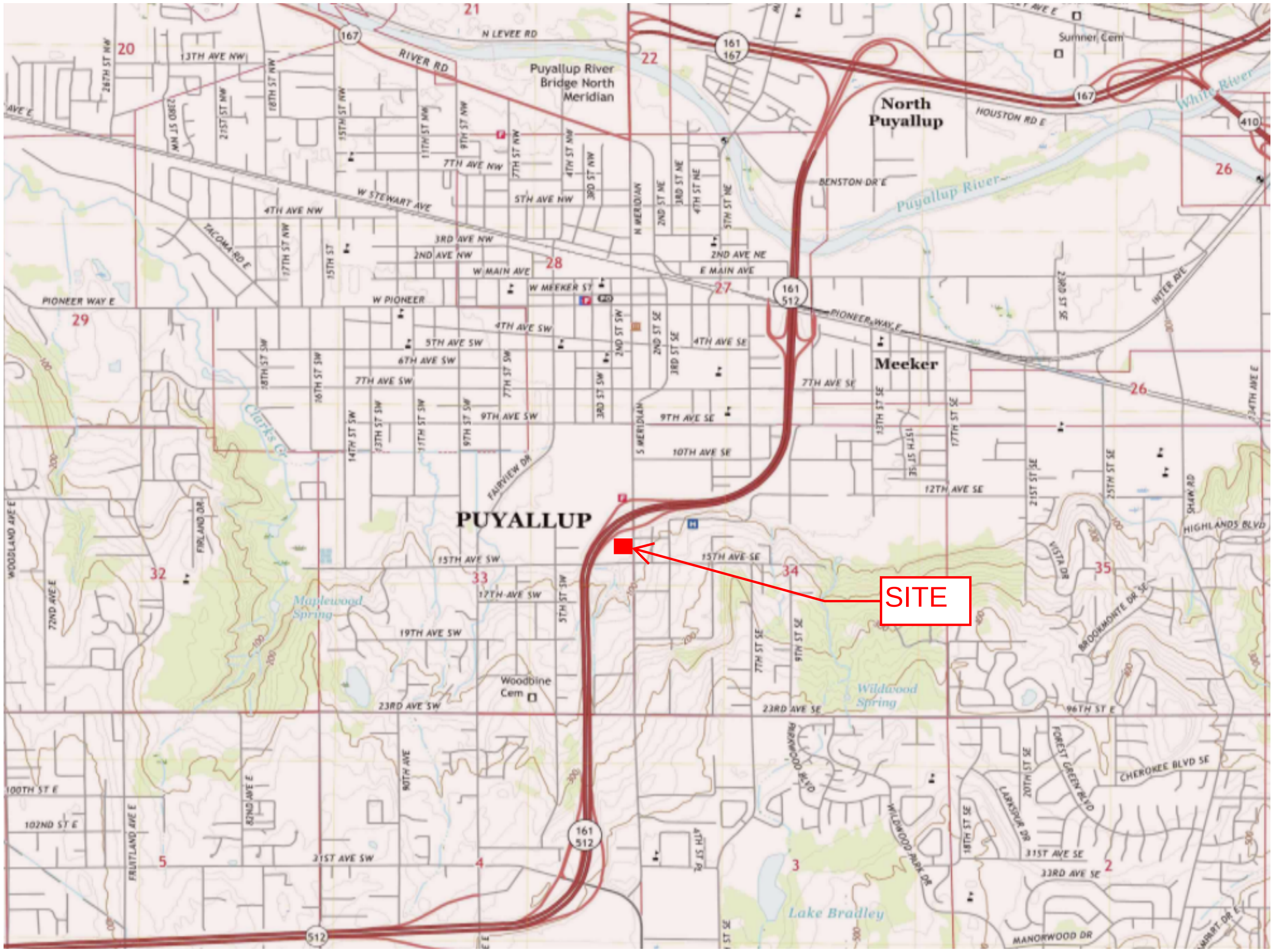


Figure 1: Vicinity Map

Reference: USGS Topographic Map titled "Puyallup Quadrangle, Washington-Pierce County, 7.5-minute series, Puyallup, WA" dated 2020.

Krazan

Project: ARCO ampm Fueling Facility, 1402 S Meridian Avenue, Puyallup, WA		
Date: April 2022	Project Number: 062-22010	
Drawn By: KC	Not to Scale	Figure 1

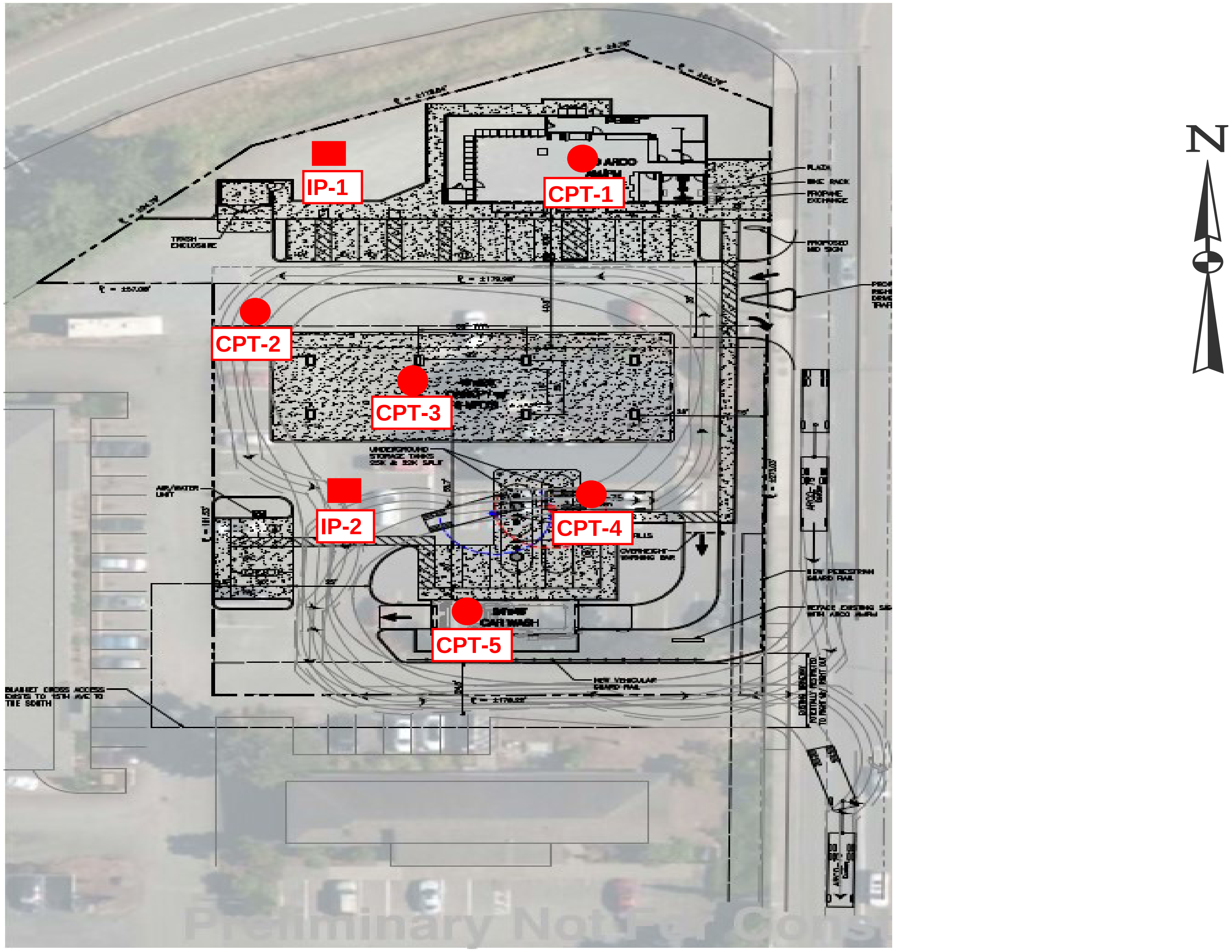


Figure 2: Site Plan

Legend:

TP-1 Test Pit Location

CPT-01 Cone Penetration Test Location

Reference: Preliminary Site Plan, Sheet SP-5, prepared by Barghausen Consulting Engineers, Inc. dated July 9, 2021.

Krazan		
Proposed ARCO ampm Fueling Facility: 1402 S Meridian Ave., Puyallup, WA		
Date: April 9 2020	Project Number: 062-22010	
Drawn By: TRN	Not to Scale	Figure 2

APPENDIX A

FIELD INVESTIGATION AND LIQUEFACTION ANALYSIS

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploration program. Six (6) Cone Penetrometer Tests (CPTs) were conducted for the subsurface investigation at this site. The CPTs were advanced to depths of about 27.0 to 46.3 feet bgs using a subcontracted testing rig. Porewater pressure dissipation tests were conducted in all of the CPTs for evaluation of the static groundwater level at the time of the explorations. Seismic shear wave testing was conducted in CPT-2B, CPT-4, and CPT-5 for use in determining seismic design parameters.

Two (2) test pits were excavated on March 28, 2022 to depths of 4.7 and 7.1 feet bgs using a subcontracted excavator and equipment operator. A geotechnical engineer from Krazan and Associates was present during the explorations, visually classified the soils obtained in the test pits in general accordance with the Unified Soil Classification System (USCS), and maintained logs of the test pits.

The test pit and CPT explorations were located in the field based on existing site features, and their approximate locations are shown on the Site Plan (Figure 2). The test pit and CPT logs are presented in this Appendix. The depths shown on the attached logs are from the existing ground surface at the time of our exploration. The ground surface elevations included on the CPT logs are based on information presented on the Alta/NSPS Land Title Survey prepared by Barghausen Consulting Engineering, Inc. and dated April 19, 2022.

Liquefaction Analysis

The commercially available liquefaction analysis software, NovoCPT from NovoTech, was used to evaluate the liquefaction potential and the possible liquefaction induced settlement for the site soil and groundwater conditions based on our explorations. The analysis was performed using the information from the CPTs. The results of the liquefaction analyses are included in this appendix.

Krazan & ASSOCIATES, INC.

Project: Prop. ARCO ampm Fueling Facility	Project Number: 062-22010	Client: BP Products North America	Test Pit No.: IP-1
Location: 1402 S. Meridian Ave., Puyallup, WA			Contractor: Strickland & Sons Excavation
Project Manager: Theresa Nunan	Date — Started: 3.28.22		Equipment: CAT 306 Excavator with WW
Field Engineer: Theresa Nunan	Date — Completed: 3.28.22		
Groundwater Depth: 5.8 +/- feet (and rising)		Ground Elevation: 46.0 +/- feet	Total Depth of Test Pit: 7.1 feet

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Soil Classification	Notes / Lab Test Results
	0						2" **PEA GRAVEL** Mixed with Silty Sand (FILL)	
	0–2.2						Brown **Silty SAND (SM)** with gravel, trace cobbles, chunks of asphalt, broken clay pipe pieces, medium dense, moist - - - At 1.5 ft., encountered chunks of 6-in. thick asphalt pavement slab - - - becomes loose **(FILL)**	
	2.2–4	BULK	S-1				Dark Brown **MUCK** (Organic Silt and Clay with some fibrous organics), very soft, moist **(SHALCAR MUCK)**	
	4–7.1	BULK	S-2				Dark Grey **SAND (SP-SM) with silt**, fine grained sand, very loose, moist to wet **(ALLUVIUM)**	
	7.1						**Test Pit Terminated at 7.1 Feet**	
	8							

Krazan & ASSOCIATES, INC.

Project: Prop. ARCO ampm Fueling Facility	**Project Number:** 062-22010	**Client:** BP Products North America	**Test Pit No.:**	**IP-2**
Location: 1402 S. Meridian Ave., Puyallup, WA			**Contractor:** Strickland & Sons Excavation	
Project Manager: Theresa Nunan	**Date** — **Started:** 3.28.22		**Equipment:** CAT 306 Excavator with WW	
Field Engineer: Theresa Nunan	**Completed:** 3.28.22			
Groundwater Depth: 2.3 +/- feet (and rising)		**Ground Elevation:** 47.0	**Total Depth of Test Pit:** 4.7 feet	

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Soil Classification	Notes / Lab Test Results
	0						3.5 Inches of **Asphalt Concrete Pavement** underlain by 6 inches of Brown Silty SAND (SM) with gravel **BASE COURSE**	
	1						Tan **Poorly Graded SAND (SP-SM)** with silt, fine to medium grained, loose, moist **(FILL)**	
	2	BULK	S-1				Bluish Grey **SAND (SP-SM)** with silt, very loose, wet **(ALLUVIUM)**	
	3	BULK	S-2				Dark Brown **Organic SILT (OH)**, very soft, wet **(SHALCAR MUCK)**	
	4	BULK	S-3				Dark Grey/Black **Poorly Graded SAND (SP-SM)** with silt, very loose, wet **(ALLUVIUM)**	
	5						**Test Pit Terminated at 4.7 Feet**	
	6							
	7							
	8							

CONETEC

Krazan

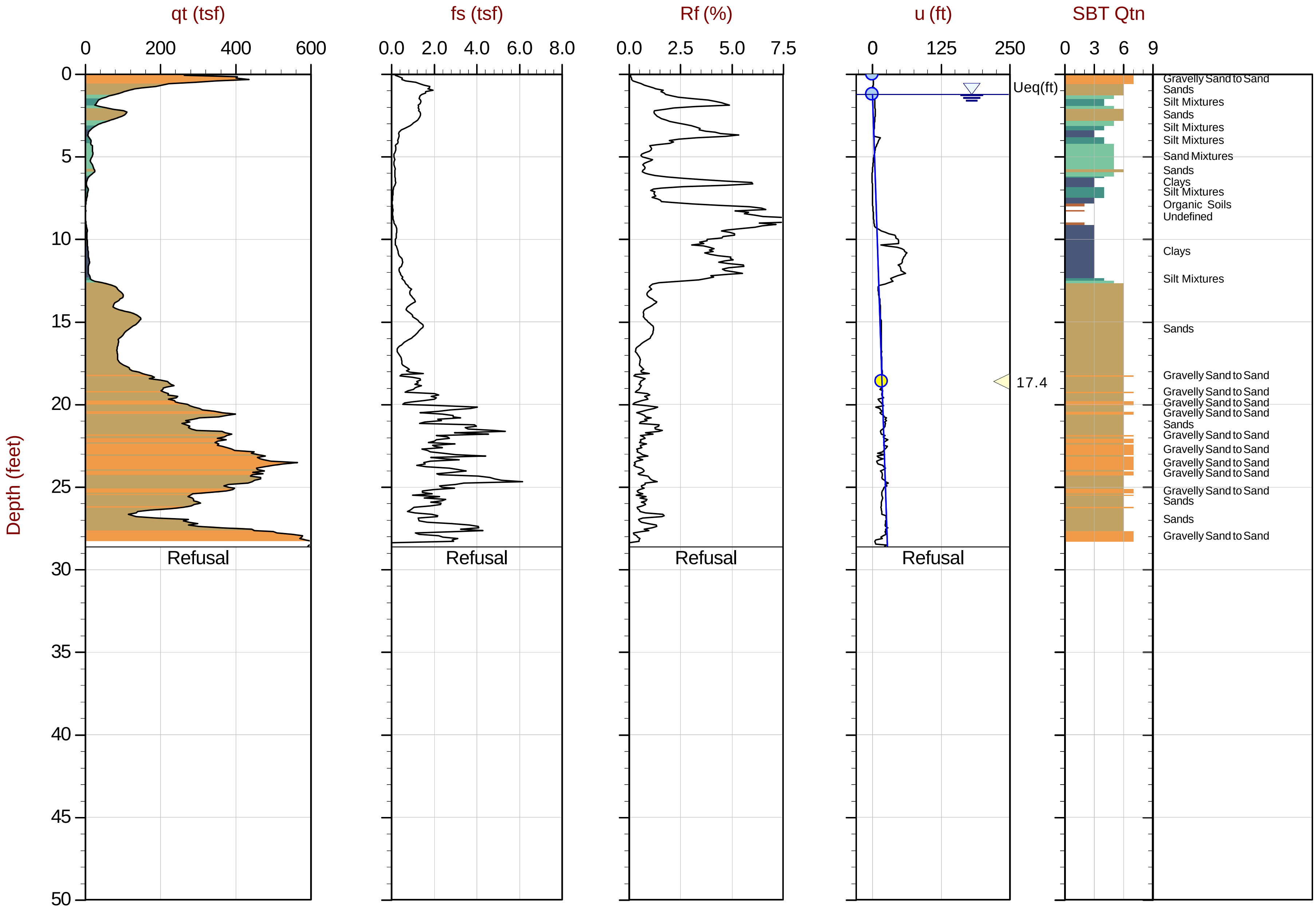
Job No: 22-59-23911

Date: 2022-03-30 13:42

Site: Puyallup CPT

Sounding: CPT-01

Cone: 781:T1500F15U35



Max Depth: 8.725 m / 28.62 ft

Depth Inc: 0.025 m / 0.082 ft

Avg Int: Every Point

File: 22-59-23911_CP01.COR

Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010

Coords: Lat: 47.17887 Long: -122.29399

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

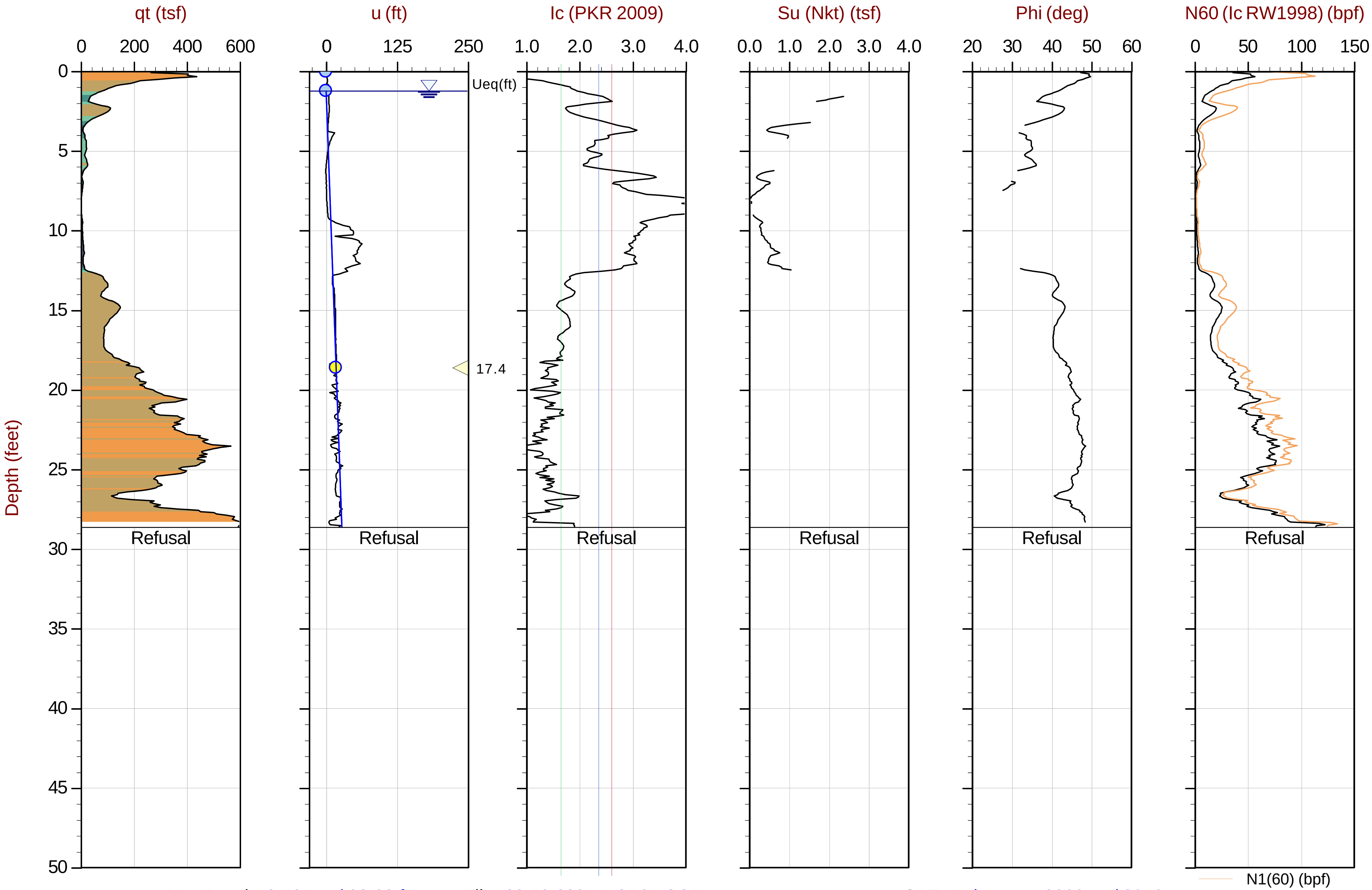
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Krazan

