Received 11-21-2022

BARGHAUSEN

STORMWATER SITE PLAN

DuPont 243
DuPont, Washington

11/18/2022

Prepared for:
Avenue 55, LLC
601 Union Street, Suite 2930
Seattle, WA 98101

November 18, 2022
Our Job No. 18666

BARGHAUSEN CONSULTING ENGINEERS, INC.
18215 72ND AVENUE SOUTH KENT, WA 98032 P) 425-251-6222 F) 425-251-8782
BRANCH OFFICES: TUMWATER, WA KLAMATH FALLS, OR LONG BEACH, CA ROSEVILLE, CA SAN DIEGO, CA
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EXECUTIVE SUMMARY

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This 25.3-acre site is located within a portion of the Northwest quarter of Section 26, Township 19 North, Range 1 East, Willamette Meridian, Pierce County, Washington. Of these 25.3 acres, 16.37 acres will be cleared, graded, and developed into a commercial building site. There are no known wetlands on the project site.

All Minimum Requirements apply to this project site and the following pages of this report describe how those Minimum Requirements will be met with this development. Flow control will be provided by three Stormtech infiltration galleries onsite as the soils onsite have high permeability per the geotechnical report included in section 7.0 of this report. Water quality will be provided by three Modular Wetland Systems which have General Use Level Designation for Enhanced, Phosphorus, and Basic Water Quality treatment per the Department of Ecology.

According to the topographic survey, there are no upstream basins that contribute runoff to this project.

Three Stormtech infiltration galleries are proposed for this project: one for the western portion of the project, one for the eastern portion of the project, and one for the proposed half street of Sequalitchew Road. These three galleries have been sized per Pierce County requirements to infiltrates all stormwater runoff from the site up to the 100-year storm event. The conveyance system for this project has been sized using Santa Barbara Urban Hydrograph (SBUH) methodology for the 25-year storm in all conveyance elements without surcharging any manholes or catch basins.

1.0 ANALYSIS OF THE MINIMUM REQUIREMENTS

FIGURE 1.1 - MINIMUM REQUIREMENTS SUMMARY

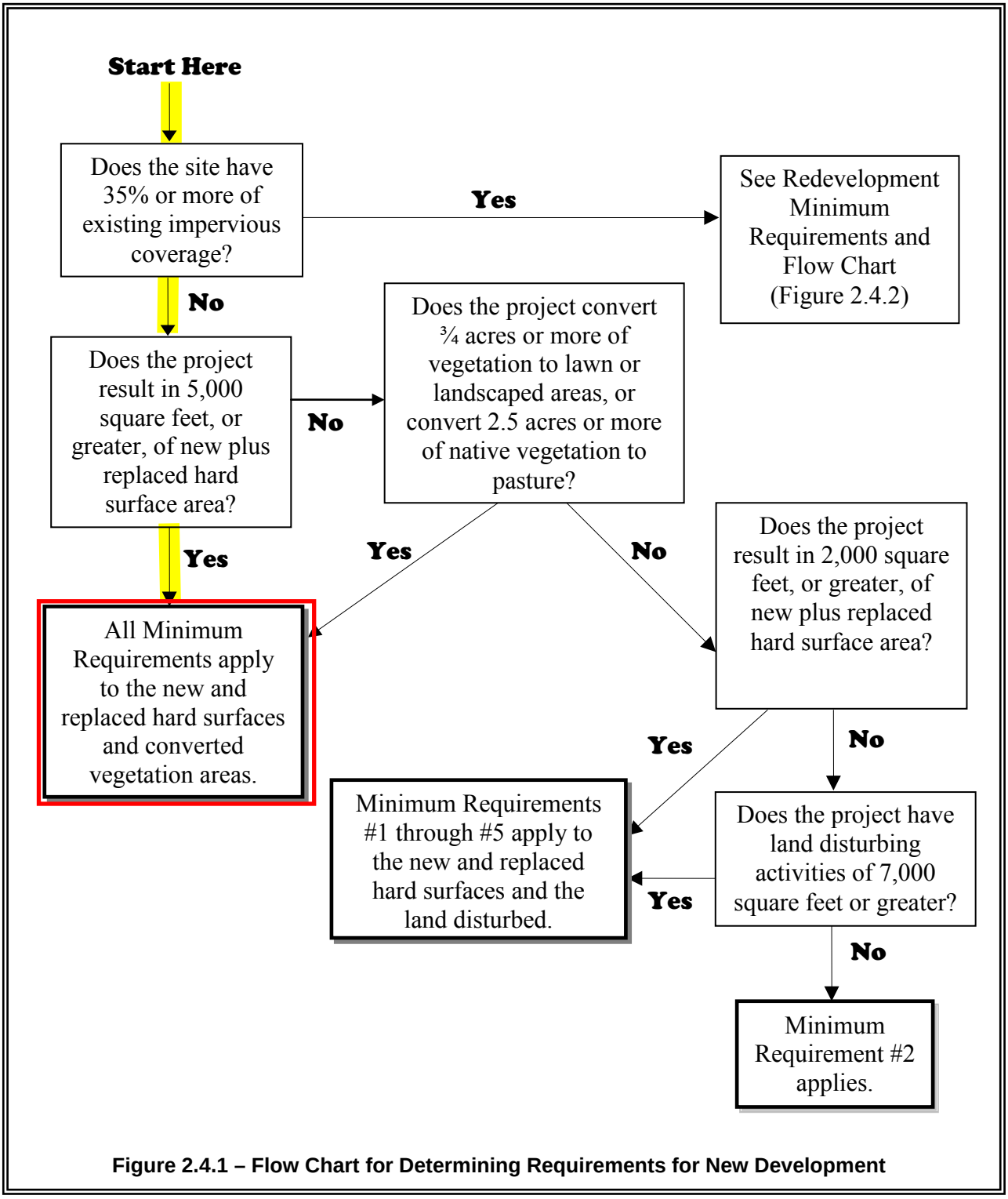


Figure 2.4.1 – Flow Chart for Determining Requirements for New Development

1.0 ANALYSIS OF THE MINIMUM REQUIREMENTS

Per Figure 1.1, which is the Minimum Requirements for New Development Projects, all the Minimum Requirements 1 through 9 apply to this project. The following is a list of each of the Minimum Requirements and how this Stormwater Site Plan and site development project meet those requirements.

Minimum Requirement No. 1: Preparation of Stormwater Site Plan.

Response: This document hereby meets the requirements for preparing a Stormwater Site Plan.

Minimum Requirement No. 2: Stormwater Pollution Prevention Plan.

Response: Please see Section 6.0 of this report for the Stormwater Pollution Prevention Plan prepared for this project.

Minimum Requirement No. 3: Source Control of Pollution.

Response: All known, available, and reasonable Source Control BMPs will be applied to this project. At a minimum the owner will be educated about the proper use of pesticides and fertilizers, the parking lot will be swept on a regular basis, and the trash enclosures will be covered.

Minimum Requirement No. 4: Preservation of Natural Drainage Systems and Outfalls.

Response: This site currently infiltrates under existing conditions. Because the development will infiltrate all stormwater runoff onsite, the existing drainage system will be preserved.

Minimum Requirement No. 5: On-Site Stormwater Management.

Response: Per the attached geotechnical report in section 7.0, soils for this site will provide a minimum infiltration rate of 6 inches per hour. As such, infiltration galleries will be used to provide onsite stormwater management.

Minimum Requirement No. 6: Runoff Treatment.

Response: Three Modular Wetland Systems are proposed to provide water quality treatment for all runoff from this project. These systems have General Use Level Designation (GULD) from the Department of Ecology for enhanced water quality treatment.

Minimum Requirement No. 7: Flow Control.

Response: Flow control will be provided for this site by three Stormtech infiltration galleries. Per Pierce County Requirements, these galleries have been designed to infiltrate 100% of runoff from the project site up to the 100-year storm event.

Minimum Requirement No. 8: Wetlands Protection.

Response: There are no known wetlands on this site or adjacent to this site.

Minimum Requirement No. 9: Operation and Maintenance.

Response: An Operations and Maintenance Manual is included in this report and meets the requirements of the Pierce County stormwater manual.

2.0 PROJECT OVERVIEW

2.0 PROJECT OVERVIEW

The site is located within a portion of the Northwest quarter of section 26, Township 19 North, Range 1 East, Willamette Meridian, Pierce County, Washington. The address of this site is 1700 Center Drive DuPont, WA 98327

This project is proposing two warehouse buildings: one with a footprint of approximately 243,180 square feet, and the other with a footprint of approximately 25,200 square feet. A half street is also proposed to connect into the existing portion of Sequalitchew road to the southeast of the site. The remaining eastern side of Sequalitchew road will be constructed during the development of the eastern side of the property. This project also proposes sidewalks, asphalt pavement, landscaping area, and a retaining wall. These improvements will total 13.57 acres of impervious surfaces, of which 6.1 acres will be asphalt pavement. The remaining area of the site will be pervious surfaces in the form of landscaping and undisturbed land, which totals 5.79 acres.

Additionally, three Stormtech infiltration galleries, a stormwater conveyance system, and three Modular Wetland Sytems are also proposed for this site. Sewer and water systems, as well as other utility services will also be included in this project.

3.0 EXISTING CONDITIONS SUMMARY

3.0 EXISTING CONDITIONS SUMMARY

Under existing conditions the eastern and western portions of the site are thickly forested. The center of the site is an open area of gravel with downward slopes of approximately 3:1. To the west of the gravel area, the site is relatively flat, other than a few areas of moderate slopes. On the east of the gravel area, the site is moderately steep, where it generally slopes downward to the southwest at a minimum of 7% and at most 30% on the far east side of the site. Overall, it appears this site slopes downward to the southwest.

Per the geotechnical report for the adjacent site, there was no groundwater at depths of 12 feet, and groundwater levels are expected to be well below this.

4.0 OFF-SITE ANALYSIS REPORT

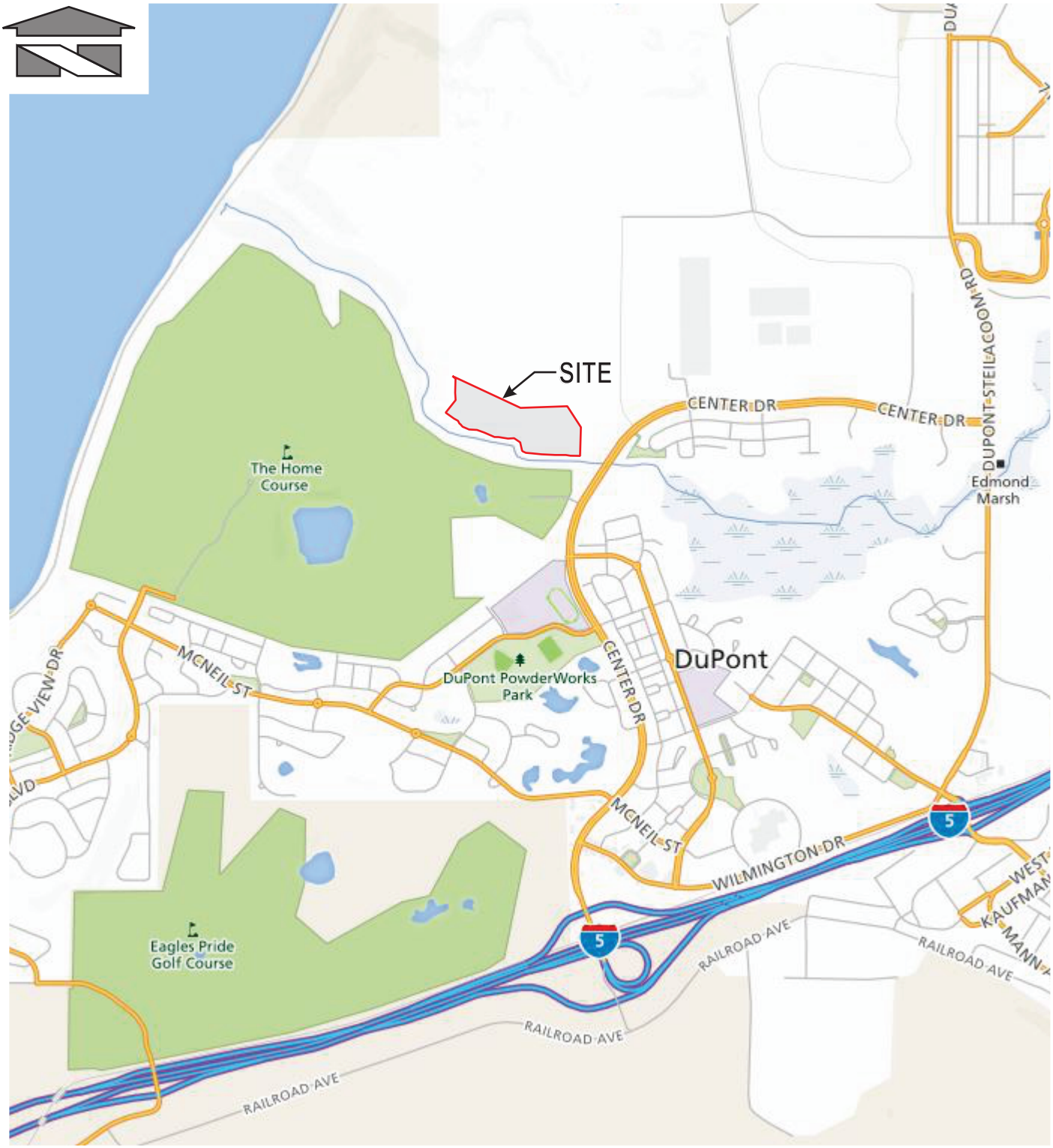
4.0 OFF-SITE ANALYSIS REPORT

An Off-Site Analysis Report will be included with the final Stormwater Site Plan.

Upstream Basin Analysis

There do not appear to be any upstream basins that contribute runoff to this project.

VICINITY MAP



REFERENCE: Rand McNally (2017)

Scale:
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CIVIL ENGINEERING, LAND PLANNING, SURVEYING, ENVIRONMENTAL SERVICES

For:
Dupont Industrial Warehouse
Dupont, Washington

Title:
VICINITY MAP

Job Number
18666

DATE: 12/19/17

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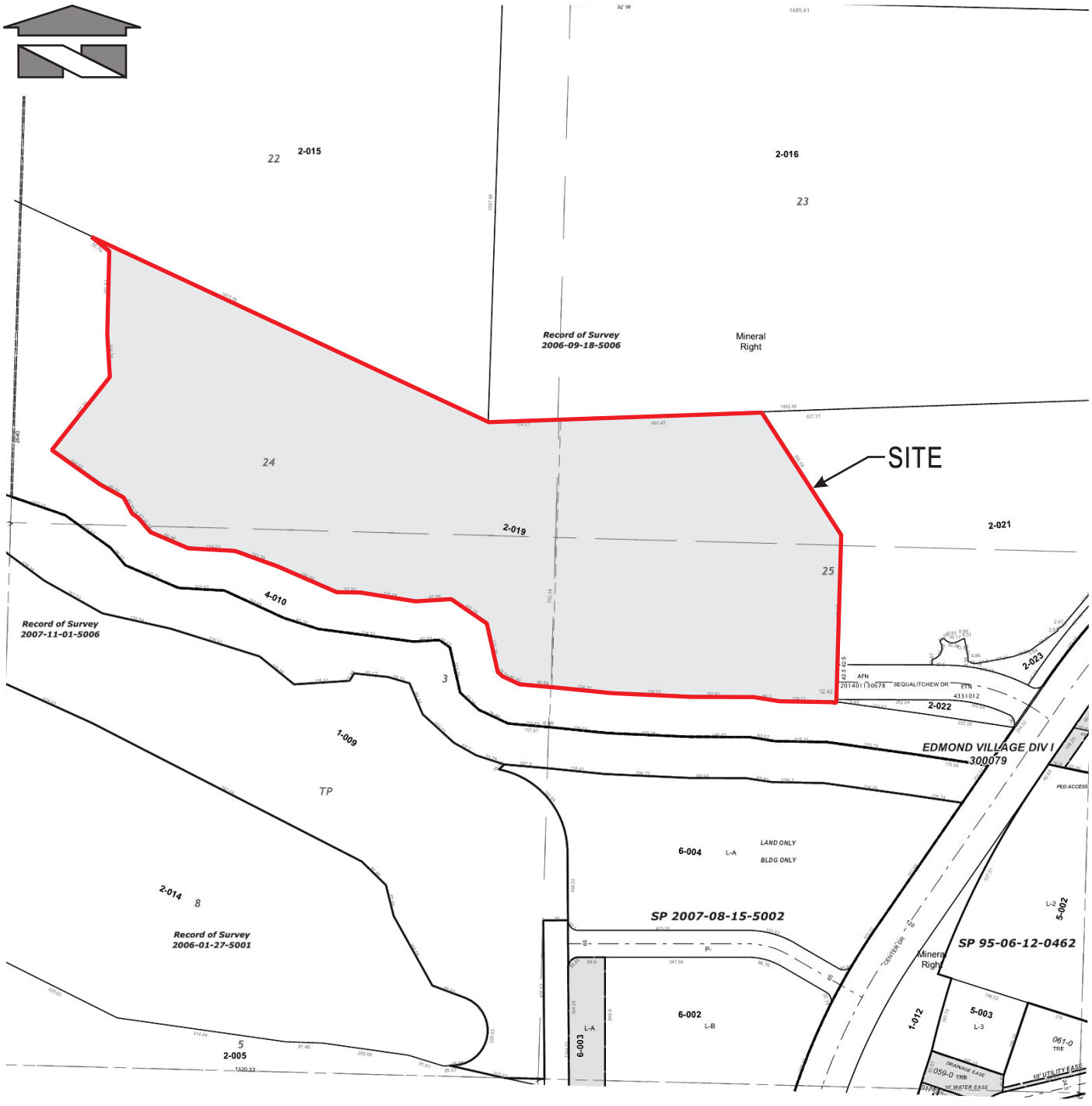
ASSESSOR'S MAP



REFERENCE: Pierce County Department of Assessments (Dec. 2015)

Scale: Horizontal: **N.T.S.** Vertical: **N/A**	*For:* Dupont Industrial Warehouse Dupont, Washington	Job Number 18666
BARGHAUSEN CONSULTING ENGINEERS, INC. 18215 72ND AVENUE SOUTH KENT, WA 98032 (425) 251-6222 (425) 251-8782 CIVIL ENGINEERING, LAND PLANNING, SURVEYING, ENVIRONMENTAL SERVICES	*Title:* ASSESSOR MAP	DATE: 12/19/17

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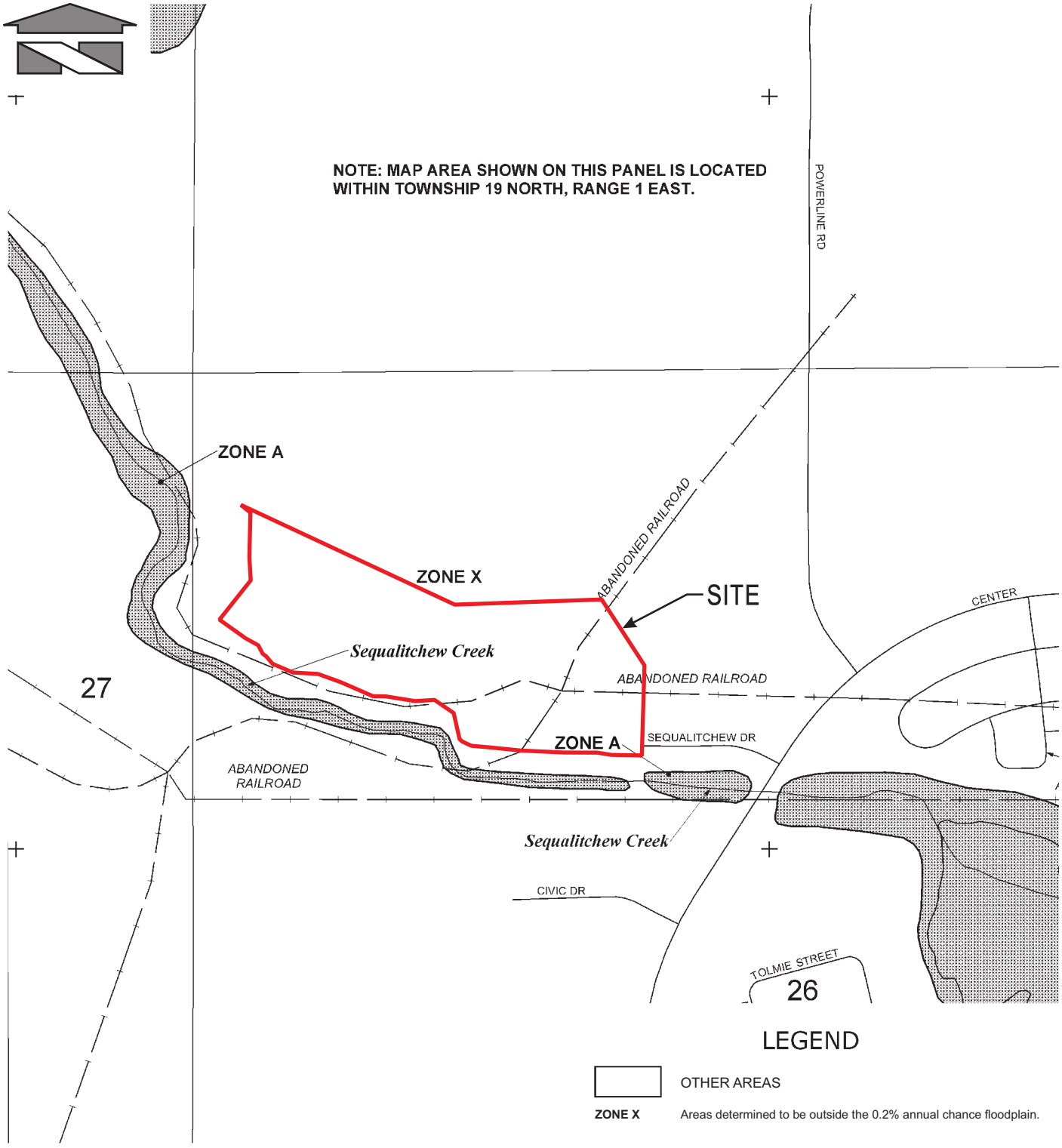
FEMA MAP