Job No: 22-59-23911
Date: 2022-03-30 13:42
Site: Puyallup CPT

Sounding: CPT-01
Cone: 781:T1500F15U35



Max Depth: 8.725 m / 28.62 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-59-23911_CP01.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17887 Long: -122.29399

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

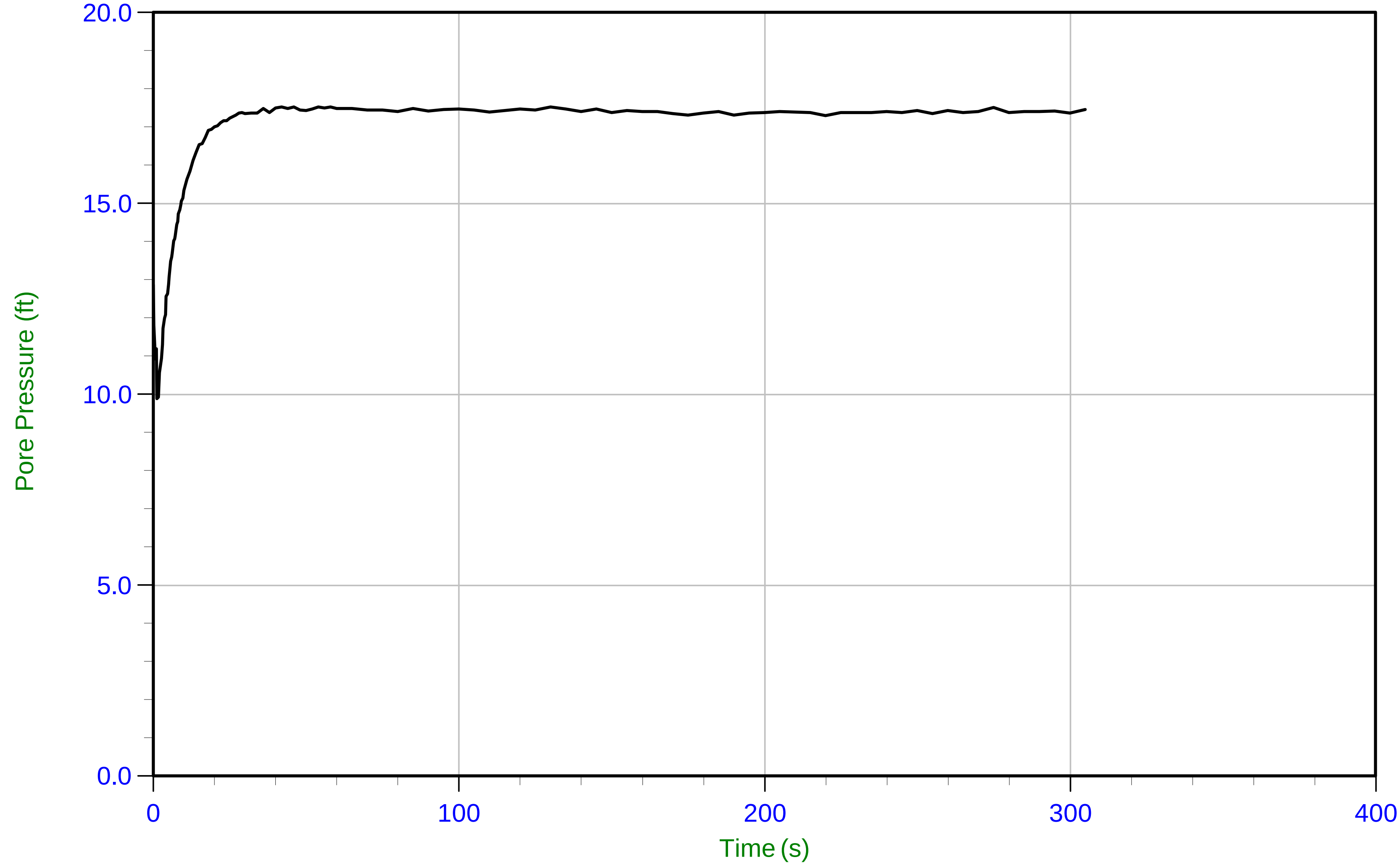
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Krazan

Job No: 22-59-23911
Date: 03/30/2022 13:42
Site: Puyallup

Sounding: CPT-01
Cone: 781:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 22-59-23911_CP01.ppd2
Depth: 5.675 m / 18.619 ft
Duration: 305.0 s

u Min: 9.9 ft
u Max: 17.5 ft
u Final: 17.5 ft

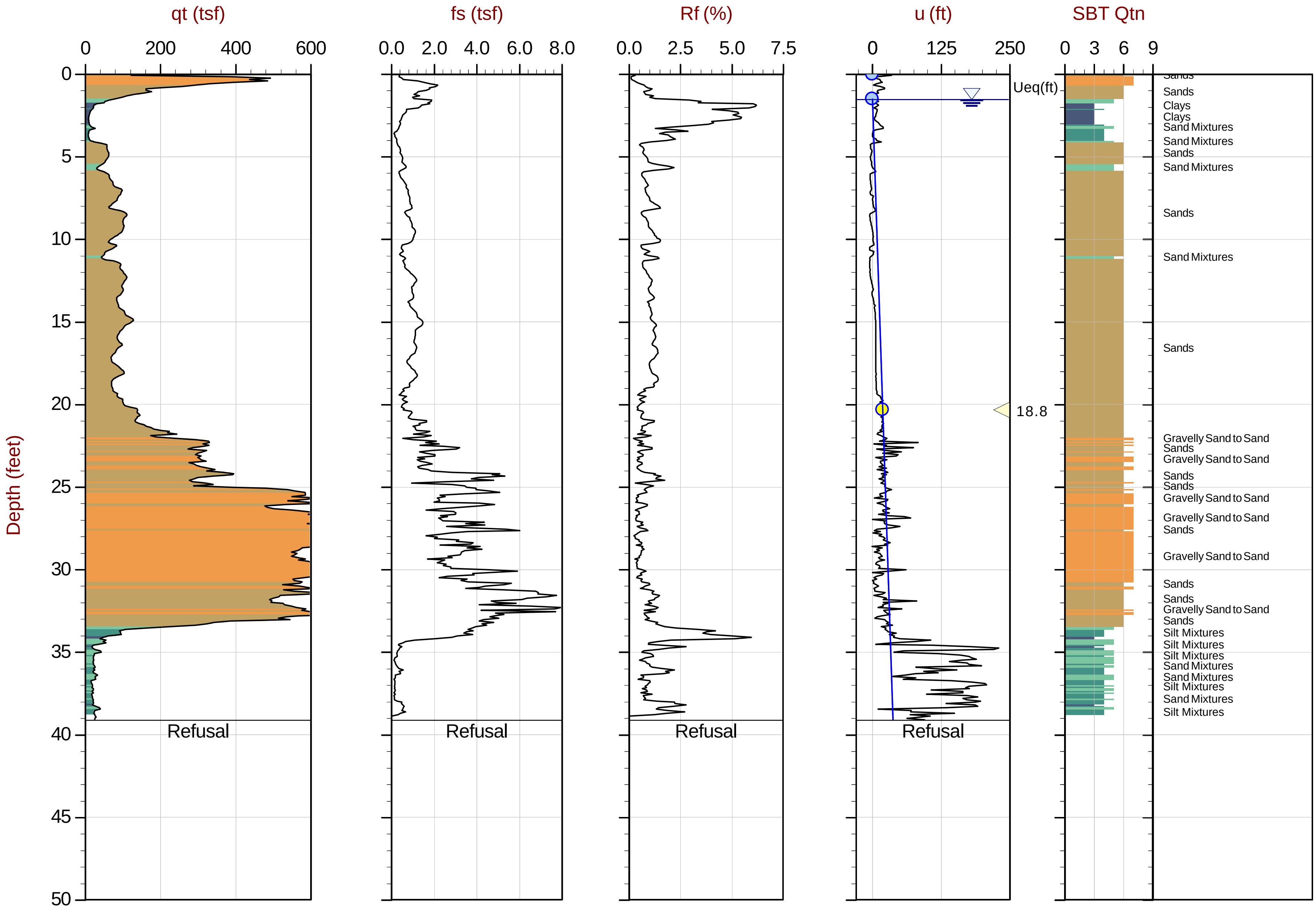
WT: 0.374 m / 1.227 ft
Ueq: 17.4 ft

CONETEC

Krazan

Job No: 22-59-23911
Date: 2022-03-30 14:45
Site: Puyallup CPT

Sounding: CPT-02
Cone: 781:T1500F15U35



Max Depth: 11.925 m / 39.12 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-59-23911_CP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17871 Long: -122.29435

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

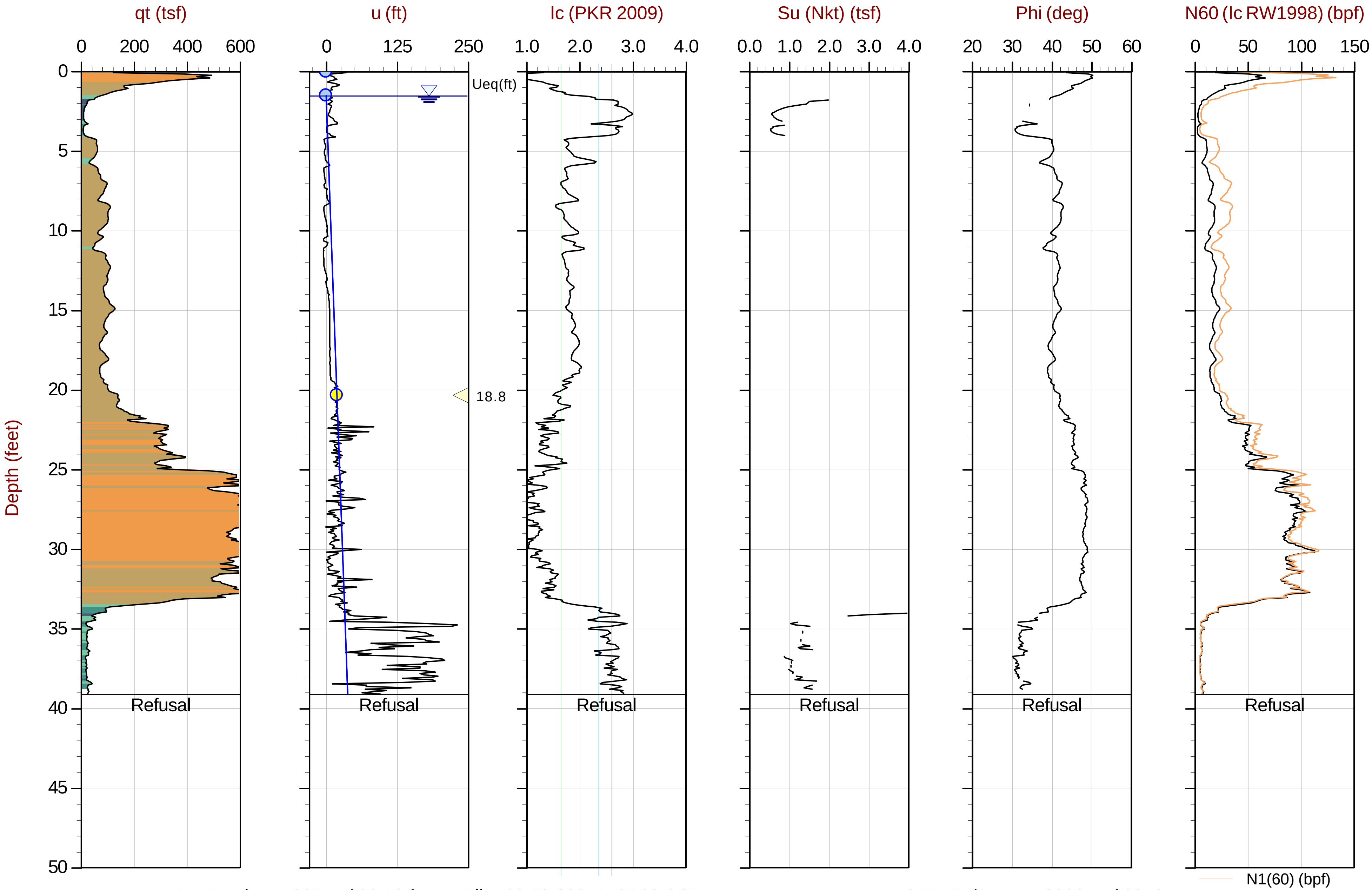
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Krazan

Job No: 22-59-23911
Date: 2022-03-30 14:45
Site: Puyallup CPT

Sounding: CPT-02
Cone: 781:T1500F15U35



Max Depth: 11.925 m / 39.12 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-59-23911_CP02.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17871 Long: -122.29435

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

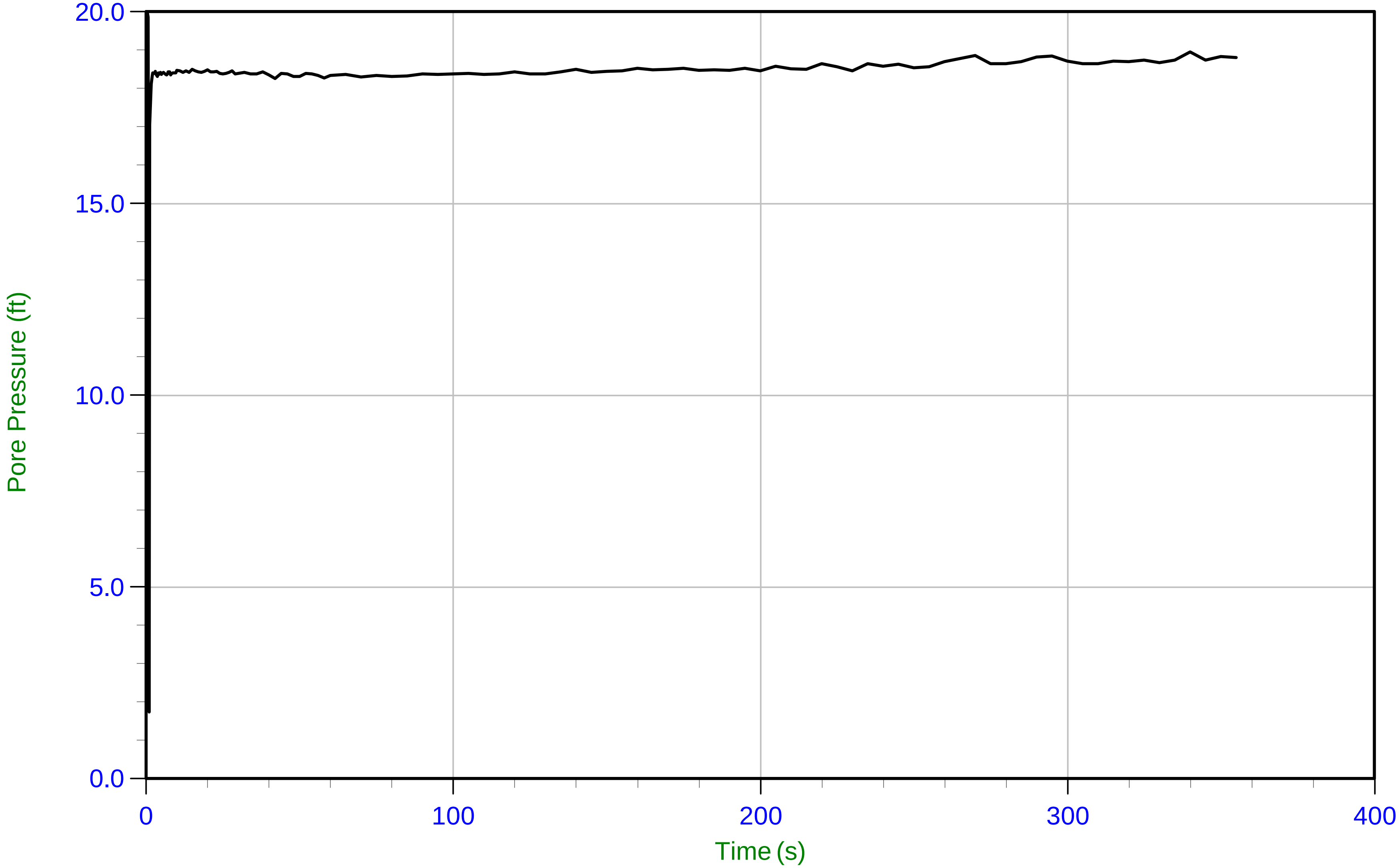
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Krazan