REFERENCE: Federal Emergency Management Agency (Portion of Map 53053C0507E, March 2017)

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Dupont Industrial Warehouse
Dupont, Washington

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FEMA MAP

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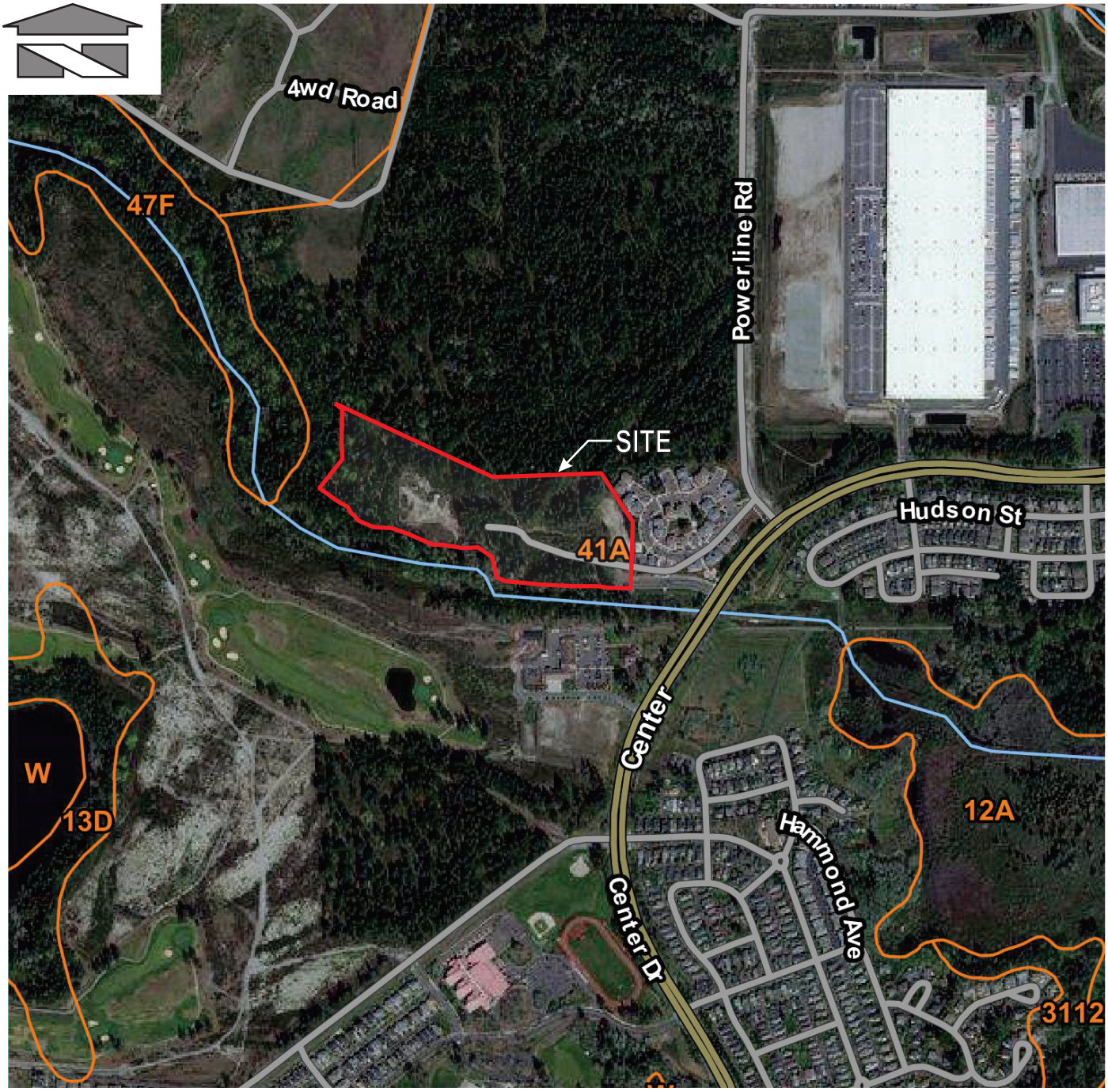
SOILS MAP



REFERENCE: USDA, Natural Resources Conservation Service

LEGEND:

41A = Spanaway gravelly sandy loam

Scale:

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SOIL SURVEY MAP

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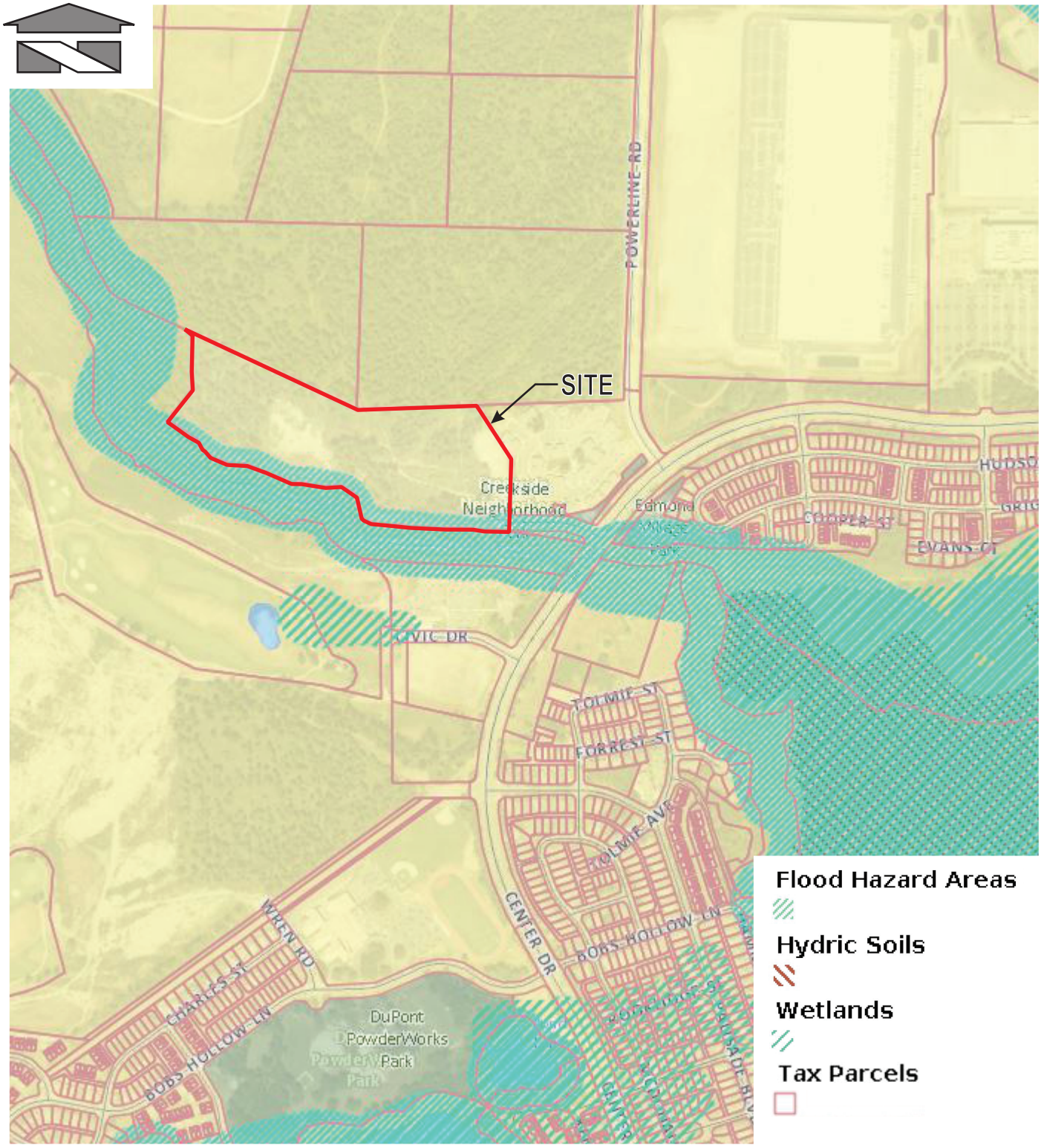
SENSITIVE AREAS MAP



REFERENCE: Pierce County PublicGIS

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

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Title:
SENSITIVE AREAS MAP

DATE: 12/19/17

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5.0 PERMANENT STORMWATER CONTROL PLAN

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Part A Existing Site Hydrology

The existing site is approximately 25.3 acres of forested land. There is an existing gravel area near the center of the site, which depresses at a slopes ranging from 30% to 45%. There are existing 1:1 slopes to the south of the property. The majority of the site is moderately steep, with slopes ranging from 2% to 20%. The east side of the site has slopes ranging from 13% to 70%. The site generally slopes southwest. This site lies within Spanaway gravelly sandy loam, according to the USDA Web Soil survey.

As required by the Pierce County Stormwater Management and Site Development Manual, the flow control facilities were sized using WWHM 2012. For this development, only the developed 16.37 developed acres were considered to contribute runoff to the Stormtech galleries. This area includes the developed half street of Sequalitchew Road to the east and excludes all areas that will not be graded.