Job No: 22-59-23911
Date: 03/30/2022 14:45
Site: Puyallup

Sounding: CPT-02
Cone: 781:T1500F15U35 Area=15 cm²



Trace Summary:

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Duration: 355.0 s

u Min: 1.7 ft
u Max: 20.1 ft
u Final: 18.8 ft

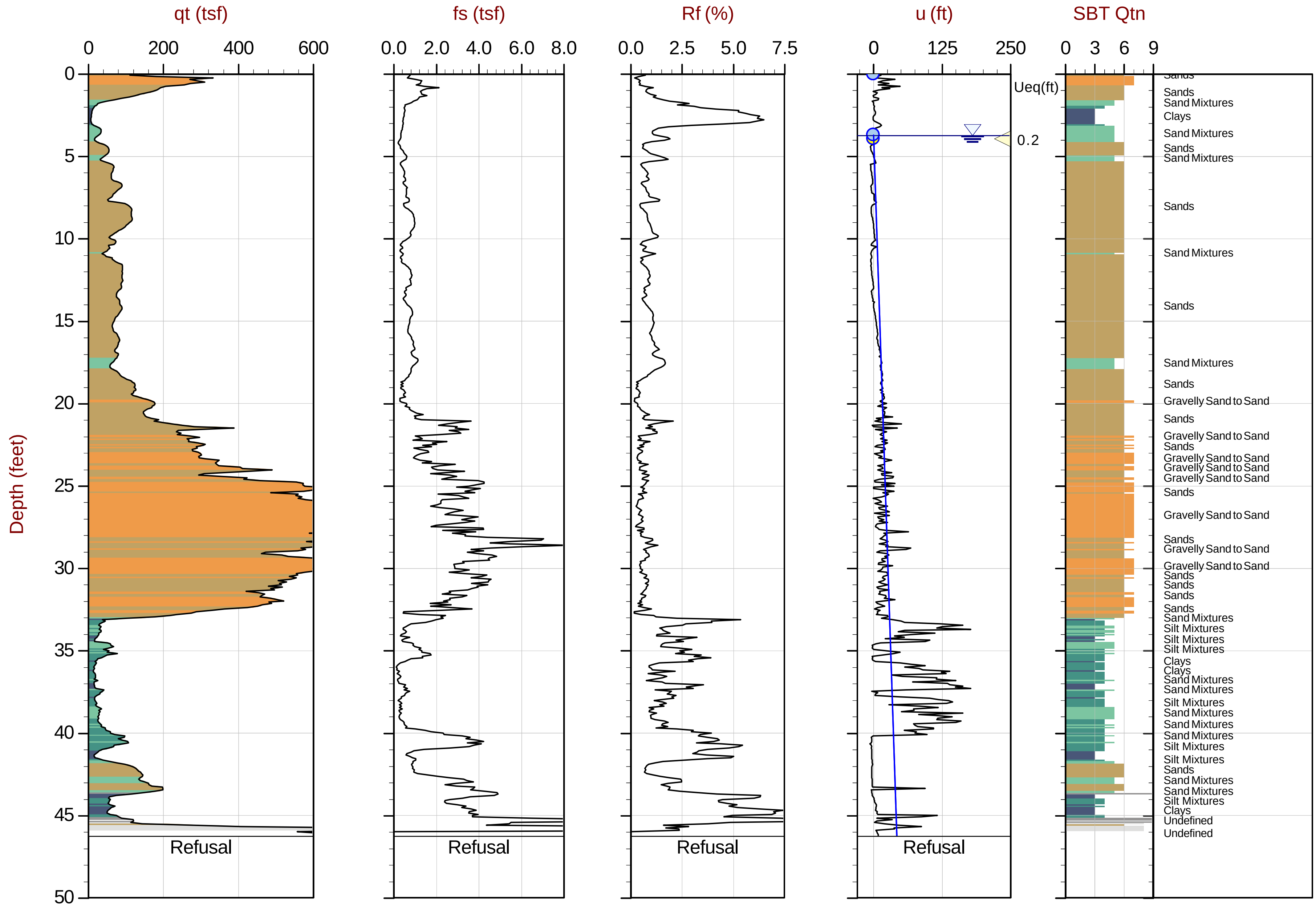
WT: 0.461 m / 1.513 ft
Ueq: 18.8 ft

CONETEC

Krazan

Job No: 22-59-23911
Date: 2022-03-30 17:07
Site: Puyallup CPT

Sounding: CPT-02B
Cone: 781:T1500F15U35



Max Depth: 14.100 m / 46.26 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-59-23911_SP02B.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.47872 Long: -122.29435

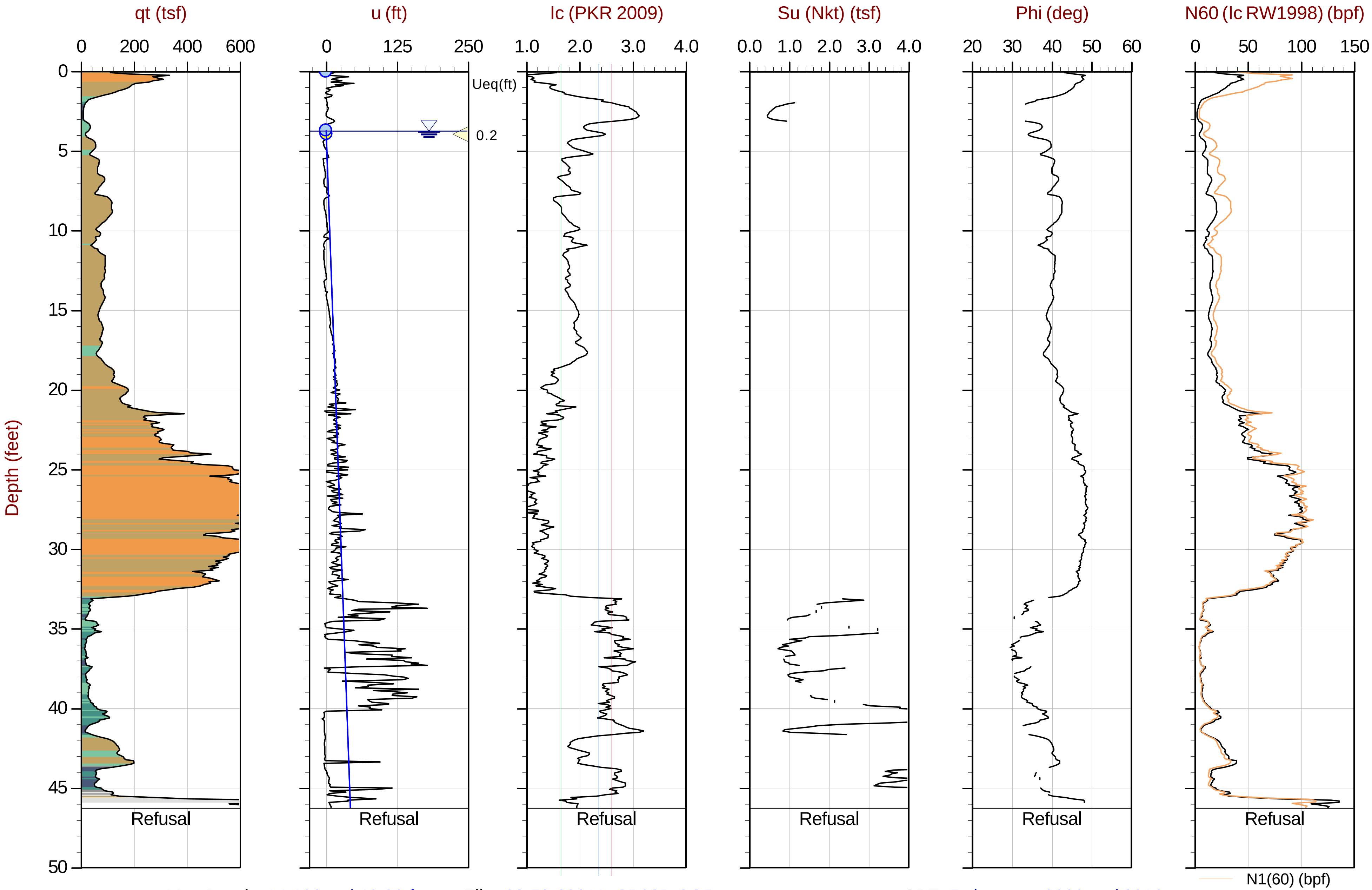
Equilibrium Pore Pressure (Ueq) · Assumed Ueq · Dissipation, Ueq achieved · Dissipation, Ueq not achieved · Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Krazan

Job No: 22-59-23911
Date: 2022-03-30 17:07
Site: Puyallup CPT
Sounding: CPT-02B
Cone: 781:T1500F15U35



Max Depth: 14.100 m / 46.26 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

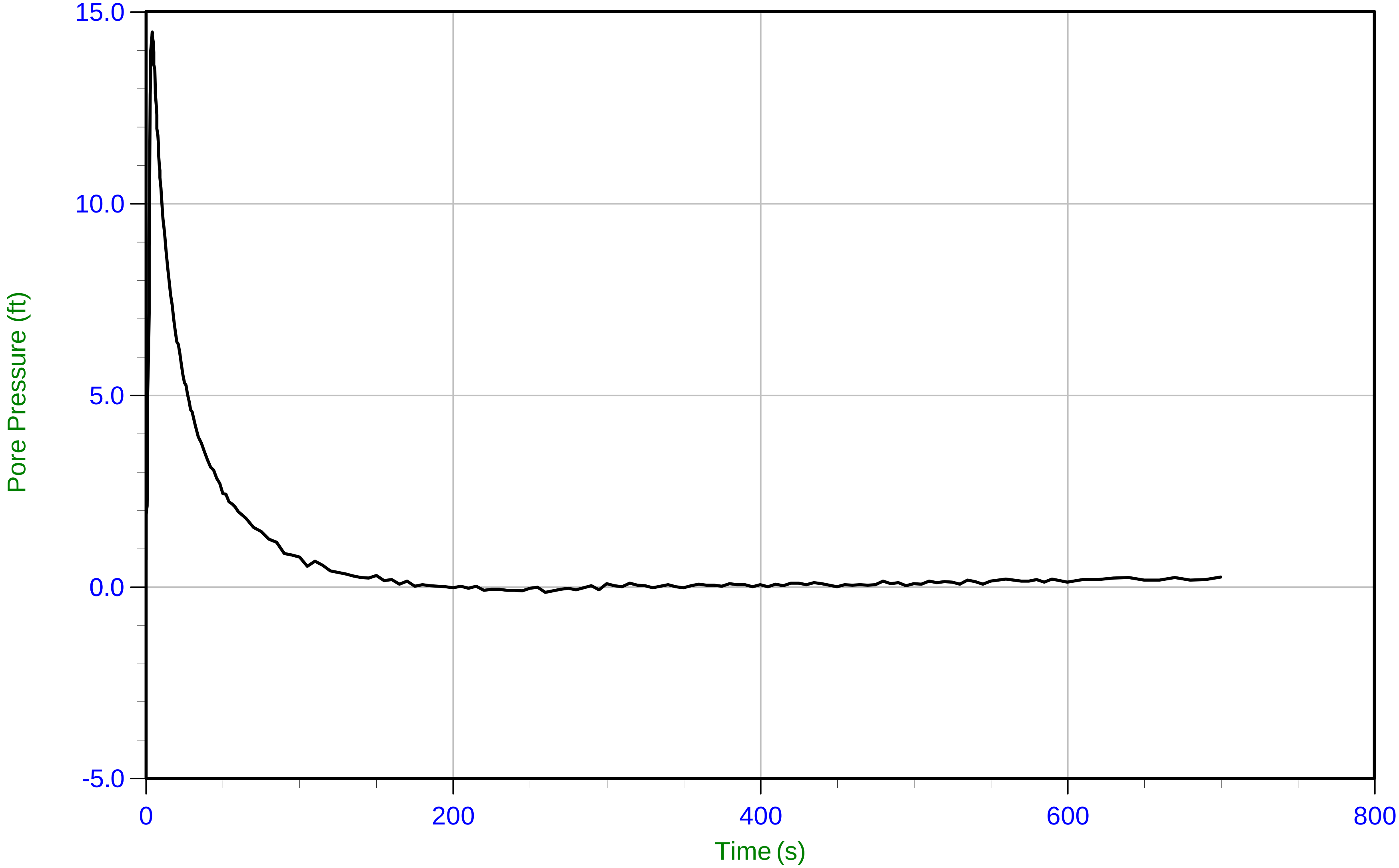
File: 22-59-23911_SP02B.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.47872 Long: -122.29435

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC	Krazan	Job No: 22-59-23911 Date: 03/30/2022 17:07 Site: Puyallup	Sounding: CPT-02B Cone: 781:T1500F15U35 Area=15 cm²



Trace Summary:

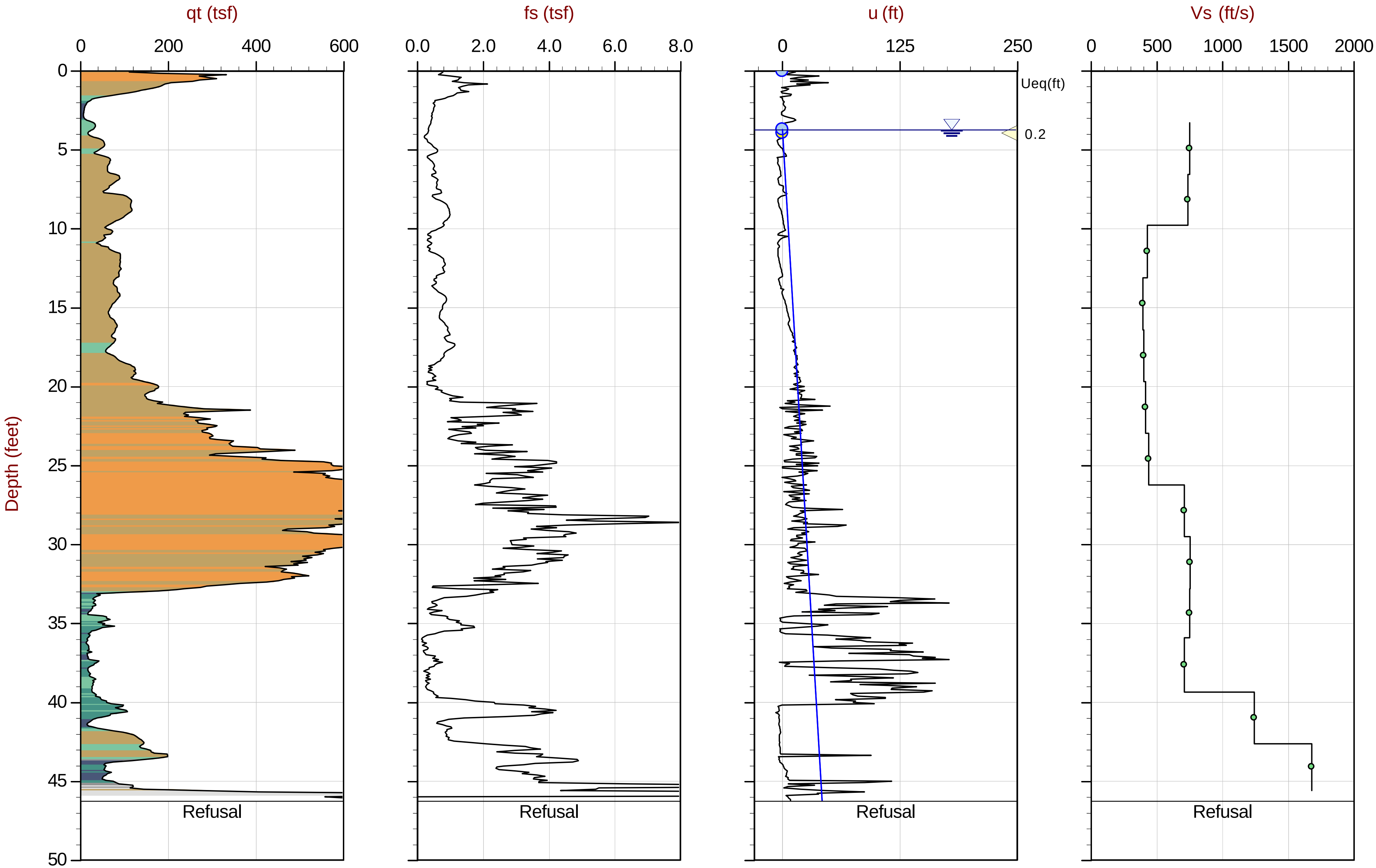
Filename: 22-59-23911_SP02B.ppd2	u Min: -0.1 ft	WT: 1.134 m / 3.720 ft
Depth: 1.200 m / 3.937 ft	u Max: 14.5 ft	Ueq: 0.2 ft
Duration: 700.0 s	u Final: 0.3 ft	

CONETEC

Krazan

Job No: 22-59-23911
Date: 2022-03-30 17:07
Site: Puyallup CPT

Sounding: CPT-02B
Cone: 781:T1500F15U35



Max Depth: 14.100 m / 46.26 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-59-23911_SP02B.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.47872 Long: -122.29435

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

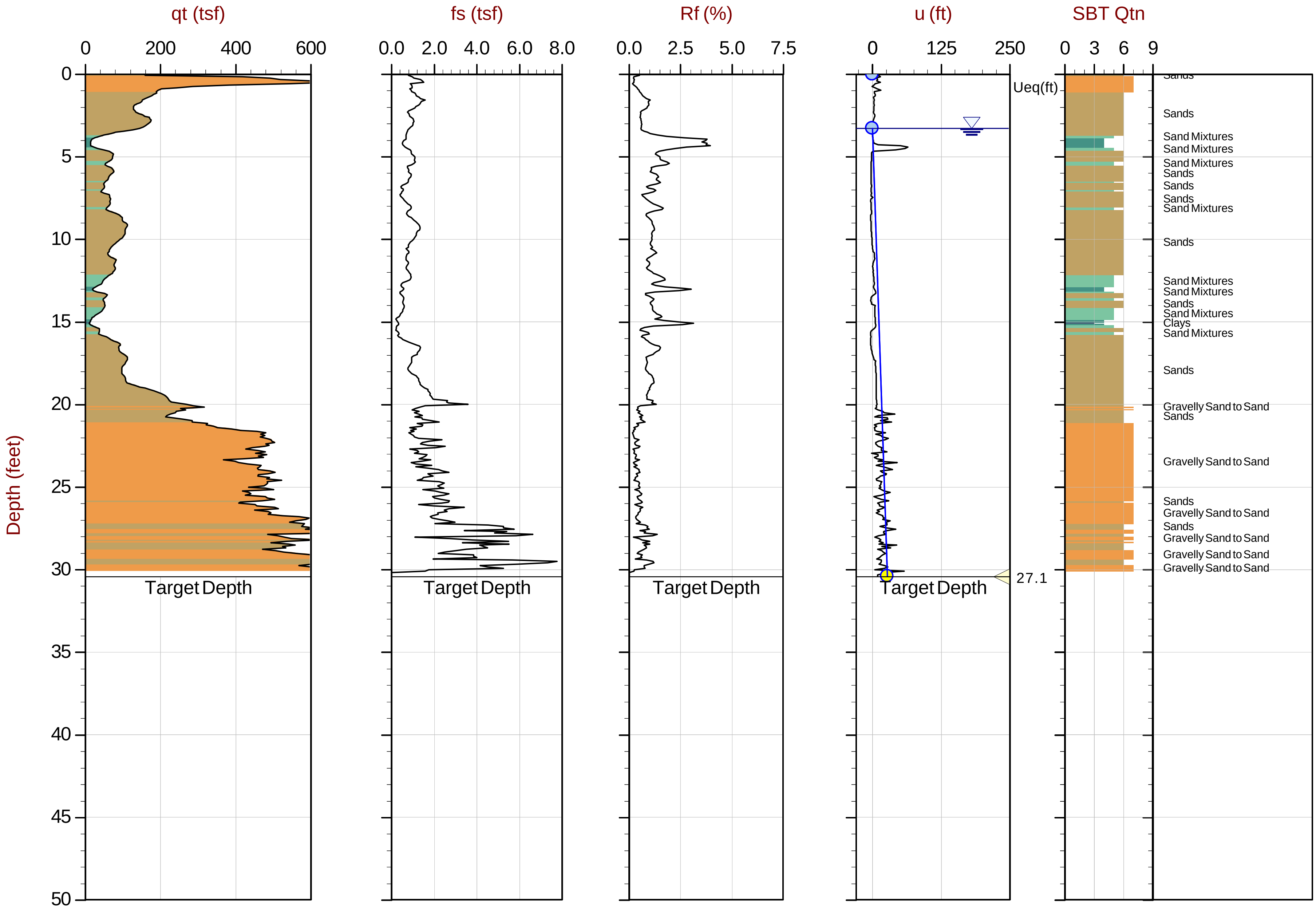
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Krazan

Job No: 22-59-23911
Date: 2022-03-30 15:29
Site: Puyallup CPT

Sounding: CPT-03
Cone: 781:T1500F15U35



Max Depth: 9.275 m / 30.43 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-59-23911_CP03.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17856 Long: -122.29418

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

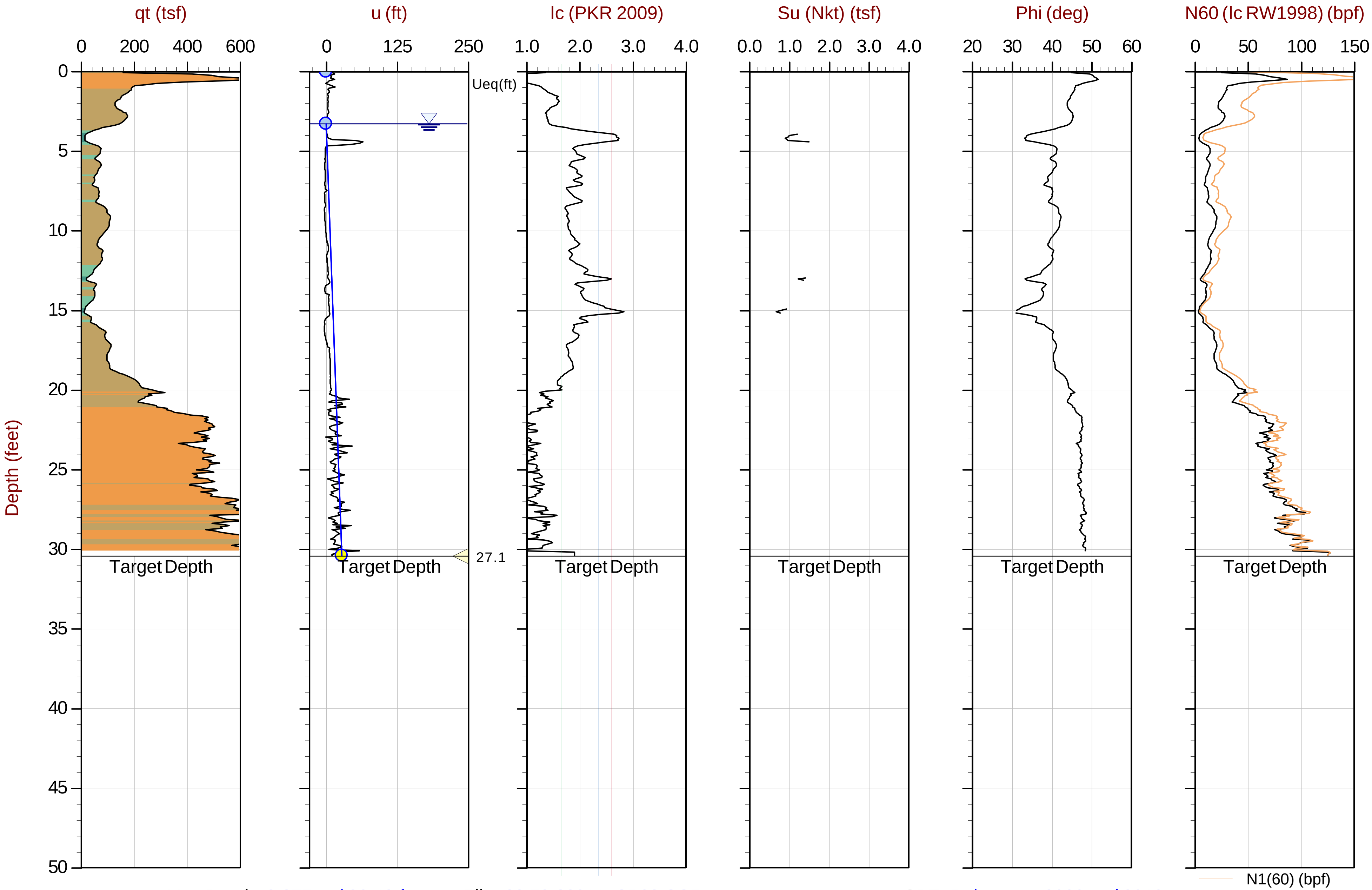
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Krazan

Job No: 22-59-23911
Date: 2022-03-30 15:29
Site: Puyallup CPT

Sounding: CPT-03
Cone: 781:T1500F15U35



Max Depth: 9.275 m / 30.43 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

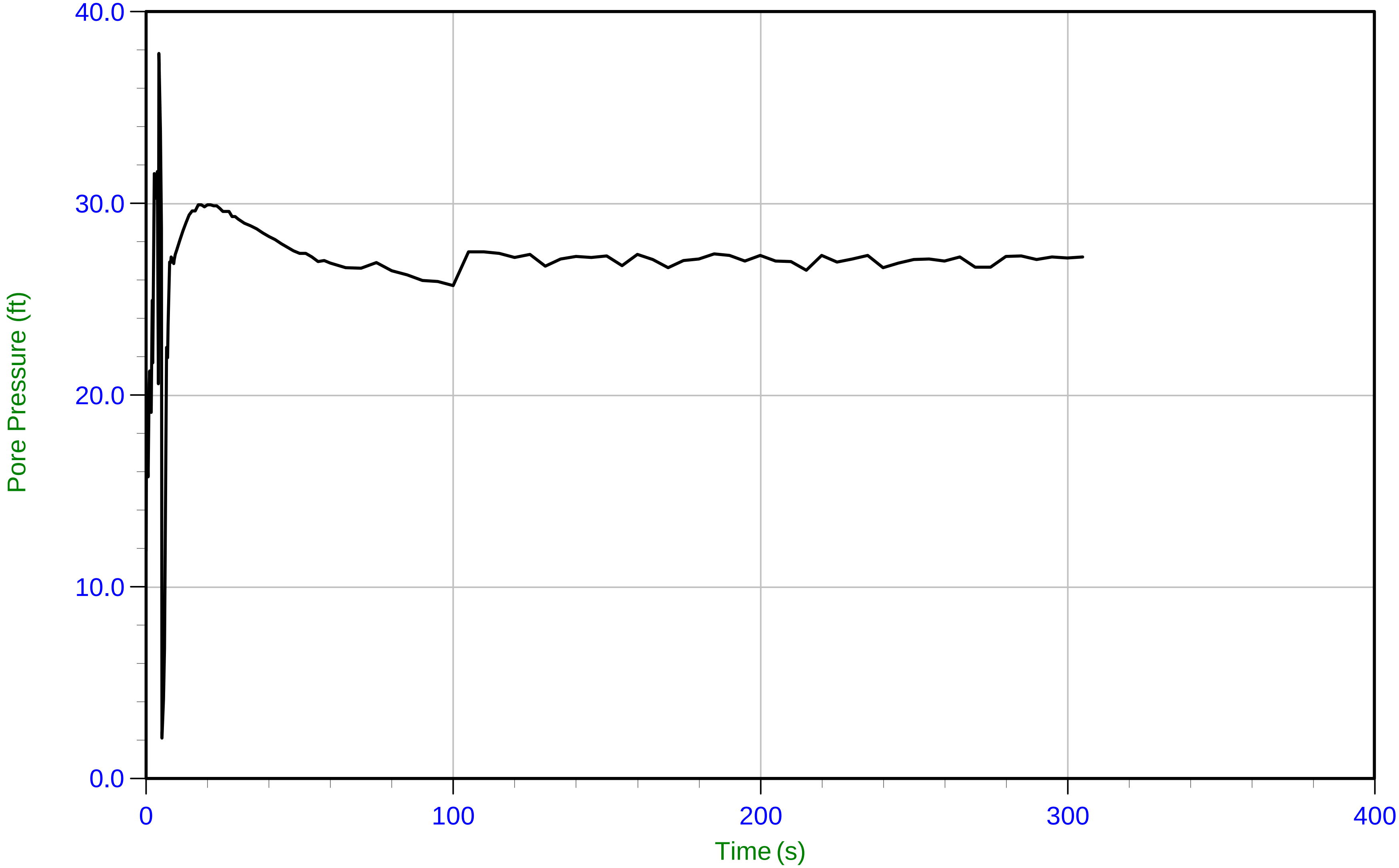
File: 22-59-23911_CP03.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17856 Long: -122.29418

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Krazan	Job No: 22-59-23911 Date: 03/30/2022 15:29 Site: Puyallup	Sounding: CPT-03 Cone: 781:T1500F15U35 Area=15 cm²



Trace Summary:

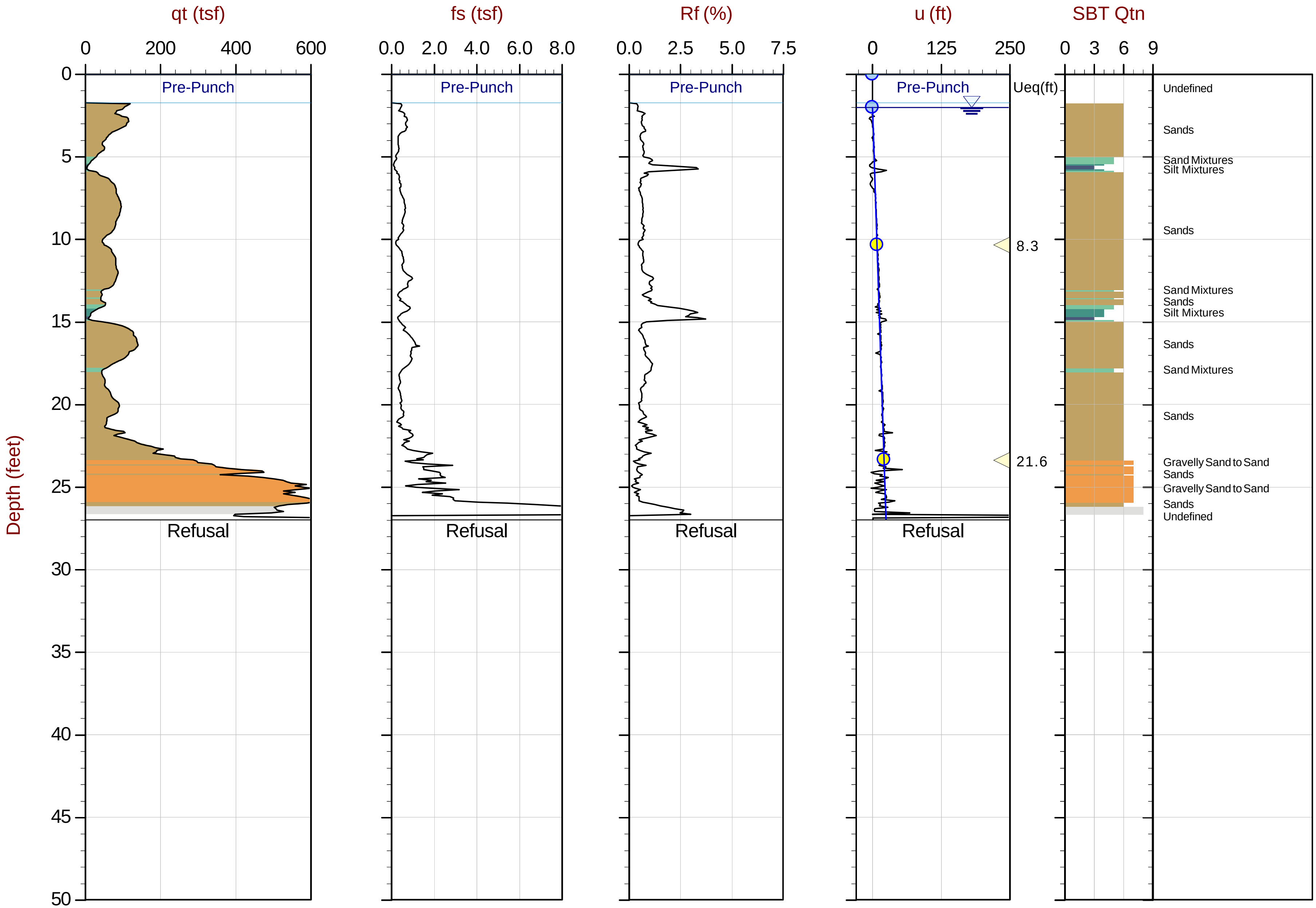
Filename: 22-59-23911_CP03.ppd2	u Min: 2.1 ft	WT: 1.001 m / 3.284 ft
Depth: 9.275 m / 30.429 ft	u Max: 37.8 ft	Ueq: 27.1 ft
Duration: 305.0 s	u Final: 27.2 ft	

ConeTec

Krazan

Job No: 22-59-23911
Date: 2022-03-30 12:23
Site: Puyallup CPT

Sounding: CPT-04
Cone: 781:T1500F15U35



Max Depth: 8.225 m / 26.98 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

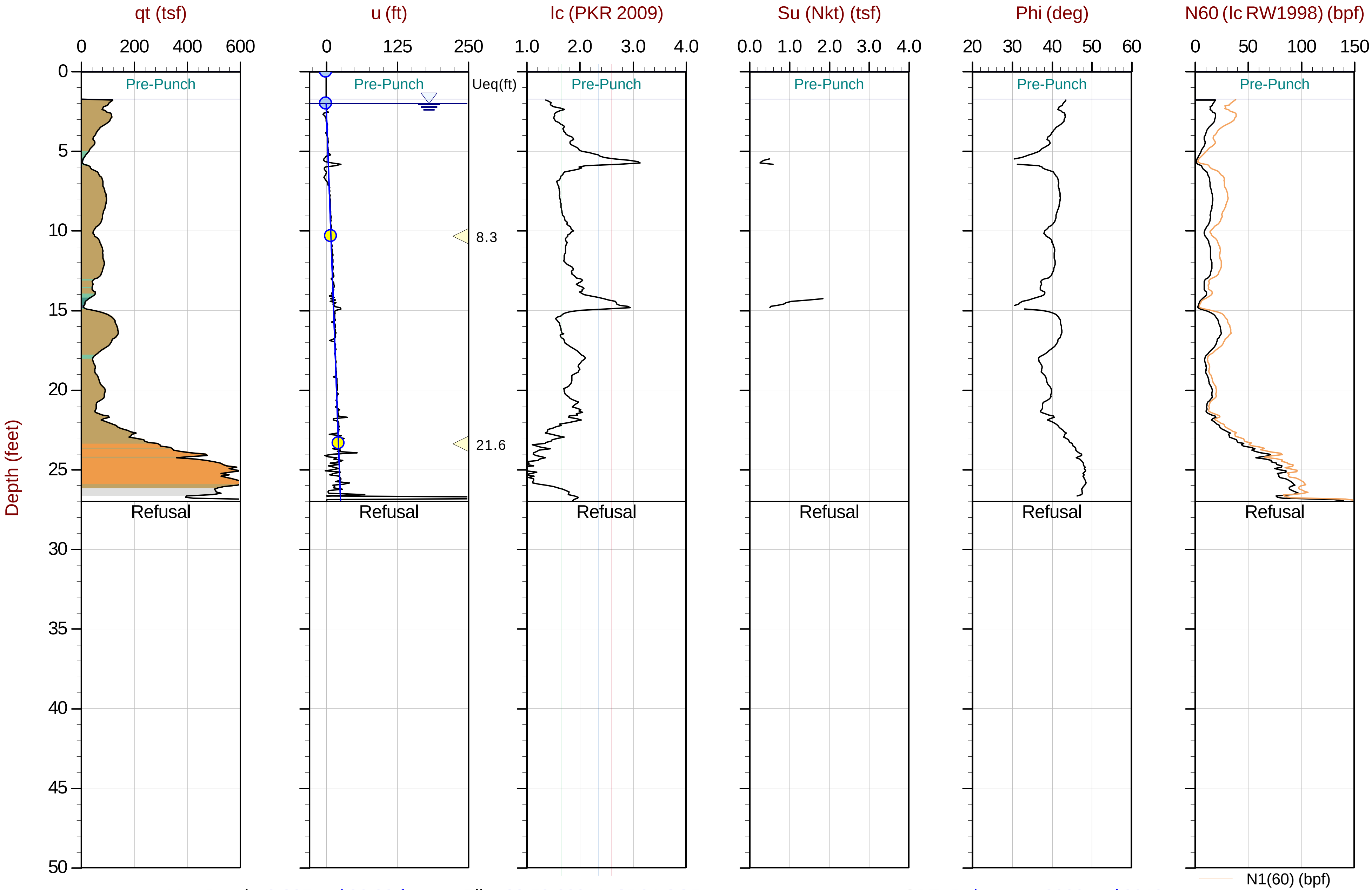
File: 22-59-23911_SP04.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17839 Long: -122.29395