Part B Developed Site Hydrology

This site will consist of approximately 13.57 acres of impervious surfaces and 6.09 acres of pervious/landscaped areas. Of the impervious areas, 6.16 acres will be roof area, while the remaining 7.41 acres will consist of asphalt and concrete pavement. Because roof area is a non-pollution generating surface, the runoff will be discharged directly into the infiltration galleries, bypassing the water quality systems.

Part C Performance Standards and Goals

The flow control standard for this project is 100% infiltration of all stormwater onsite. The Santa Barbara Urban Hydrograph (SBUH) methodology will be used in the final report to size all the conveyance elements for the 25-year storm event.

Part D Low Impact Development Features

Flow control for this site will be provided entirely by three Stormtech infiltration galleries which will infiltrate 100% of stormwater runoff from the project onsite, eliminating any discharge from the property.

Part E Flow Control System

Flow control for this site will be provided by three Stormtech infiltration galleries. Details for these chambers will be provided in the final Stormwater Site Plan.

Part F Water Quality System

Water quality for this site will be provided by three Modular Wetland Systems which have General used Level Designation (GULD) for enhanced water quality treatment from the Department of Ecology.

Part G Conveyance System Analysis and Design

The conveyance system for this project has been sized to convey the 25-year storm event per the requirements of the Pierce County stormwater manual using a 5-minute time of concentration and a Manning's 'n' value of 0.013 for all pipes. Conveyance calculations will be provided in the final storm report.

FLOW CONTROL AND WATER QUALITY SIZING CRITERIA

FLOW CONTROL AND WATER QUALITY SIZING CRITERIA

West Side

Roof Tops	=	5.58 Acres
Pavement	=	4.19 Acres
Landscape	=	2.70 Acres
Total	=	12.47 Acres

East Side

Roof Tops	=	0.58 Acres
Pavement	=	2.35 Acres
Landscape	=	3.09 Acre
Total	=	6.02 Acres

Sequalitchew Road

Pavement	=	0.87 Acres
Landscape	=	0.30 Acre
Total	=	1.17 Acres

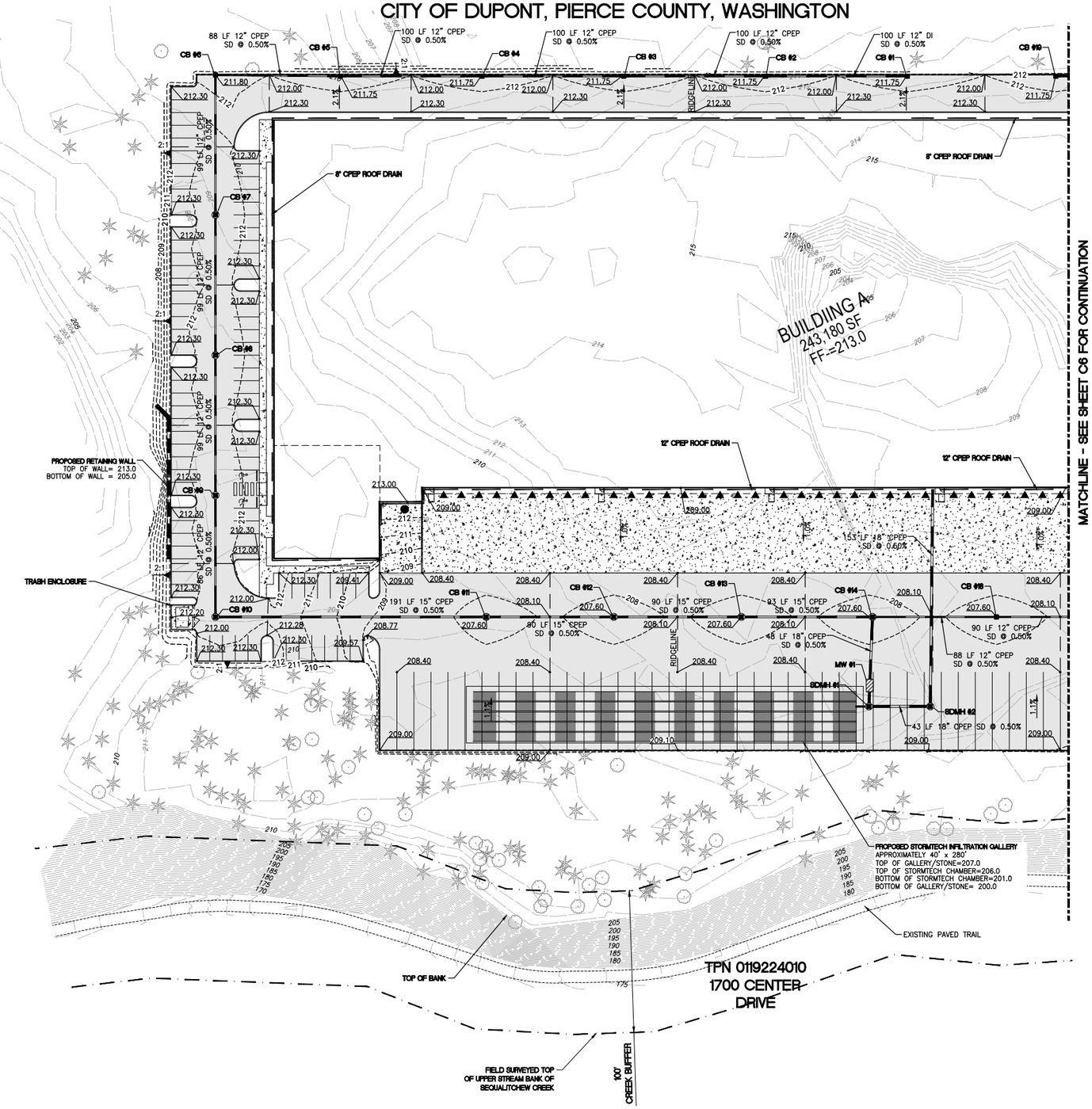
BASIN MAP

Pipe Conveyance Calculations will be included in the final Stormwater Site Plan.

GRADING PLAN

PRELIMINARY GRADING AND STORM DRAINAGE PLAN-WEST
FOR
DUPONT 243
A PORTION OF THE NW 1/4 OF SECTION 26, TOWNSHIP 19N, RANGE 01E, W.M.
CITY OF DUPONT, PIERCE COUNTY, WASHINGTON

1"=40'
0 20 40 80



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BY: _____ DATE: _____
CITY OF DUPONT

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NOTE:
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No.	Date	By	Ckd.	Appr.	Revision

Title: PRELIMINARY GRADING AND STORM DRAINAGE PLAN-WEST FOR DUPONT 243

For: AVENUE 55, LLC
601 UNION STREET, SUITE 2930
SEATTLE, WA 98101
(206) 707-9696

DANIEL K. BALMELLI — STATE OF WASHINGTON — 25672 — REGISTERED PROFESSIONAL ENGINEER
11/18/2022

Scale: Horizontal 1"=40' Vertical N/A

Designed JAT | Drawn JAT | Checked DKB | Approved DKB | Date 11/18/22

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Sheet C5 of 13

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PRELIMINARY GRADING AND STORM DRAINAGE PLAN-EAST

FOR

DUPONT 243

A PORTION OF THE NW 1/4 OF SECTION 26, TOWNSHIP 19N, RANGE 01E, W.M.

CITY OF DUPONT, PIERCE COUNTY, WASHINGTON

1"=40'

0 20 40 80

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CITY OF DUPONT

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NOTE:
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NOT A PART
THIS PORTION TO BE DEVELOPED UNDER A SEPARATE LAND USE APPLICATION AND PERMITS

MATCHLINE - SEE SHEET C5 FOR CONTINUATION

BUILDIING A
243,180 SF
FF-=213.0

BUILDING B
25,200 SF
FF=213.0

SEQUALITCHEW ROAD

TEMPORARY CUL-DE-SAC

EDGE OF FUTURE ROW

CENTERLINE OF PROPOSED SEQUALITCHEW ROAD

PROPOSED 40' DRIVEWAY

PROPOSED 5' SIDEWALK

PROPOSED STORMTECH INFILTRATION GALLERY
APPROXIMATELY 20' x 70'
TOP OF GALLERY/STONE=209.5
TOP OF STORMTECH CHAMBER=208.5
BOTTOM OF STORMTECH CHAMBER=206.0
BOTTOM OF GALLERY/STONE= 205.0

REMAINDER OF SEQUALITCHEW ROAD TO BE CONSTRUCTED UNDER A SEPARATE LAND USE APPLICATION AND PERMITS

PROPOSED HALF STREET. EASTERN HALF TO BE COMPLETED BY ADJACENT DEVELOPMENT. SEE SHEETS C9 AND C10 FOR DETAILS

PROPOSED 30' DRIVEWAY

CENTERLINE OF PROPOSED SEQUALITCHEW ROAD

42.5' FUTURE ROW

42.5' PROPOSED ROW

EX. CUL-DE-SAC

12" CPEP ROOF DRAIN

8" CPEP ROOF DRAIN

6" CPEP ROOF DRAIN

TRASH ENCLOSURE

EX. MONITOR WELL
RIM=212.78
TOP PVC=212.08

PROPOSED SEQUALITCHEW TRAIL CONNECTION

TOP OF BANK

EXISTING PAVED TRAIL

EXISTING SLOPE

PROPOSED 8' SEQUALITCHEW CREEK TRAIL

PROPOSED STORMTECH INFILTRATION GALLERY
APPROXIMATELY 30' x 120'
TOP OF GALLERY/STONE=208.0
TOP OF STORMTECH CHAMBER=207.0
BOTTOM OF STORMTECH CHAMBER=202.0
BOTTOM OF GALLERY/STONE= 201.0

EX. OREGON WHITE OAK TO REMAIN

PROPOSED SEQUALITCHEW TRAIL CONNECTION

100' CREEK BUFFER

FIELD SURVEYED TOP OF UPPER STREAM BANK OF SEQUALITCHEW CREEK

TPN 0119224010
1700 CENTER DRIVE

17.5' TRAIL CONST. EASEMENT PER REC. NO. 201009301052 (24)

30' TRAIL CONSTRUCTION EASEMENT PER REC. NO. 201009301052 (24)

15' TRAIL EASEMENT PER REC. NO. 201009301052 (24)

TPOB TRAIL ESMT PER 201009301052 (24)

5' TRAIL EASEMENT AND TRAIL CONSTRUCTION EASEMENT PER 201009301052 (24)

No.	Date	By	Ckd.	Appr.	Revision

Title: PRELIMINARY GRADING AND STORM DRAINAGE PLAN-EAST FOR DUPONT 243

For: AVENUE 55, LLC
601 UNION STREET, SUITE 2930
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(206) 707-9696