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Job No: 22-59-23911
Date: 2022-03-30 12:23
Site: Puyallup CPT
Sounding: CPT-04
Cone: 781:T1500F15U35



Max Depth: 8.225 m / 26.98 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-59-23911_SP04.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17839 Long: -122.29395

Equilibrium Pore Pressure (Ueq) · Assumed Ueq · Dissipation, Ueq achieved · Dissipation, Ueq not achieved · Hydrostatic Line

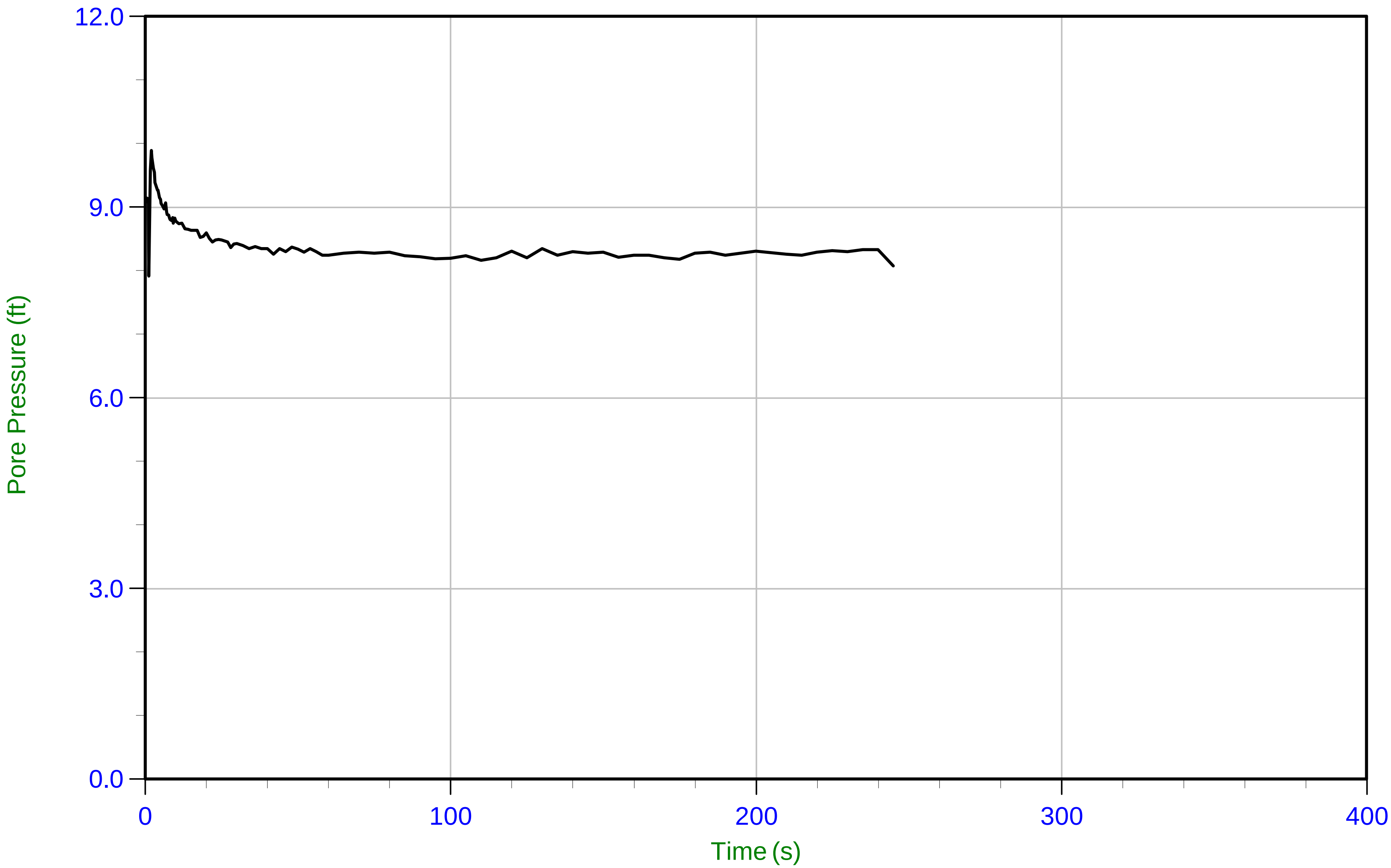
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Krazan

Job No: 22-59-23911
Date: 03/30/2022 12:23
Site: Puyallup

Sounding: CPT-04
Cone: 781:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 22-59-23911_SP04.ppd2
Depth: 3.150 m / 10.335 ft
Duration: 245.0 s

u Min: 7.9 ft
u Max: 9.9 ft
u Final: 8.1 ft

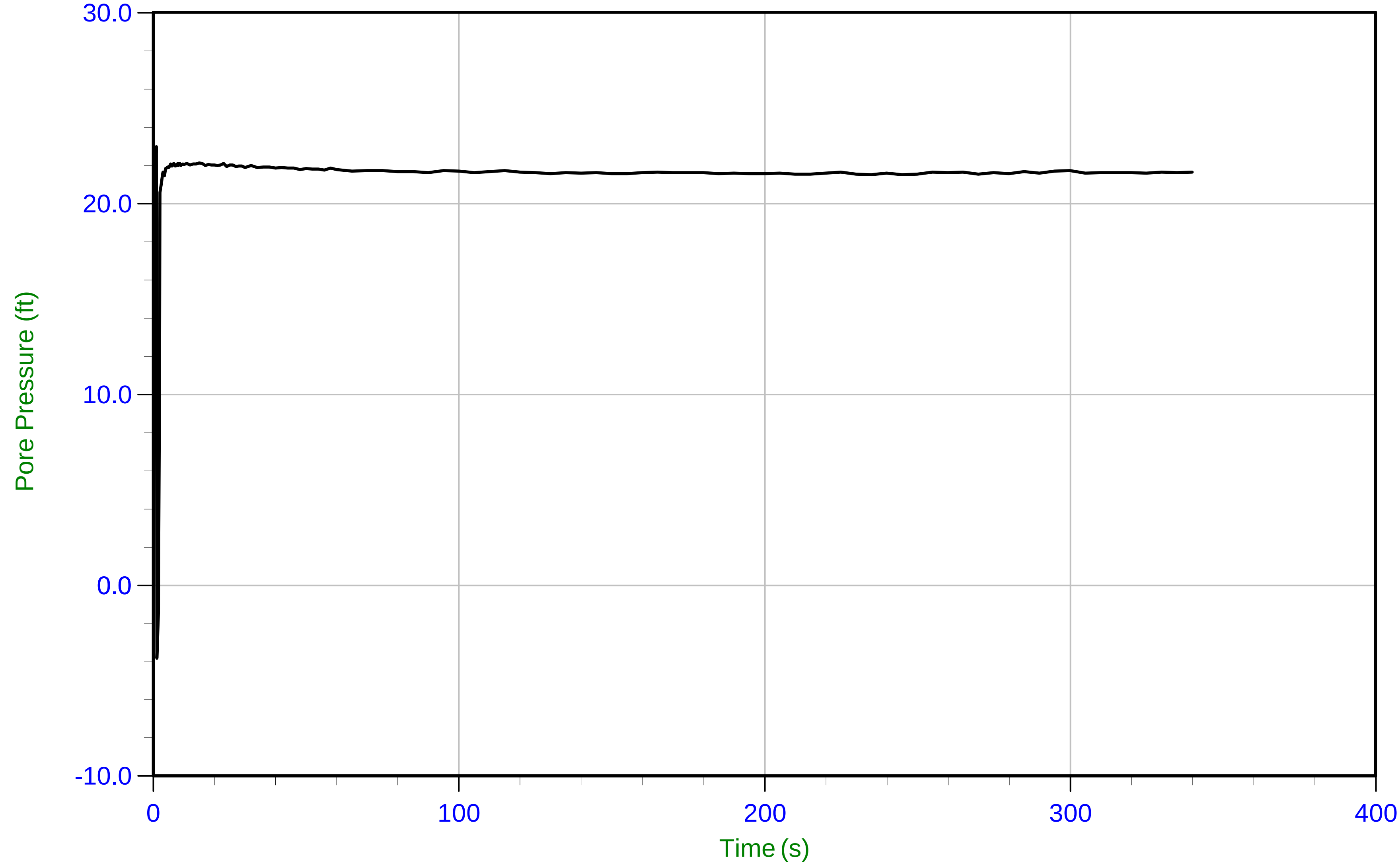
WT: 0.612 m / 2.009 ft
Ueq: 8.3 ft

CONETEC

Krazan

Job No: 22-59-23911
Date: 03/30/2022 12:23
Site: Puyallup

Sounding: CPT-04
Cone: 781:T1500F15U35 Area=15 cm²



Trace Summary:

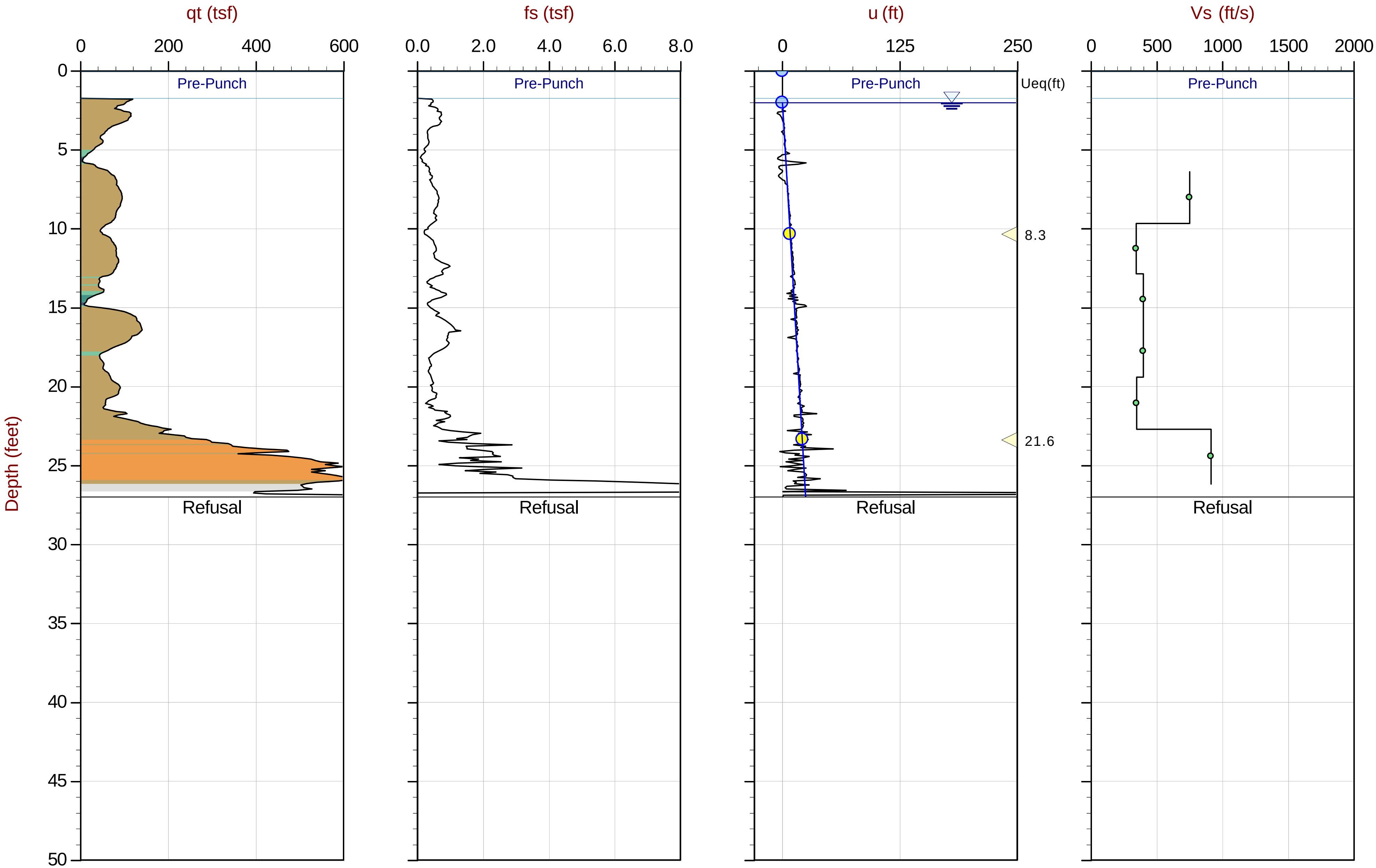
Filename: 22-59-23911_SP04.ppd2
Depth: 7.125 m / 23.376 ft
Duration: 340.0 s

u Min: -3.8 ft
u Max: 23.0 ft
u Final: 21.7 ft

WT: 0.542 m / 1.779 ft
Ueq: 21.6 ft

Krazan

Job No: 22-59-23911
Date: 2022-03-30 12:23
Site: Puyallup CPT
Sounding: CPT-04
Cone: 781:T1500F15U35



Max Depth: 8.225 m / 26.98 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-59-23911_SP04.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17839 Long: -122.29395

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

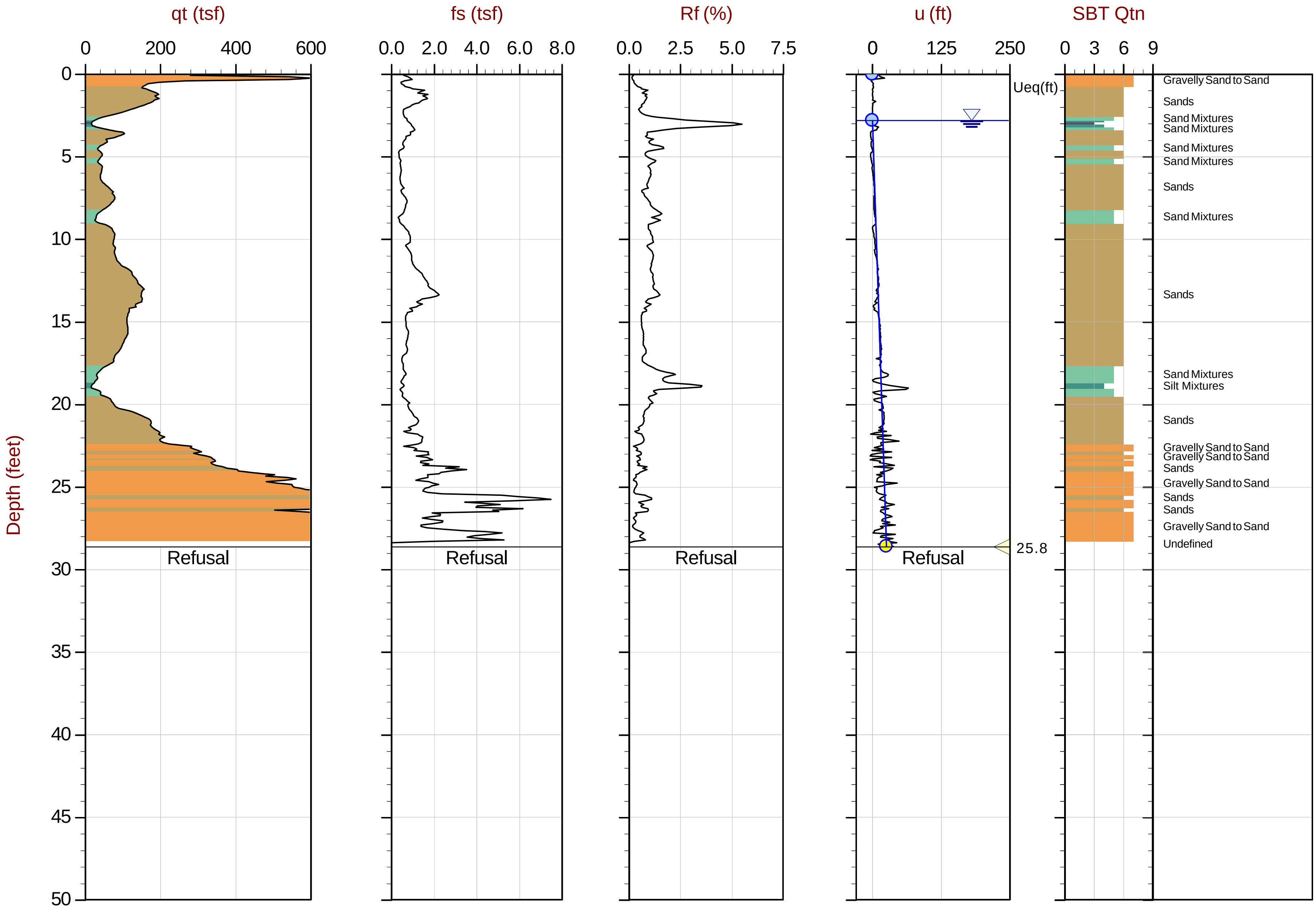
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Krazan

Job No: 22-59-23911
Date: 2022-03-30 16:06
Site: Puyallup CPT

Sounding: CPT-05
Cone: 781:T1500F15U35



Max Depth: 8.725 m / 28.62 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

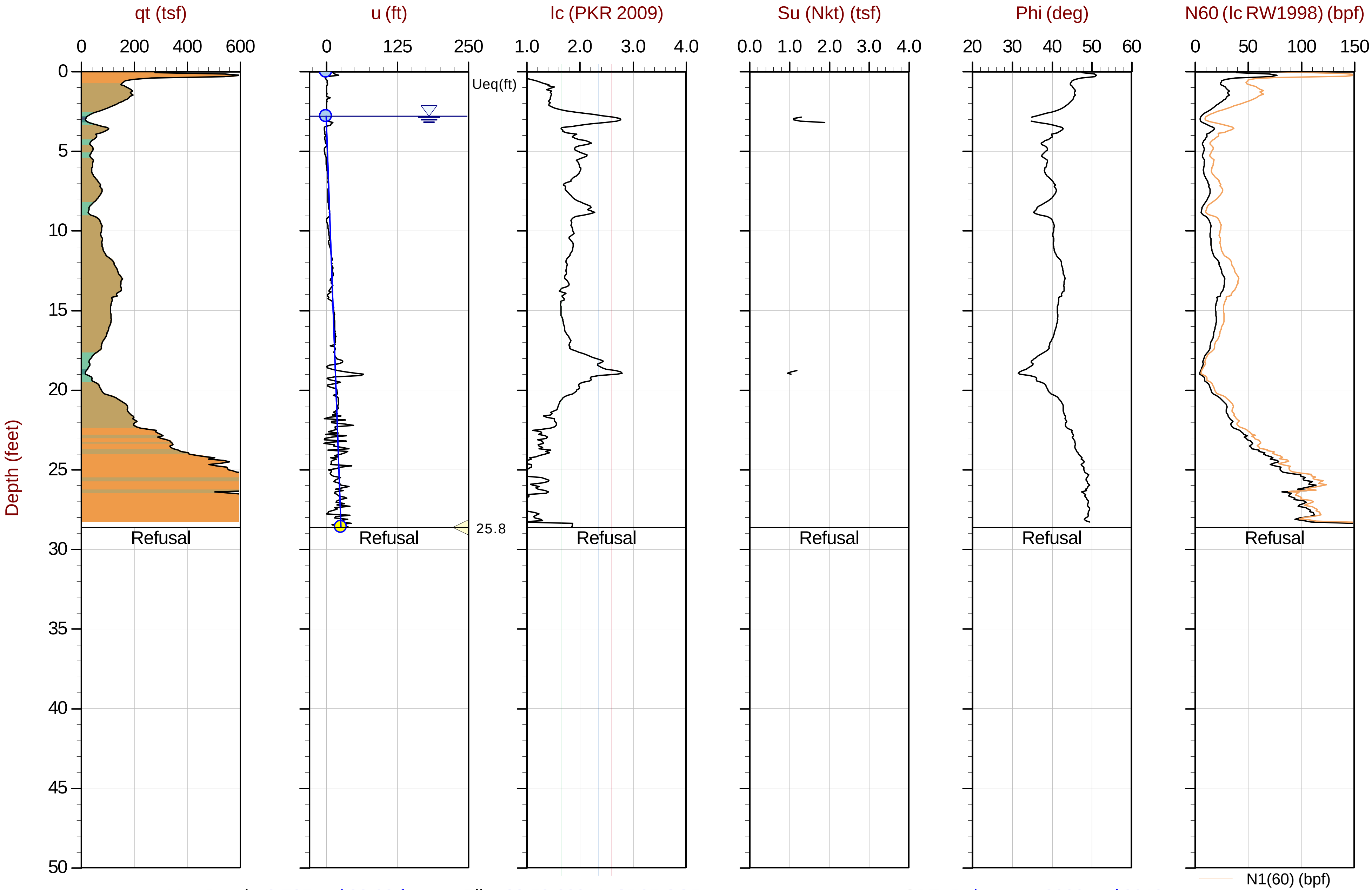
File: 22-59-23911_SP05.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17827 Long: -122.29415

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Krazan	Job No: 22-59-23911	Sounding: CPT-05
	Date: 2022-03-30 16:06	Cone: 781:T1500F15U35
	Site: Puyallup CPT	



Max Depth: 8.725 m / 28.62 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-59-23911_SP05.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17827 Long: -122.29415

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

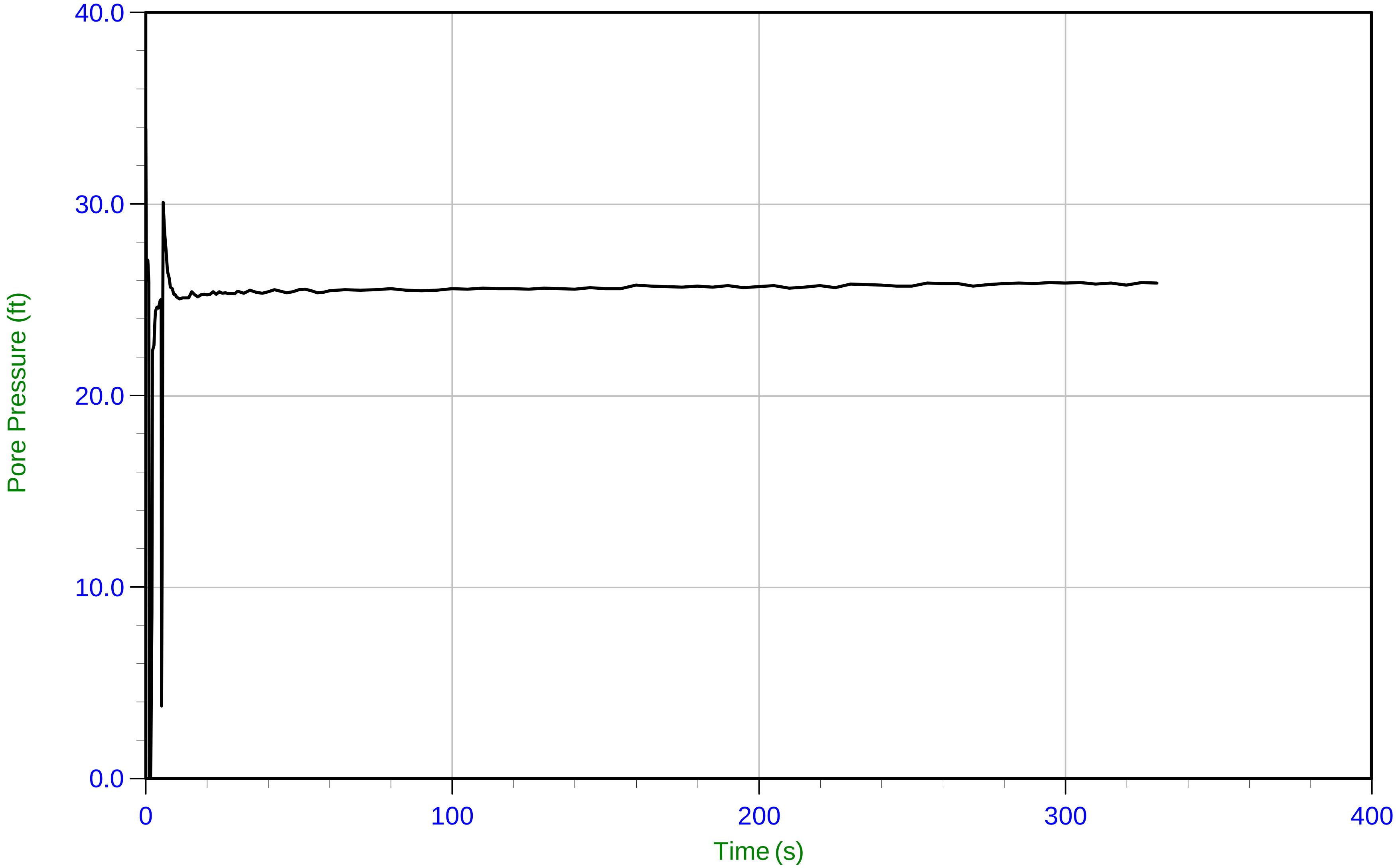
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Krazan

Job No: 22-59-23911
Date: 03/30/2022 16:06
Site: Puyallup

Sounding: CPT-05
Cone: 781:T1500F15U35 Area=15 cm²



Trace Summary:

Filename: 22-59-23911_SP05.ppd2
Depth: 8.725 m / 28.625 ft
Duration: 330.0 s

u Min: -3.3 ft
u Max: 33.9 ft
u Final: 25.9 ft

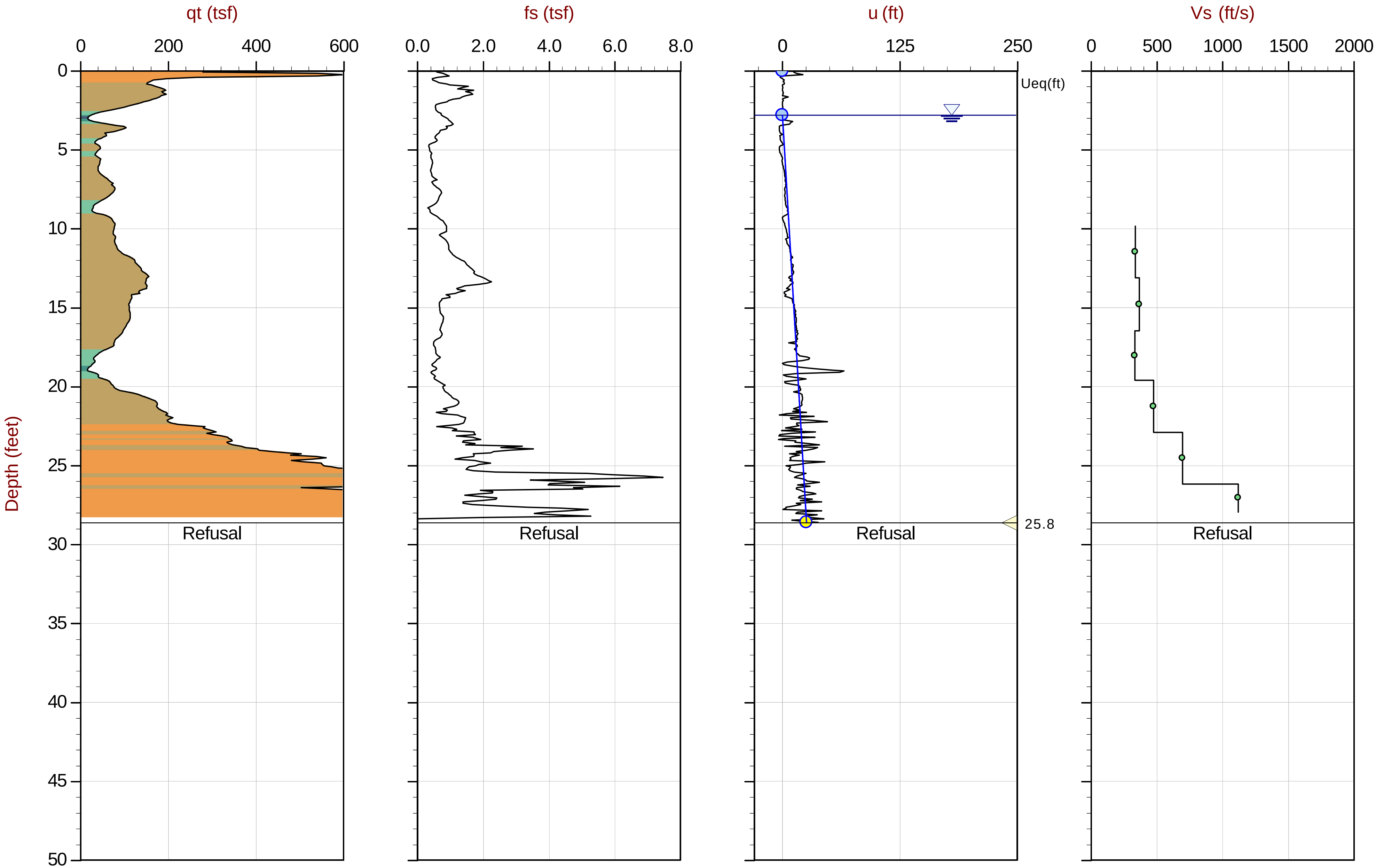
WT: 0.854 m / 2.802 ft
Ueq: 25.8 ft

CONETEC

Krazan

Job No: 22-59-23911
Date: 2022-03-30 16:06
Site: Puyallup CPT

Sounding: CPT-05
Cone: 781:T1500F15U35



Max Depth: 8.725 m / 28.62 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 22-59-23911_SP05.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: Lat: 47.17827 Long: -122.29415

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

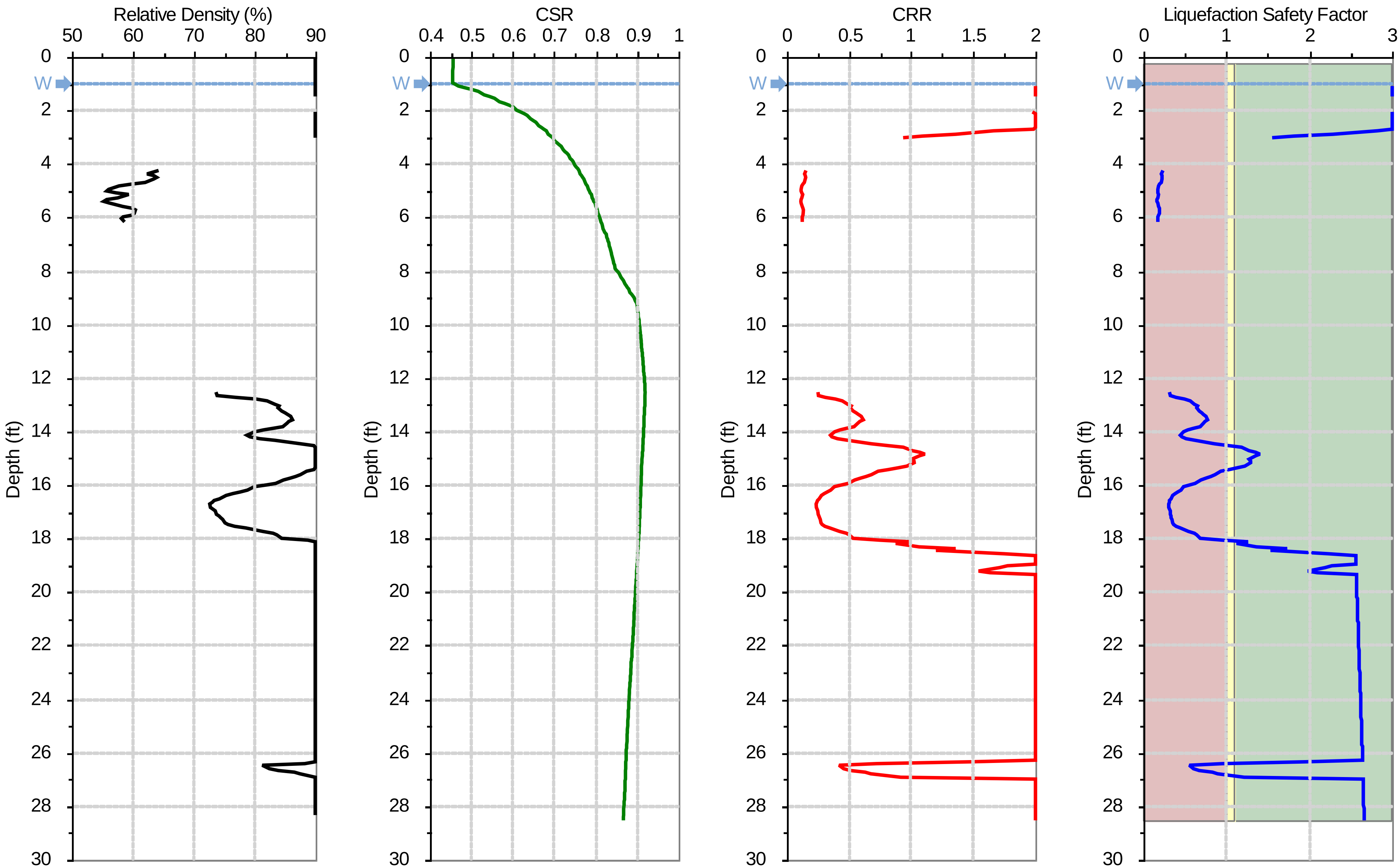
LIQUEFACTION CPT ANALYSIS REPORT

Theresa Nunan

Project :
Project No. :
Client :
Location :
Notes :

Borehole : CPT-1
Ground Water Level : 1 ft
Coordinates : n.a.
Calculated By :

Ground Slope : Gently Sloped 0.3%
PGA = 0.7 g, EQ. Magnitude M = 7.1
Cone Area Ratio = 0.8
CPT Max. Depth = 28.63 ft
Checked By :