DANIEL K. BALMELLI
STATE OF WASHINGTON
25672
REGISTERED PROFESSIONAL ENGINEER
11/18/2022

Scale: Horizontal 1"=40' Vertical N/A

Designed MAT Drawn MAT Checked DKB Approved DKB Date 11/18/22

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Job Number 18666

Sheet C6 of 13

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FLOW CONTROL CALCULATIONS

WWHM2012

PROJECT REPORT

18666 - DuPont Industrial Warehouse
Infiltration Calculations - West Basin

General Model Information

Project Name:	18666 FC Building A
Site Name:	
Site Address:	
City:	
Report Date:	11/16/2022
Gage:	40 IN WEST
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

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	12.47
Pervious Total	12.47
Impervious Land Use	acre
Impervious Total	0
Basin Total	12.47

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	2.7
Pervious Total	2.7

Impervious Land Use	acre
ROOF TOPS FLAT	5.58
PARKING FLAT	4.19
Impervious Total	9.77
Basin Total	12.47

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	280.00 ft.
Bottom Width:	40.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	1
Pour Space of material for first layer:	0.3
Material thickness of second layer:	5
Pour Space of material for second layer:	0.7
Material thickness of third layer:	1
Pour Space of material for third layer:	0.3
Infiltration On	
Infiltration rate:	6
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	4195.261
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	4195.261
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	7 ft.
Riser Diameter:	18 in.
Element Flows To:	
Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

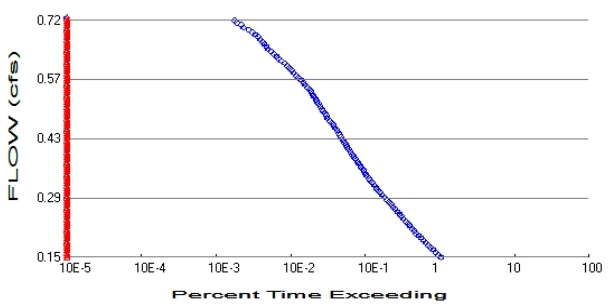
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.257	0.000	0.000	0.000
0.0889	0.257	0.006	0.000	1.555
0.1778	0.257	0.013	0.000	1.555
0.2667	0.257	0.020	0.000	1.555
0.3556	0.257	0.027	0.000	1.555
0.4444	0.257	0.034	0.000	1.555
0.5333	0.257	0.041	0.000	1.555
0.6222	0.257	0.048	0.000	1.555
0.7111	0.257	0.054	0.000	1.555
0.8000	0.257	0.061	0.000	1.555
0.8889	0.257	0.068	0.000	1.555
0.9778	0.257	0.075	0.000	1.555
1.0667	0.257	0.091	0.000	1.555
1.1556	0.257	0.107	0.000	1.555
1.2444	0.257	0.123	0.000	1.555
1.3333	0.257	0.139	0.000	1.555
1.4222	0.257	0.155	0.000	1.555
1.5111	0.257	0.171	0.000	1.555
1.6000	0.257	0.187	0.000	1.555
1.6889	0.257	0.203	0.000	1.555
1.7778	0.257	0.219	0.000	1.555
1.8667	0.257	0.235	0.000	1.555
1.9556	0.257	0.251	0.000	1.555
2.0444	0.257	0.267	0.000	1.555

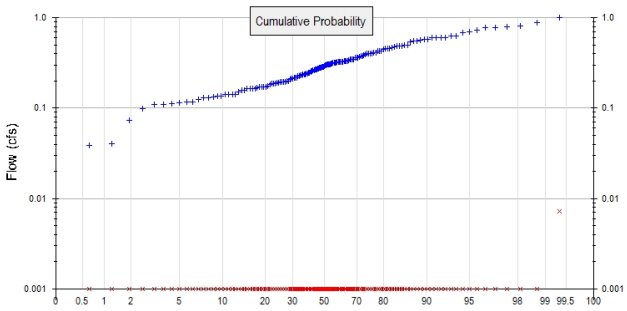
2.1333	0.257	0.283	0.000	1.555
2.2222	0.257	0.299	0.000	1.555
2.3111	0.257	0.315	0.000	1.555
2.4000	0.257	0.331	0.000	1.555
2.4889	0.257	0.347	0.000	1.555
2.5778	0.257	0.363	0.000	1.555
2.6667	0.257	0.379	0.000	1.555
2.7556	0.257	0.395	0.000	1.555
2.8444	0.257	0.411	0.000	1.555
2.9333	0.257	0.427	0.000	1.555
3.0222	0.257	0.443	0.000	1.555
3.1111	0.257	0.459	0.000	1.555
3.2000	0.257	0.475	0.000	1.555
3.2889	0.257	0.491	0.000	1.555
3.3778	0.257	0.507	0.000	1.555
3.4667	0.257	0.523	0.000	1.555
3.5556	0.257	0.539	0.000	1.555
3.6444	0.257	0.555	0.000	1.555
3.7333	0.257	0.571	0.000	1.555
3.8222	0.257	0.587	0.000	1.555
3.9111	0.257	0.603	0.000	1.555
4.0000	0.257	0.619	0.000	1.555
4.0889	0.257	0.635	0.000	1.555
4.1778	0.257	0.651	0.000	1.555
4.2667	0.257	0.667	0.000	1.555
4.3556	0.257	0.683	0.000	1.555
4.4444	0.257	0.699	0.000	1.555
4.5333	0.257	0.715	0.000	1.555
4.6222	0.257	0.731	0.000	1.555
4.7111	0.257	0.747	0.000	1.555
4.8000	0.257	0.763	0.000	1.555
4.8889	0.257	0.779	0.000	1.555
4.9778	0.257	0.795	0.000	1.555
5.0667	0.257	0.811	0.000	1.555
5.1556	0.257	0.827	0.000	1.555
5.2444	0.257	0.843	0.000	1.555
5.3333	0.257	0.859	0.000	1.555
5.4222	0.257	0.875	0.000	1.555
5.5111	0.257	0.891	0.000	1.555
5.6000	0.257	0.907	0.000	1.555
5.6889	0.257	0.923	0.000	1.555
5.7778	0.257	0.939	0.000	1.555
5.8667	0.257	0.955	0.000	1.555
5.9556	0.257	0.971	0.000	1.555
6.0444	0.257	0.978	0.000	1.555
6.1333	0.257	0.985	0.000	1.555
6.2222	0.257	0.991	0.000	1.555
6.3111	0.257	0.998	0.000	1.555
6.4000	0.257	1.005	0.000	1.555
6.4889	0.257	1.012	0.000	1.555
6.5778	0.257	1.019	0.000	1.555
6.6667	0.257	1.026	0.000	1.555
6.7556	0.257	1.033	0.000	1.555
6.8444	0.257	1.039	0.000	1.555
6.9333	0.257	1.046	0.000	1.555
7.0222	0.257	1.069	0.052	1.555
7.1111	0.257	1.092	0.587	1.555
7.2000	0.257	1.115	1.404	1.555

7.2889	0.257	1.138	2.374	1.555
7.3778	0.257	1.161	3.386	1.555
7.4667	0.257	1.183	4.326	1.555
7.5556	0.257	1.206	5.097	1.555
7.6444	0.257	1.229	5.649	1.555
7.7333	0.257	1.252	6.014	1.555
7.8222	0.257	1.275	6.425	1.555
7.9111	0.257	1.298	6.764	1.555
8.0000	0.257	1.321	7.086	1.555

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 12.47
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 2.7
Total Impervious Area: 9.77

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.29752
5 year	0.457921
10 year	0.550659
25 year	0.651119
50 year	0.715749
100 year	0.771831

Flow Frequency Return Periods for Mitigated. POC #1

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

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.210	0.000
1903	0.196	0.000
1904	0.319	0.000
1905	0.159	0.000
1906	0.073	0.000
1907	0.456	0.000
1908	0.334	0.000
1909	0.325	0.000
1910	0.452	0.000
1911	0.307	0.000

1912	0.997	0.000
1913	0.463	0.000
1914	0.117	0.000
1915	0.201	0.000
1916	0.305	0.000
1917	0.113	0.000
1918	0.321	0.000
1919	0.251	0.000
1920	0.304	0.000
1921	0.326	0.000
1922	0.328	0.000
1923	0.271	0.000
1924	0.131	0.000
1925	0.166	0.000
1926	0.287	0.000
1927	0.189	0.000
1928	0.227	0.000
1929	0.455	0.000
1930	0.293	0.000
1931	0.278	0.000
1932	0.213	0.000
1933	0.232	0.000
1934	0.597	0.000
1935	0.282	0.000
1936	0.260	0.000
1937	0.403	0.000
1938	0.258	0.000
1939	0.021	0.000
1940	0.270	0.000
1941	0.151	0.000
1942	0.412	0.000
1943	0.214	0.000
1944	0.430	0.000
1945	0.345	0.000
1946	0.198	0.000
1947	0.137	0.000
1948	0.630	0.000
1949	0.557	0.000
1950	0.164	0.000
1951	0.183	0.000
1952	0.810	0.007
1953	0.737	0.000
1954	0.270	0.000
1955	0.219	0.000
1956	0.109	0.000
1957	0.402	0.000
1958	0.785	0.000
1959	0.482	0.000
1960	0.141	0.000
1961	0.487	0.000
1962	0.280	0.000
1963	0.142	0.000
1964	0.141	0.000
1965	0.557	0.000
1966	0.164	0.000
1967	0.243	0.000
1968	0.248	0.000
1969	0.249	0.000

1970	0.390	0.000
1971	0.578	0.000
1972	0.381	0.000
1973	0.501	0.000
1974	0.275	0.000
1975	0.606	0.000
1976	0.333	0.000
1977	0.132	0.000
1978	0.542	0.000
1979	0.157	0.000
1980	0.317	0.000
1981	0.308	0.000
1982	0.131	0.000
1983	0.491	0.000
1984	0.234	0.000
1985	0.358	0.000
1986	0.304	0.000
1987	0.569	0.000
1988	0.361	0.000
1989	0.327	0.000
1990	0.380	0.000
1991	0.298	0.000
1992	0.386	0.000
1993	0.400	0.000
1994	0.581	0.000
1995	0.125	0.000
1996	0.636	0.000
1997	0.237	0.000
1998	0.323	0.000
1999	0.039	0.000
2000	0.237	0.000
2001	0.112	0.000
2002	0.429	0.000
2003	0.373	0.000
2004	0.326	0.000
2005	0.609	0.000
2006	0.188	0.000
2007	0.167	0.000
2008	0.318	0.000
2009	0.219	0.000
2010	0.193	0.000
2011	0.143	0.000
2012	0.256	0.000
2013	0.170	0.000
2014	0.137	0.000
2015	0.261	0.000
2016	0.109	0.000
2017	0.428	0.000
2018	0.802	0.000
2019	0.782	0.000
2020	0.241	0.000
2021	0.403	0.000
2022	0.172	0.000
2023	0.346	0.000
2024	0.893	0.000
2025	0.314	0.000
2026	0.493	0.000
2027	0.197	0.000