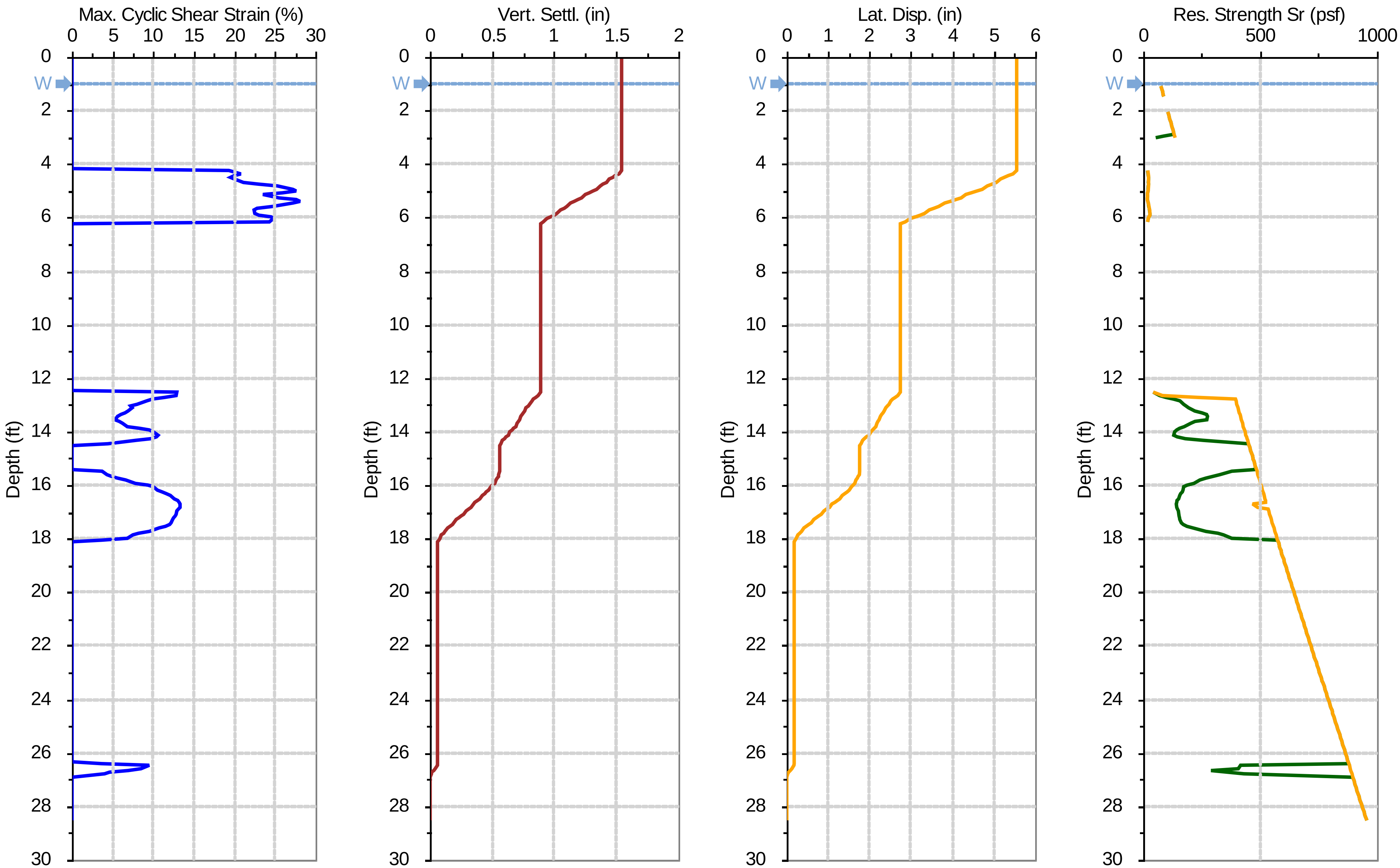
LIQUEFACTION CPT ANALYSIS REPORT

Theresa Nunan

Project :
Project No. :
Client :
Location :
Notes :

Borehole : CPT-1
Ground Water Level : 1 ft
Coordinates : n.a.
Calculated By :

Ground Slope : Gently Sloped 0.3%
PGA = 0.7 g, EQ. Magnitude M = 7.1
Cone Area Ratio = 0.8
CPT Max. Depth = 28.63 ft
Checked By :



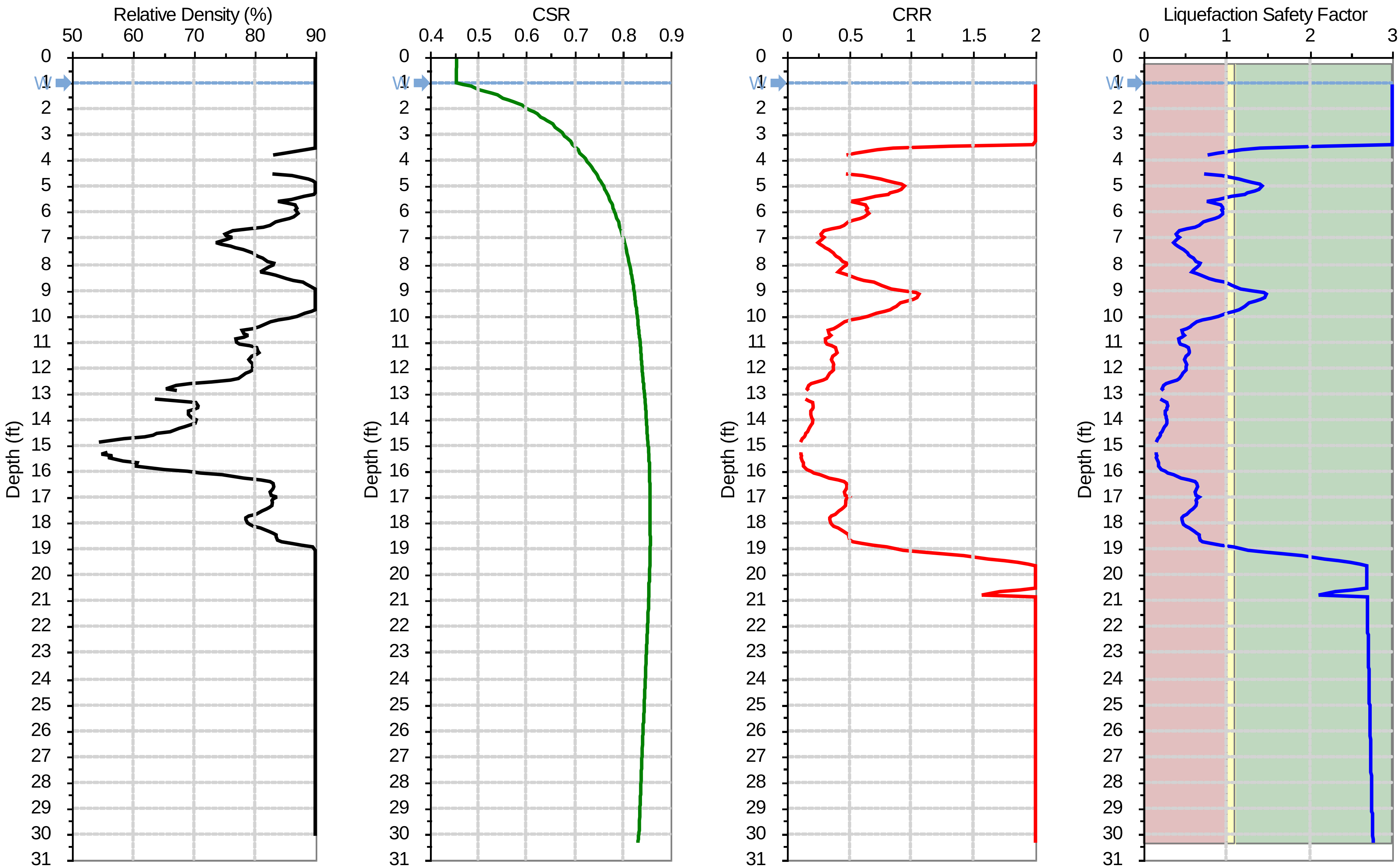
LIQUEFACTION CPT ANALYSIS REPORT

Theresa Nunan

Project :
Project No. :
Client :
Location :
Notes :

Borehole : CPT-3
Ground Water Level : 1 ft
Coordinates : n.a.
Calculated By :

Ground Slope : Gently Sloped 0.3%
PGA = 0.7 g, EQ. Magnitude M = 7.1
Cone Area Ratio = 0.8
CPT Max. Depth = 30.43 ft
Checked By :



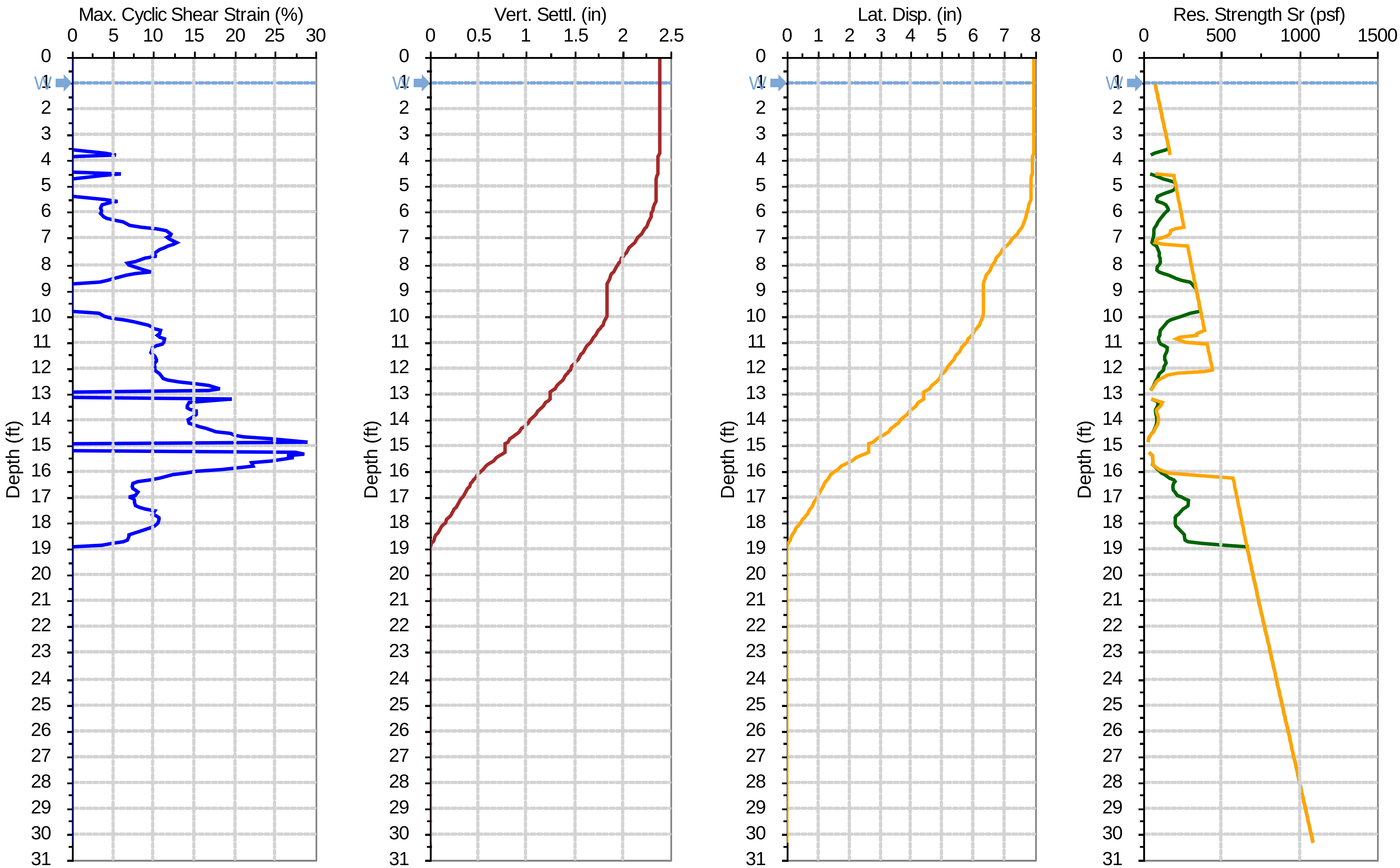
LIQUEFACTION CPT ANALYSIS REPORT

Theresa Nunan

Project :
Project No. :
Client :
Location :
Notes :

Borehole : CPT-3
Ground Water Level : 1 ft
Coordinates : n.a.
Calculated By :

Ground Slope : Gently Sloped 0.3%
PGA = 0.7 g, EQ. Magnitude M = 7.1
Cone Area Ratio = 0.8
CPT Max. Depth = 30.43 ft
Checked By :



APPENDIX B

EARTHWORK SPECIFICATIONS

GENERAL

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including but not limited to the furnishing of all labor, tools, and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans, and disposal of excess materials.

PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of Krazan and Associates, Inc., hereinafter known as the Geotechnical Engineer and/or Testing Agency. Attainment of design grades when achieved shall be certified by the project Civil Engineer. Both the Geotechnical Engineer and Civil Engineer are the Owner's representatives. If the contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory as determined by both the Geotechnical Engineer and Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Geotechnical Engineer, Civil Engineer or project Architect.

No earthwork shall be performed without the physical presence or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork. The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner of the Engineers.

TECHNICAL REQUIREMENTS: All compacted materials shall be moisture conditioned to within 2 percent of the materials optimum moisture content and compacted to a density not less than 95 percent of maximum dry density as determined by ASTM Test Method D1557, unless specified otherwise in the technical portion of the Geotechnical Engineering Report. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Geotechnical Engineer.

SOIL AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the soil report. The Contractor shall make his own interpretation of the data contained in said report, and the Contractor shall not be relieved of liability under the contractor for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including Court costs of codefendants, for all claims related to dust or windblown materials attributable to his work.

SITE PREPARATION

Site preparation shall consist of site clearing and grubbing and preparations of foundation materials for receiving fill.

CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter, and all other matter determined by the Geotechnical Engineer to be deleterious. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed building area should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots larger than 1 inch. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill or tree root excavation should not be permitted until all exposed surfaces have been inspected and the Geotechnical Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

SUBGRADE PREPARATION: Subgrade should be prepared as described in our site preparation section of this report.

EXCAVATION: All excavations shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All excavations extending beyond the excavation or over-excavation limits specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence of the Geotechnical Engineer. Material from the required site excavation may be utilized for construction site fills provided prior approval is given by the Geotechnical Engineer and the compaction requirements can be met. All materials utilized for constructing site fills shall be free from vegetable or other deleterious matter as determined by the Geotechnical Engineer.

PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. However, **compaction of fill materials by flooding, ponding, or jetting shall not be permitted**. Both cut and fill shall be compacted to the satisfaction of the Geotechnical Engineer prior to final acceptance.

SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Geotechnical Engineer indicates that the moisture content and density of previously placed fill are as specified.

APPENDIX C

PAVEMENT SPECIFICATIONS

1. DEFINITIONS – The term “pavement” shall include asphalt concrete surfacing, untreated aggregate base, and aggregate subbase. The term “subgrade” is that portion of the area on which surfacing, base, or subbase is to be placed.

2. SCOPE OF WORK – This portion of the work shall include all labor, materials, tools, and equipment necessary for and reasonably incidental to the completion of the pavement shown on the plans and as herein specified, except work specifically notes as “Work Not Included.”

3. PREPARATION OF THE SUBGRADE – Subgrade should be prepared as described in our site preparation and pavement design sections of this report.

4. AGGREGATE BASE – The aggregate base shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base should conform to WSDOT Standard Specification for Crushed Surfacing Base Course or Top Course (Item 9-03.9(3)). The base material shall be compacted to a minimum compaction of 95% as determined by ASTM D1557 Modified Proctor. Each layer of subbase shall be tested and approved by the Geotechnical Engineer prior to the placement of successive layers.

5. ASPHALTIC CONCRETE SURFACING – Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades, and dimensions shown on the plans. The drying, proportioning, and mixing of the materials shall conform to WSDOT Specifications. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

The prime coat, spreading and compaction equipment, as well as the process of spreading and compacting the mixture, shall conform to WSDOT Specifications, with the exception that no surface course shall be placed when the atmospheric temperature is below 50 degrees F. The surfacing shall be rolled with combination steel-wheel and pneumatic rollers, as described in WSDOT Specifications. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

6. TACK COAT – The tack (mixing type asphaltic emulsion) shall conform to and be applied in accordance with the requirements of WSDOT Specifications.

Tab 8.0

8.0 OTHER PERMITS

The permits pertaining to this project will be provided in this section upon subsequent review, as necessary.

Tab 9.0

9.0 OPERATIONS AND MAINTENANCE MANUAL

Refer to Figure 9.1 for the complete Operations and Maintenance Manual for the proposed on-site stormwater infrastructure.

Figure 9.1
O&M Manual

Table V-A.2: Maintenance Standards - Infiltration (continued)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		(A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Piping	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Emergency Overflow Spillway	Rock Missing	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
	Erosion	See Table V-A.1: Maintenance Standards - Detention Ponds	See Table V-A.1: Maintenance Standards - Detention Ponds
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Storage Area	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point or the vent is damaged.	Vents open and functioning.
	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)	All sediment and debris removed from storage area.
	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. (Will require engineering analysis to determine structural stability).	All joint between tank/pipe sections are sealed.
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).	Tank/pipe repaired or replaced to design.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	Vault replaced or repaired to design specifications and is structurally sound. No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults) (continued)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.	Cover can be removed and reinstalled by one maintenance person.
	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.	Ladder meets design standards. Allows maintenance person safe access.
Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

Table V-A.4: Maintenance Standards - Control Structure/Flow Restrictor

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris (Includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as designed. Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.
Overflow Pipe	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.	Pipe is free of all obstructions and works as designed.
Manhole	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)	See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults)
Catch Basin	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

Table V-A.5: Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Basin replaced or repaired to design standards. Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.
	Contamination and Pollution	See Table V-A.1: Maintenance Standards - Detention Ponds	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing.	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.

Table V-A.17: Maintenance Standards - Coalescing Plate Oil/Water Separators

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Monitoring	Inspection of discharge water for obvious signs of poor water quality.	Effluent discharge from vault should be clear with no thick visible sheen.
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth and/or visible signs of sediment on plates.	No sediment deposits on vault bottom and plate media, which would impede flow through the vault and reduce separation efficiency.
	Trash and Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables and non-floatables.	Trash and debris removed from vault, and inlet/outlet piping.
	Oil Accumulation	Oil accumulation that exceeds 1-inch at the water surface.	Oil is extracted from vault using vactoring methods. Coalescing plates are cleaned by thoroughly rinsing and flushing. Should be no visible oil depth on water.
	Damaged Coalescing Plates	Plate media broken, deformed, cracked and/or showing signs of failure.	A portion of the media pack or the entire plate pack is replaced depending on severity of failure.
	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.	Pipe repaired and or replaced.
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Vault Structure Damage - Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.

Table V-A.18: Maintenance Standards - Catch Basin Inserts

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Media Insert Use Beyond Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.

Table V-A.19: Maintenance Standards - Media Filter Drain (MFD)

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Sediment accumulation on grass filter strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope. There should be no areas of standing water once inflow has ceased.
	No-vegetation	Flow spreader is uneven or clogged so that flows are not uniformly distributed over entire embankment width.	Level the spreader and clean to spread flows evenly over entire embankment width.

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Modular Wetlands® Linear
Operation & Maintenance Manual

MODULAR WETLANDS®

MODULAR WETLANDS® LINEAR
OPERATION & MAINTENANCE MANUAL

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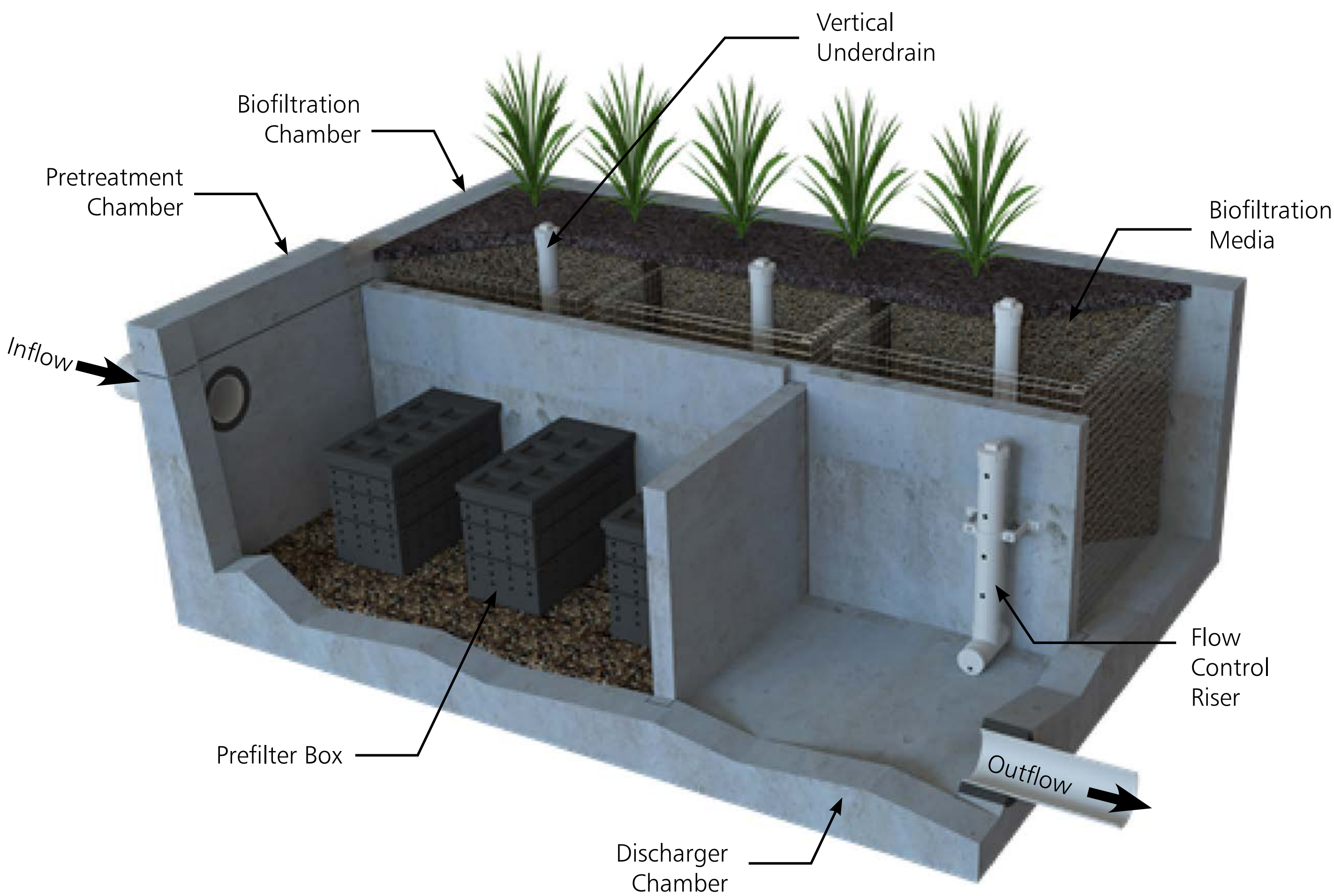
OVERVIEW

The Modular Wetlands® Linear Biofilter is designed to remove high levels of trash, debris, sediments, nutrients, metals, and hydrocarbons. Its simple design allows for quick and easy installation. The system is housed in a standard precast structure and can be installed at various depths to meet site-specific conditions.

INTRODUCTION

This is the Modular Wetlands Linear Biofilter operation and maintenance manual. Before starting, read the instructions and equipment lists closely. It is important to follow all necessary safety procedures associated with state and local regulations. Some steps required confined space entry. Please contact Contech for more information on pre-authorized third party contractors who can provide installation services in your area. For a list of service providers in your area please visit: www.conteches.com/maintenance.



INSTRUCTIONS

INSPECTION SUMMARY

Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess the site specific loading conditions. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years to ensure appropriate maintenance is provided.

- Inspect pre-treatment, biofiltration, and discharge chambers an average of once every six to twelve months. Varies based on site specific and local conditions.
- Average inspection time is approximately 15 minutes. Always ensure appropriate safety protocol and procedures are followed.

The following is a list of equipment required to allow for simple and effective inspection of the Modular Wetlands Linear:

- Modular Wetlands Linear Inspection Form
- Flashlight
- Manhole hook or appropriate tools to remove access hatches and covers
- Appropriate traffic control signage and procedures
- Measuring pole and/or tape measure
- Protective clothing and eye protection
- 7/16" open or closed ended wrench
- Large permanent black marker (initial inspections only - first year)

Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections of the system

INSPECTION AND MAINTENANCE NOTES

1. Following maintenance and/or inspection, it is recommended that the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.
2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.
3. Transport all debris, trash, organics, and sediments to approved facility for disposal in accordance with local and state requirements.
4. Entry into chambers may require confined space training based on state and local regulations.
5. No fertilizer shall be used in the biofiltration chamber.
6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may not require irrigation after initial establishment.

INSPECTION PROCESS

1. Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other information (see inspection form).
2. Observe the inside of the system through the access covers. If minimal light is available and vision into the unit is impaired, utilize a flashlight to see inside the system and all of its chambers.
3. Look for any out of the ordinary obstructions in the inflow pipe, pre-treatment chamber, biofiltration chamber, discharge chamber or outflow pipe. Write down any observations on the inspection form.
4. Through observation and/or digital photographs, estimate the amount of trash, debris accumulated in the pre-treatment chamber. Utilizing a tape measure or measuring stick, estimate the amount of sediment in this chamber. Record this depth on the inspection form.
5. Through visual observation, inspect the condition of the pre-filter cartridges. Look for excessive build-up of sediment on the cartridges, any build-up on the tops of the cartridges, or clogging of the holes. Record this information on the inspection form. The prefilter cartridges can be further inspected by removing the cartridge tops and assessing the color of the BioMediaGREEN filter cubes (requires entry into pre-treatment chamber - see notes previous notes regarding confined space entry). Record the color of the material. New material is a light green color. As the media becomes clogged, it will turn darker in color, eventually becoming dark brown or black. The closer to black the media is the higher percentage that the media is exhausted and is in need of replacement.

New
BioMediaGREEN
0%

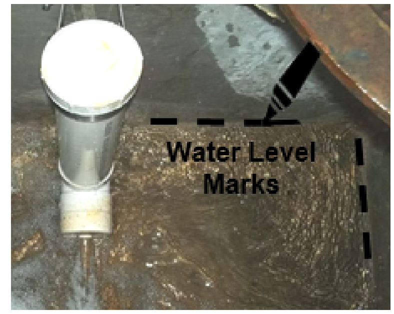
Exhausted
BioMediaGREEN
100%

6. The biofiltration chamber is generally maintenance-free due to the system's advanced pre-treatment chamber. For units which have open planters with vegetation, it is recommended that the vegetation be inspected. Look for any plants that are dead or showing signs of disease or other negative stressors. Record the general health of the plants on the inspection form and indicate through visual observation or digital photographs if trimming of the vegetation is required.
7. The discharge chamber houses the orifice control structure, drain down filter (only in California - older models), and is connected to the outflow pipe. It is important to check to ensure the orifice is in proper operating conditions and free of any obstructions. It is also important to assess the condition of the drain down filter media which utilizes a block form of the BioMediaGREEN. Assess in the same manner as the cubes in the pre-filter cartridge as mentioned above. Generally, the discharge chamber will be clean and free of debris. Inspect the water marks on the side walls. If possible, inspect the discharge chamber during a rain event to assess the amount of flow leaving the system while it is at 100% capacity (pre-treatment chamber water level at peak HGL - top of bypass weir). The water level of the flowing water should be compared to the watermark level on the side walls, which is an indicator of the highest discharge rate the system achieved when initially installed. Record on the form if there is any difference in level from the watermark in inches.

NOTE: During the first few storms, the water level in the outflow chamber should be observed and a 6" long horizontal watermark line drawn (using a large permanent marker) at the water level in the discharge chamber while the system is operating at 100% capacity. The diagram below illustrates where the line should be drawn. This line is a reference point for future inspections of the system.

Water level in the discharge chamber is a function of flow rate and pipe size. Observation of the water level during the first few months of operation can be used as a benchmark level for future inspections. The initial mark and all future observations shall be made when the system is at 100% capacity (water level at maximum level in the pre-treatment chamber). If future water levels are below this mark when the system is at 100% capacity, this is an indicator that maintenance to the pre-filter cartridges may be needed.

8. Finalize the inspection report for analysis by the maintenance manager to determine if maintenance is required.



MAINTENANCE INDICATORS

Based upon the observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components or cartridges
- Obstructions in the system or its inlet and/or outlet pipes
- Excessive accumulation of floatables in the pretreatment chamber in which the length and width of the chamber is fully impacted more than 18". See photo below.
- Excessive accumulation of sediment in the pretreatment chamber of more than 6" in depth.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. The following chart shows photos of the condition of the BioMediaGREEN contained within the pre-filter cartridges. When media is more than 85% clogged, replacement is required.
- Excessive accumulation of sediment on the BioMediaGREEN media housed within the pretreatment cartridges. When media is more than 85% clogged, replacement is required. The darker the BioMediaGREEN, the more clogged it is and in need of replacement.

INSPECTION PROCESS

- Excessive accumulation of sediment on the BioMediaGREEN media housed within the drain down filter (California only - older models). The following photos show the condition of the BioMediaGREEN contained within the drain down filter. When media is more than 85% clogged, replacement is required.

- Overgrown vegetation.

- Water level in the discharge chamber during 100% operating capacity (pretreatment chamber water level at max height) is lower than the water mark by 20%.

MAINTENANCE SUMMARY

The time has come to maintain your Modular Wetlands® Linear. All necessary pre-maintenance steps must be carried out before maintenance occurs. Once traffic control has been set up per local and state regulations and access covers have been safely opened, the maintenance process can begin. It should be noted that some maintenance activities require confined space entry. All confined space requirements must be strictly followed before entry into the system. In addition, the following is recommended:

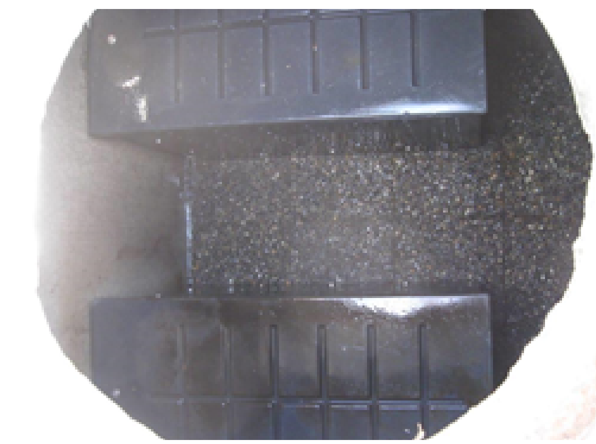
- Prepare the maintenance form by writing in the necessary information including project name, location, date & time, unit number and other info (see maintenance form).
- Set up all appropriate safety and cleaning equipment.
- Ensure traffic control is set up and properly positioned.
- Prepared pre-checks (OSHA, safety, confined space entry) are performed.

The following is a list of equipment to required for maintenance of the Modular Wetlands® Linear:

- Modular Wetlands Linear Maintenance Form
- Manhole hook or appropriate tools to access hatches and covers
- Protective clothing, flashlight, and eye protection
- 7/16” open or closed ended wrench
- Vacuum assisted truck with pressure washer
- Replacement BioMediaGREEN for pre-filter cartridges if required (order from one of Contech’s Maintenance Team members at https://www.conteches.com/maintenance).

MAINTENANCE | PRETREATMENT CHAMBER

1. Remove access cover over pre-treatment chamber and position vacuum truck accordingly.
2. With a pressure washer, spray down pollutants accumulated on walls and pre-filter cartridges.
3. Vacuum out pre-treatment chamber and remove all accumulated pollutants including trash, debris, and sediments. Be sure to vacuum the floor until the pervious pavers are visible and clean.
4. If pre-filter cartridges require media replacement, continue to step 5. If not, replace access cover and move to step 11.

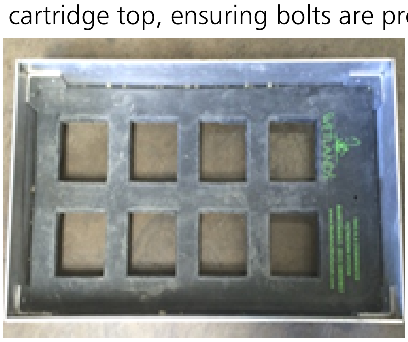


MAINTENANCE | PREFILTER CARTRIDGES

5. After successfully cleaning out the pre-treatment chamber (previous page) enter the pre-treatment chamber.
6. Unscrew the two bolts (circles shown below) holding the lid on each cartridge filter and remove lid.


7. Place the vacuum hose over each individual media filter to suck out filter media.

8. Once filter media has been sucked out, use a pressure washer to spray down the inside of the cartridge and it's media cages. Remove cleaned media cages and place to the side. Once removed, the vacuum hose can be inserted into the cartridge to vacuum out any remaining material near the bottom of the cartridge.
9. Reinstall media cages and fill with new media from the manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase. Utilize the manufacture-provided refilling tray and place on top of the cartridge. Fill the tray with new bulk media and shake down into place. Using your hands, lightly compact the media into each filter cage. Once the cages are full, remove the refilling tray and replace the cartridge top, ensuring bolts are properly tightened.



10. Exit the pre-treatment chamber. Replace access hatch or manhole cover.

MAINTENANCE | BIOFILTRATION CHAMBER

11. In general, the biofiltration chamber is maintenance-free with the exception of maintaining the vegetation. The Modular Wetlands Linear utilizes vegetation similar to surrounding landscape areas, therefore trim vegetation to match surrounding vegetation. If any plants have died, replace them with new ones.

12. Each vertical under drain on the biofiltration chamber has a removable (threaded cap) that can be taken off to check any blockages or root growth. Once removed, a jetting attachment can be used to clean out the under drain and orifice riser.
13. As with all biofilter systems, at some point the biofiltration media (WetlandMedia) will need to be replaced. Either because of physical clogging of sorptive exhaustion of the media ion exchange capacity (to remove dissolved metals and phosphorous). The general life of this media is 10 to 20 years based on site specific conditions and pollutant loading. Utilize the vacuum truck to vacuum out the media by placing the hose into the chamber. Once all the media is removed use the power washer to spray down all the netting on the outer metal cage. Inspect the netting for any damage or holes. If the netting is damaged it can be repaired or replaced with guidance by the manufacturer.
14. Contact one of Contech's Maintenance Team members at https://www.conteches.com/maintenance to order new WetlandMedia. The quantity of media needed can be determined by providing the model number and unit depth. Media will be provided in super sacks for easy installation. Each sack will weigh between 1000 and 2000 lbs. A lifting apparatus (backhoe, boom truck, or other) is recommended to position the super sack over the biofiltration chamber. Fill the media cages up to the same level as the old media. Replant with vegetation.

MAINTENANCE | DISCHARGE CHAMBER

15. Remove access hatch or manhole cover over discharge chamber.
16. Enter chamber to gain access to the drain down filter. Unlock the locking mechanism and lift up drain down filter housing to remove used BioMediaGREEN filter block as shown below. *NOTE: Drain down filter is only found on units installed in California prior to 2023. If no drain down filter is present, skip steps 16 and 17.*

17. Insert a new BioMediaGREEN filter block and lock drain down filter housing back in place.
18. Replace access hatch or manhole cover over discharge chamber.

NOTES

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Inspection Report
Modular Wetlands Linear

Project Name ______	For Office Use Only
Project Address ______ (city) (Zip Code)	(Reviewed By)
Owner / Management Company ______	(Date) Office personnel to complete section to the left.

Contact ______ Phone ( ) –

Inspector Name ______ Date / / Time ______ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ______ Additional Notes ______

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): ______ Size (22', 14' or etc.): ______

Structural Integrity:	Yes	No	Comments
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes, specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	Yes	No
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: ______

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Cleaning and Maintenance Report
Modular Wetlands Linear

For Office Use Only
(Reviewed By)
(Date)
Office personnel to complete section to the left.

Project Name ____________________

Project Address ____________________ (city) (Zip Code)

Owner / Management Company ____________________

Contact ____________________ Phone ( ) –

Inspector Name ____________________ Date ___ / ___ / ______ Time ________ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ____________________ Additional Notes ____________________

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

Comments:

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Modular Wetlands Maintenance Guide 1/2023

Tab 10.0

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

The Declaration of Covenant for the Privately Maintained Treatment Facilities may be provided if required by the City.

Tab 11.0

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

Per Section 5.4 of this report, there are no proposed on-site stormwater management BMPs; therefore, a Declaration of Covenant will not be provided within this report.

Tab 12.0

12.0 BOND QUANTITIES WORKSHEET

The Applicable Bond Quantities will be provided upon project acceptance and at the request of the City.