2028	0.172	0.000
2029	0.328	0.000
2030	0.603	0.000
2031	0.196	0.000
2032	0.118	0.000
2033	0.187	0.000
2034	0.174	0.000
2035	0.696	0.000
2036	0.359	0.000
2037	0.099	0.000
2038	0.285	0.000
2039	0.041	0.000
2040	0.189	0.000
2041	0.219	0.000
2042	0.680	0.000
2043	0.341	0.000
2044	0.456	0.000
2045	0.298	0.000
2046	0.347	0.000
2047	0.266	0.000
2048	0.348	0.000
2049	0.307	0.000
2050	0.226	0.000
2051	0.331	0.000
2052	0.195	0.000
2053	0.332	0.000
2054	0.413	0.000
2055	0.171	0.000
2056	0.166	0.000
2057	0.230	0.000
2058	0.285	0.000
2059	0.478	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

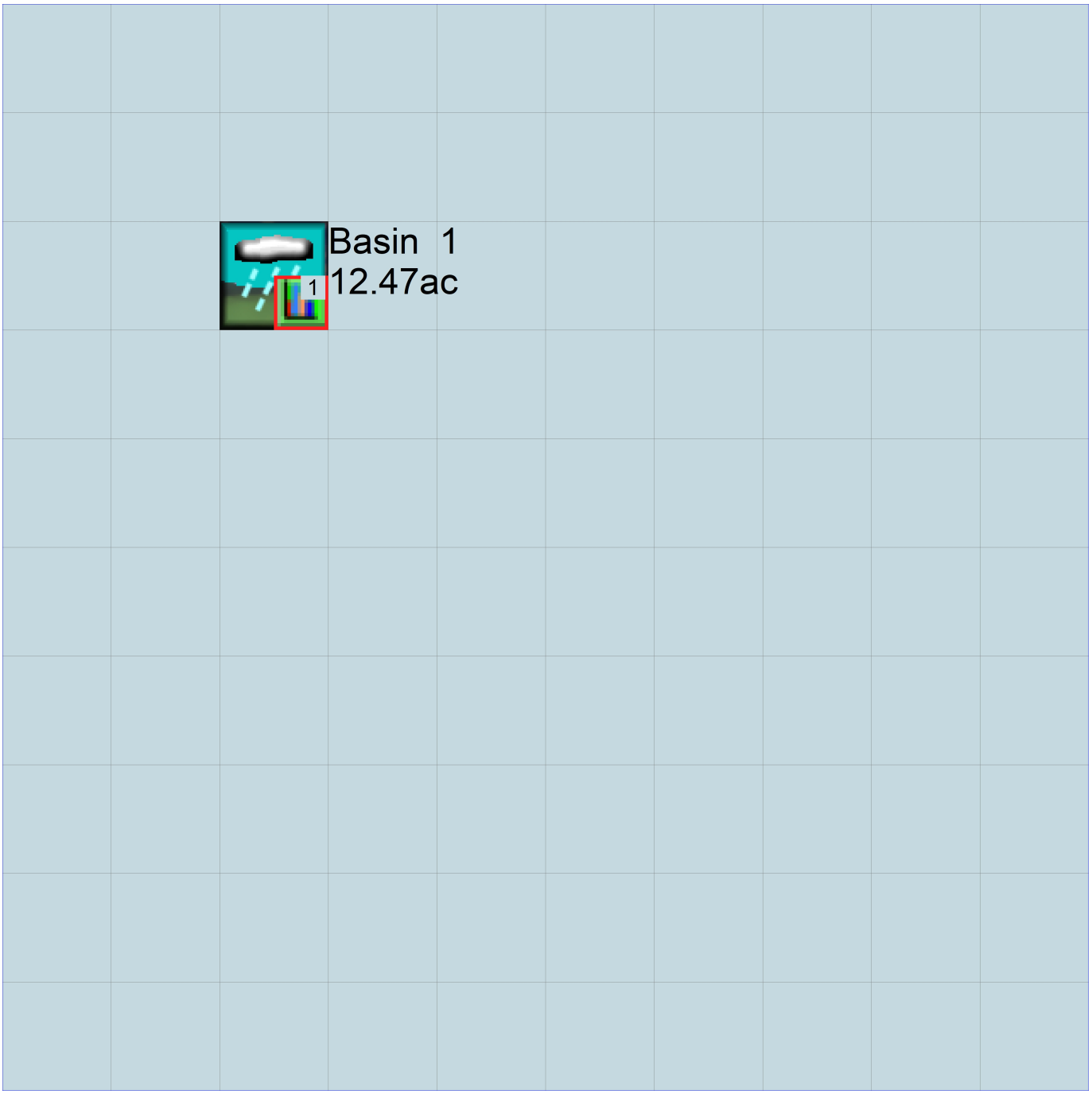
Rank	Predeveloped	Mitigated
1	0.9972	0.0071
2	0.8925	0.0000
3	0.8096	0.0000
4	0.8023	0.0000
5	0.7851	0.0000
6	0.7815	0.0000
7	0.7369	0.0000
8	0.6956	0.0000
9	0.6795	0.0000
10	0.6356	0.0000
11	0.6296	0.0000
12	0.6088	0.0000
13	0.6059	0.0000
14	0.6032	0.0000
15	0.5973	0.0000
16	0.5813	0.0000
17	0.5781	0.0000
18	0.5695	0.0000
19	0.5575	0.0000
20	0.5570	0.0000
21	0.5425	0.0000
22	0.5012	0.0000

23	0.4932	0.0000
24	0.4914	0.0000
25	0.4872	0.0000
26	0.4821	0.0000
27	0.4777	0.0000
28	0.4635	0.0000
29	0.4560	0.0000
30	0.4559	0.0000
31	0.4547	0.0000
32	0.4517	0.0000
33	0.4298	0.0000
34	0.4290	0.0000
35	0.4277	0.0000
36	0.4129	0.0000
37	0.4120	0.0000
38	0.4029	0.0000
39	0.4029	0.0000
40	0.4017	0.0000
41	0.3996	0.0000
42	0.3903	0.0000
43	0.3859	0.0000
44	0.3807	0.0000
45	0.3804	0.0000
46	0.3732	0.0000
47	0.3607	0.0000
48	0.3594	0.0000
49	0.3579	0.0000
50	0.3483	0.0000
51	0.3469	0.0000
52	0.3465	0.0000
53	0.3445	0.0000
54	0.3408	0.0000
55	0.3339	0.0000
56	0.3327	0.0000
57	0.3320	0.0000
58	0.3306	0.0000
59	0.3282	0.0000
60	0.3277	0.0000
61	0.3267	0.0000
62	0.3264	0.0000
63	0.3264	0.0000
64	0.3252	0.0000
65	0.3226	0.0000
66	0.3212	0.0000
67	0.3193	0.0000
68	0.3182	0.0000
69	0.3170	0.0000
70	0.3137	0.0000
71	0.3084	0.0000
72	0.3075	0.0000
73	0.3068	0.0000
74	0.3046	0.0000
75	0.3042	0.0000
76	0.3039	0.0000
77	0.2984	0.0000
78	0.2984	0.0000
79	0.2933	0.0000
80	0.2865	0.0000

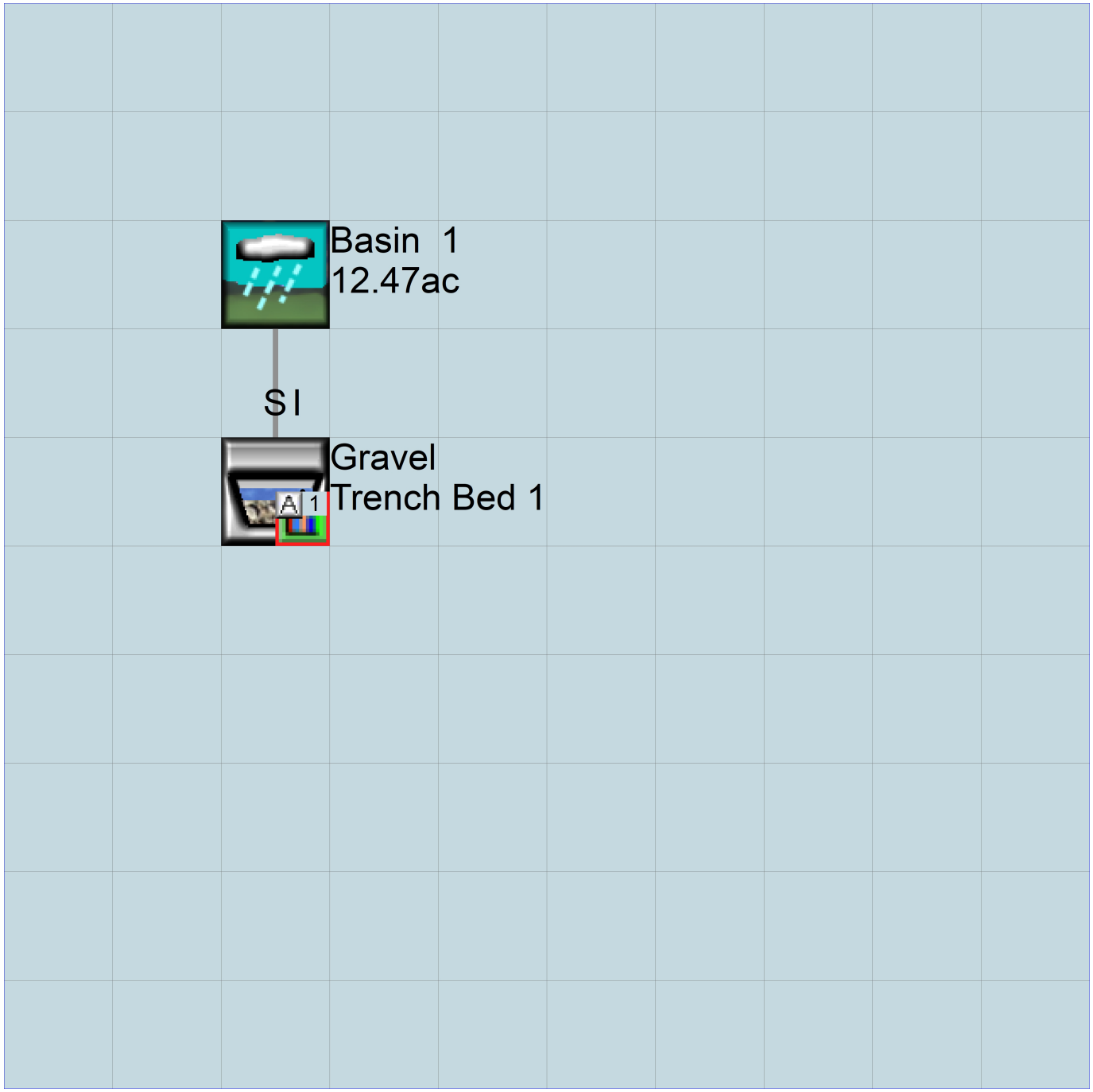
81	0.2851	0.0000
82	0.2848	0.0000
83	0.2818	0.0000
84	0.2797	0.0000
85	0.2784	0.0000
86	0.2748	0.0000
87	0.2715	0.0000
88	0.2701	0.0000
89	0.2697	0.0000
90	0.2664	0.0000
91	0.2609	0.0000
92	0.2605	0.0000
93	0.2583	0.0000
94	0.2557	0.0000
95	0.2506	0.0000
96	0.2489	0.0000
97	0.2479	0.0000
98	0.2430	0.0000
99	0.2410	0.0000
100	0.2369	0.0000
101	0.2366	0.0000
102	0.2340	0.0000
103	0.2325	0.0000
104	0.2304	0.0000
105	0.2271	0.0000
106	0.2259	0.0000
107	0.2192	0.0000
108	0.2192	0.0000
109	0.2187	0.0000
110	0.2143	0.0000
111	0.2131	0.0000
112	0.2095	0.0000
113	0.2013	0.0000
114	0.1984	0.0000
115	0.1965	0.0000
116	0.1960	0.0000
117	0.1957	0.0000
118	0.1949	0.0000
119	0.1930	0.0000
120	0.1894	0.0000
121	0.1888	0.0000
122	0.1882	0.0000
123	0.1867	0.0000
124	0.1826	0.0000
125	0.1741	0.0000
126	0.1722	0.0000
127	0.1717	0.0000
128	0.1715	0.0000
129	0.1702	0.0000
130	0.1669	0.0000
131	0.1664	0.0000
132	0.1659	0.0000
133	0.1644	0.0000
134	0.1641	0.0000
135	0.1590	0.0000
136	0.1571	0.0000
137	0.1506	0.0000
138	0.1429	0.0000

139	0.1425	0.0000
140	0.1412	0.0000
141	0.1406	0.0000
142	0.1373	0.0000
143	0.1373	0.0000
144	0.1324	0.0000
145	0.1310	0.0000
146	0.1309	0.0000
147	0.1246	0.0000
148	0.1176	0.0000
149	0.1174	0.0000
150	0.1135	0.0000
151	0.1121	0.0000
152	0.1092	0.0000
153	0.1090	0.0000
154	0.0987	0.0000
155	0.0732	0.0000
156	0.0409	0.0000
157	0.0391	0.0000
158	0.0207	0.0000

Appendix
Predeveloped Schematic



Mitigated Schematic



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Local (360)943-0304

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WWHM2012

PROJECT REPORT

18666 - DuPont Industrial Warehouse
Infiltration Calculations - East Basin

General Model Information

Project Name:	18666 FC Building B
Site Name:	
Site Address:	
City:	
Report Date:	11/16/2022
Gage:	40 IN WEST
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

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	12.47
Pervious Total	12.47
Impervious Land Use	acre
Impervious Total	0
Basin Total	12.47

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	3.09
Pervious Total	3.09

Impervious Land Use	acre
ROOF TOPS FLAT	0.58
PARKING FLAT	2.35
Impervious Total	2.93
Basin Total	6.02

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	120.00 ft.
Bottom Width:	30.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	1
Pour Space of material for first layer:	0.3
Material thickness of second layer:	5
Pour Space of material for second layer:	0.7
Material thickness of third layer:	1
Pour Space of material for third layer:	0.3
Infiltration On	
Infiltration rate:	6
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	1259.947
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	1259.947
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	7 ft.
Riser Diameter:	18 in.
Element Flows To:	
Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

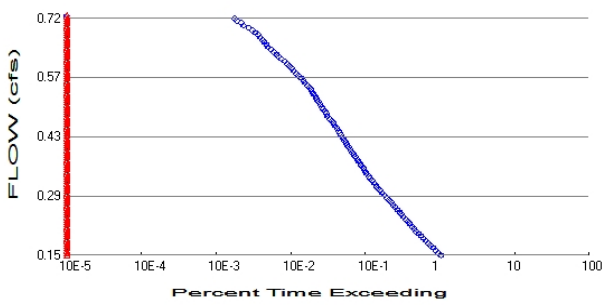
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.082	0.000	0.000	0.000
0.0889	0.082	0.002	0.000	0.500
0.1778	0.082	0.004	0.000	0.500
0.2667	0.082	0.006	0.000	0.500
0.3556	0.082	0.008	0.000	0.500
0.4444	0.082	0.011	0.000	0.500
0.5333	0.082	0.013	0.000	0.500
0.6222	0.082	0.015	0.000	0.500
0.7111	0.082	0.017	0.000	0.500
0.8000	0.082	0.019	0.000	0.500
0.8889	0.082	0.022	0.000	0.500
0.9778	0.082	0.024	0.000	0.500
1.0667	0.082	0.029	0.000	0.500
1.1556	0.082	0.034	0.000	0.500
1.2444	0.082	0.039	0.000	0.500
1.3333	0.082	0.044	0.000	0.500
1.4222	0.082	0.050	0.000	0.500
1.5111	0.082	0.055	0.000	0.500
1.6000	0.082	0.060	0.000	0.500
1.6889	0.082	0.065	0.000	0.500
1.7778	0.082	0.070	0.000	0.500
1.8667	0.082	0.075	0.000	0.500
1.9556	0.082	0.080	0.000	0.500
2.0444	0.082	0.086	0.000	0.500

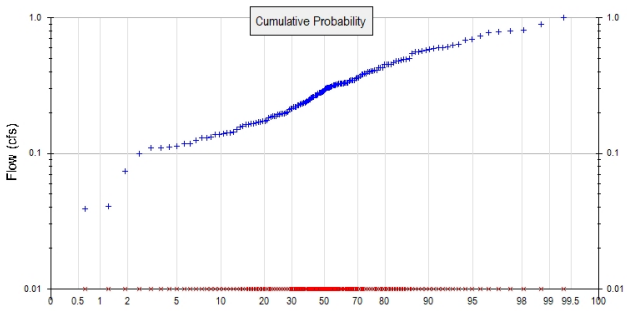
2.1333	0.082	0.091	0.000	0.500
2.2222	0.082	0.096	0.000	0.500
2.3111	0.082	0.101	0.000	0.500
2.4000	0.082	0.106	0.000	0.500
2.4889	0.082	0.111	0.000	0.500
2.5778	0.082	0.116	0.000	0.500
2.6667	0.082	0.121	0.000	0.500
2.7556	0.082	0.127	0.000	0.500
2.8444	0.082	0.132	0.000	0.500
2.9333	0.082	0.137	0.000	0.500
3.0222	0.082	0.142	0.000	0.500
3.1111	0.082	0.147	0.000	0.500
3.2000	0.082	0.152	0.000	0.500
3.2889	0.082	0.157	0.000	0.500
3.3778	0.082	0.163	0.000	0.500
3.4667	0.082	0.168	0.000	0.500
3.5556	0.082	0.173	0.000	0.500
3.6444	0.082	0.178	0.000	0.500
3.7333	0.082	0.183	0.000	0.500
3.8222	0.082	0.188	0.000	0.500
3.9111	0.082	0.193	0.000	0.500
4.0000	0.082	0.199	0.000	0.500
4.0889	0.082	0.204	0.000	0.500
4.1778	0.082	0.209	0.000	0.500
4.2667	0.082	0.214	0.000	0.500
4.3556	0.082	0.219	0.000	0.500
4.4444	0.082	0.224	0.000	0.500
4.5333	0.082	0.229	0.000	0.500
4.6222	0.082	0.235	0.000	0.500
4.7111	0.082	0.240	0.000	0.500
4.8000	0.082	0.245	0.000	0.500
4.8889	0.082	0.250	0.000	0.500
4.9778	0.082	0.255	0.000	0.500
5.0667	0.082	0.260	0.000	0.500
5.1556	0.082	0.265	0.000	0.500
5.2444	0.082	0.271	0.000	0.500
5.3333	0.082	0.276	0.000	0.500
5.4222	0.082	0.281	0.000	0.500
5.5111	0.082	0.286	0.000	0.500
5.6000	0.082	0.291	0.000	0.500
5.6889	0.082	0.296	0.000	0.500
5.7778	0.082	0.301	0.000	0.500
5.8667	0.082	0.307	0.000	0.500
5.9556	0.082	0.312	0.000	0.500
6.0444	0.082	0.314	0.000	0.500
6.1333	0.082	0.316	0.000	0.500
6.2222	0.082	0.318	0.000	0.500
6.3111	0.082	0.321	0.000	0.500
6.4000	0.082	0.323	0.000	0.500
6.4889	0.082	0.325	0.000	0.500
6.5778	0.082	0.327	0.000	0.500
6.6667	0.082	0.329	0.000	0.500
6.7556	0.082	0.332	0.000	0.500
6.8444	0.082	0.334	0.000	0.500
6.9333	0.082	0.336	0.000	0.500
7.0222	0.082	0.343	0.052	0.500
7.1111	0.082	0.351	0.587	0.500
7.2000	0.082	0.358	1.404	0.500

7.2889	0.082	0.365	2.374	0.500
7.3778	0.082	0.373	3.386	0.500
7.4667	0.082	0.380	4.326	0.500
7.5556	0.082	0.387	5.097	0.500
7.6444	0.082	0.395	5.649	0.500
7.7333	0.082	0.402	6.014	0.500
7.8222	0.082	0.409	6.425	0.500
7.9111	0.082	0.417	6.764	0.500
8.0000	0.082	0.424	7.086	0.500

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 12.47
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 3.09
Total Impervious Area: 2.93

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.29752
5 year	0.457921
10 year	0.550659
25 year	0.651119
50 year	0.715749
100 year	0.771831

Flow Frequency Return Periods for Mitigated. POC #1

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

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.210	0.000
1903	0.196	0.000
1904	0.319	0.000
1905	0.159	0.000
1906	0.073	0.000
1907	0.456	0.000
1908	0.334	0.000
1909	0.325	0.000
1910	0.452	0.000
1911	0.307	0.000

1912	0.997	0.000
1913	0.463	0.000
1914	0.117	0.000
1915	0.201	0.000
1916	0.305	0.000
1917	0.113	0.000
1918	0.321	0.000
1919	0.251	0.000
1920	0.304	0.000
1921	0.326	0.000
1922	0.328	0.000
1923	0.271	0.000
1924	0.131	0.000
1925	0.166	0.000
1926	0.287	0.000
1927	0.189	0.000
1928	0.227	0.000
1929	0.455	0.000
1930	0.293	0.000
1931	0.278	0.000
1932	0.213	0.000
1933	0.232	0.000
1934	0.597	0.000
1935	0.282	0.000
1936	0.260	0.000
1937	0.403	0.000
1938	0.258	0.000
1939	0.021	0.000
1940	0.270	0.000
1941	0.151	0.000
1942	0.412	0.000
1943	0.214	0.000
1944	0.430	0.000
1945	0.345	0.000
1946	0.198	0.000
1947	0.137	0.000
1948	0.630	0.000
1949	0.557	0.000
1950	0.164	0.000
1951	0.183	0.000
1952	0.810	0.000
1953	0.737	0.000
1954	0.270	0.000
1955	0.219	0.000
1956	0.109	0.000
1957	0.402	0.000
1958	0.785	0.000
1959	0.482	0.000
1960	0.141	0.000
1961	0.487	0.000
1962	0.280	0.000
1963	0.142	0.000
1964	0.141	0.000
1965	0.557	0.000
1966	0.164	0.000
1967	0.243	0.000
1968	0.248	0.000
1969	0.249	0.000

1970	0.390	0.000
1971	0.578	0.000
1972	0.381	0.000
1973	0.501	0.000
1974	0.275	0.000
1975	0.606	0.000
1976	0.333	0.000
1977	0.132	0.000
1978	0.542	0.000
1979	0.157	0.000
1980	0.317	0.000
1981	0.308	0.000
1982	0.131	0.000
1983	0.491	0.000
1984	0.234	0.000
1985	0.358	0.000
1986	0.304	0.000
1987	0.569	0.000
1988	0.361	0.000
1989	0.327	0.000
1990	0.380	0.000
1991	0.298	0.000
1992	0.386	0.000
1993	0.400	0.000
1994	0.581	0.000
1995	0.125	0.000
1996	0.636	0.000
1997	0.237	0.000
1998	0.323	0.000
1999	0.039	0.000
2000	0.237	0.000
2001	0.112	0.000
2002	0.429	0.000
2003	0.373	0.000
2004	0.326	0.000
2005	0.609	0.000
2006	0.188	0.000
2007	0.167	0.000
2008	0.318	0.000
2009	0.219	0.000
2010	0.193	0.000
2011	0.143	0.000
2012	0.256	0.000
2013	0.170	0.000
2014	0.137	0.000
2015	0.261	0.000
2016	0.109	0.000
2017	0.428	0.000
2018	0.802	0.000
2019	0.782	0.000
2020	0.241	0.000
2021	0.403	0.000
2022	0.172	0.000
2023	0.346	0.000
2024	0.893	0.000
2025	0.314	0.000
2026	0.493	0.000
2027	0.197	0.000

2028	0.172	0.000
2029	0.328	0.000
2030	0.603	0.000
2031	0.196	0.000
2032	0.118	0.000
2033	0.187	0.000
2034	0.174	0.000
2035	0.696	0.000
2036	0.359	0.000
2037	0.099	0.000
2038	0.285	0.000
2039	0.041	0.000
2040	0.189	0.000
2041	0.219	0.000
2042	0.680	0.000
2043	0.341	0.000
2044	0.456	0.000
2045	0.298	0.000
2046	0.347	0.000
2047	0.266	0.000
2048	0.348	0.000
2049	0.307	0.000
2050	0.226	0.000
2051	0.331	0.000
2052	0.195	0.000
2053	0.332	0.000
2054	0.413	0.000
2055	0.171	0.000
2056	0.166	0.000
2057	0.230	0.000
2058	0.285	0.000
2059	0.478	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

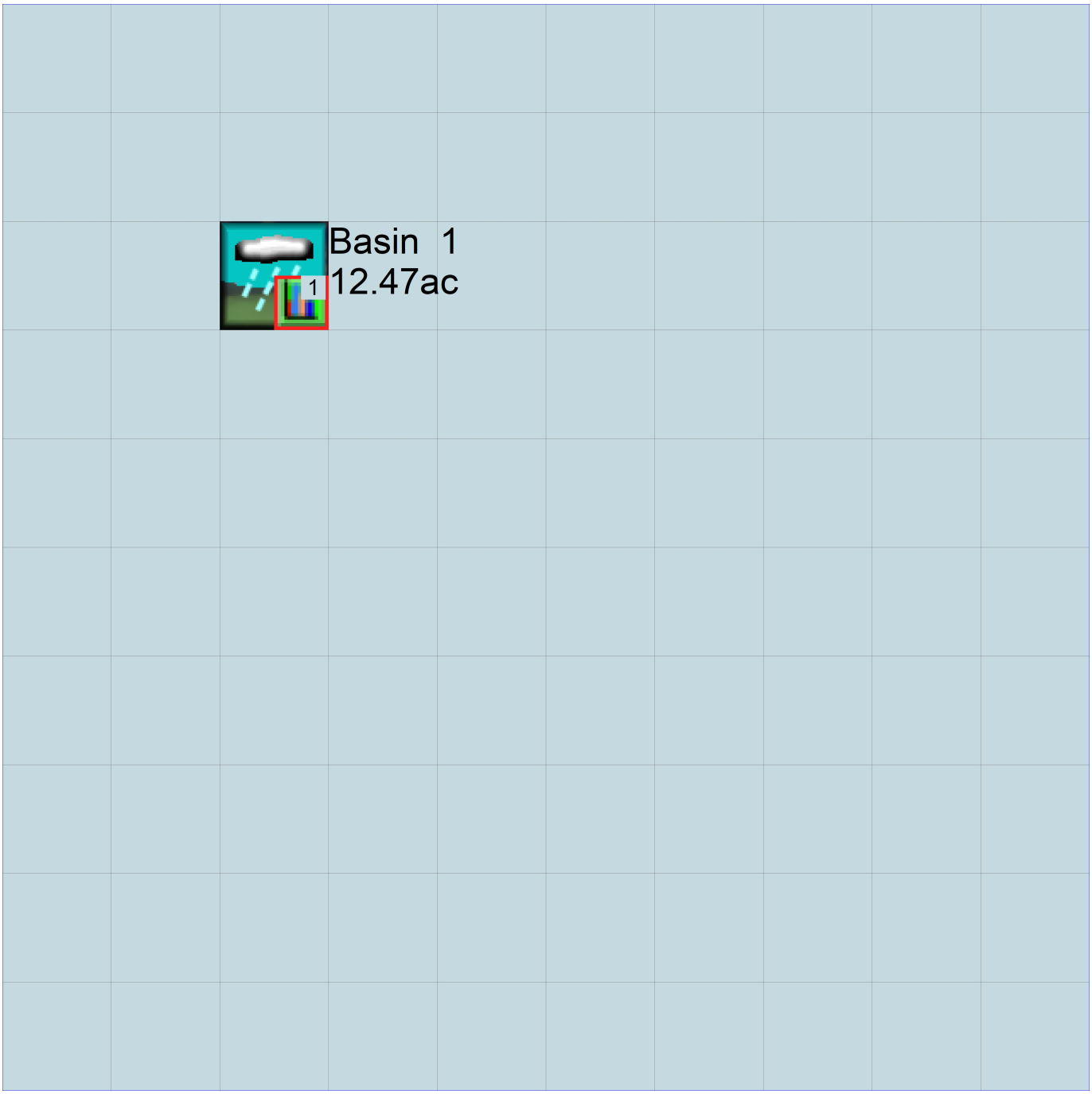
Rank	Predeveloped	Mitigated
1	0.9972	0.0000
2	0.8925	0.0000
3	0.8096	0.0000
4	0.8023	0.0000
5	0.7851	0.0000
6	0.7815	0.0000
7	0.7369	0.0000
8	0.6956	0.0000
9	0.6795	0.0000
10	0.6356	0.0000
11	0.6296	0.0000
12	0.6088	0.0000
13	0.6059	0.0000
14	0.6032	0.0000
15	0.5973	0.0000
16	0.5813	0.0000
17	0.5781	0.0000
18	0.5695	0.0000
19	0.5575	0.0000
20	0.5570	0.0000
21	0.5425	0.0000
22	0.5012	0.0000

23	0.4932	0.0000
24	0.4914	0.0000
25	0.4872	0.0000
26	0.4821	0.0000
27	0.4777	0.0000
28	0.4635	0.0000
29	0.4560	0.0000
30	0.4559	0.0000
31	0.4547	0.0000
32	0.4517	0.0000
33	0.4298	0.0000
34	0.4290	0.0000
35	0.4277	0.0000
36	0.4129	0.0000
37	0.4120	0.0000
38	0.4029	0.0000
39	0.4029	0.0000
40	0.4017	0.0000
41	0.3996	0.0000
42	0.3903	0.0000
43	0.3859	0.0000
44	0.3807	0.0000
45	0.3804	0.0000
46	0.3732	0.0000
47	0.3607	0.0000
48	0.3594	0.0000
49	0.3579	0.0000
50	0.3483	0.0000
51	0.3469	0.0000
52	0.3465	0.0000
53	0.3445	0.0000
54	0.3408	0.0000
55	0.3339	0.0000
56	0.3327	0.0000
57	0.3320	0.0000
58	0.3306	0.0000
59	0.3282	0.0000
60	0.3277	0.0000
61	0.3267	0.0000
62	0.3264	0.0000
63	0.3264	0.0000
64	0.3252	0.0000
65	0.3226	0.0000
66	0.3212	0.0000
67	0.3193	0.0000
68	0.3182	0.0000
69	0.3170	0.0000
70	0.3137	0.0000
71	0.3084	0.0000
72	0.3075	0.0000
73	0.3068	0.0000
74	0.3046	0.0000
75	0.3042	0.0000
76	0.3039	0.0000
77	0.2984	0.0000
78	0.2984	0.0000
79	0.2933	0.0000
80	0.2865	0.0000

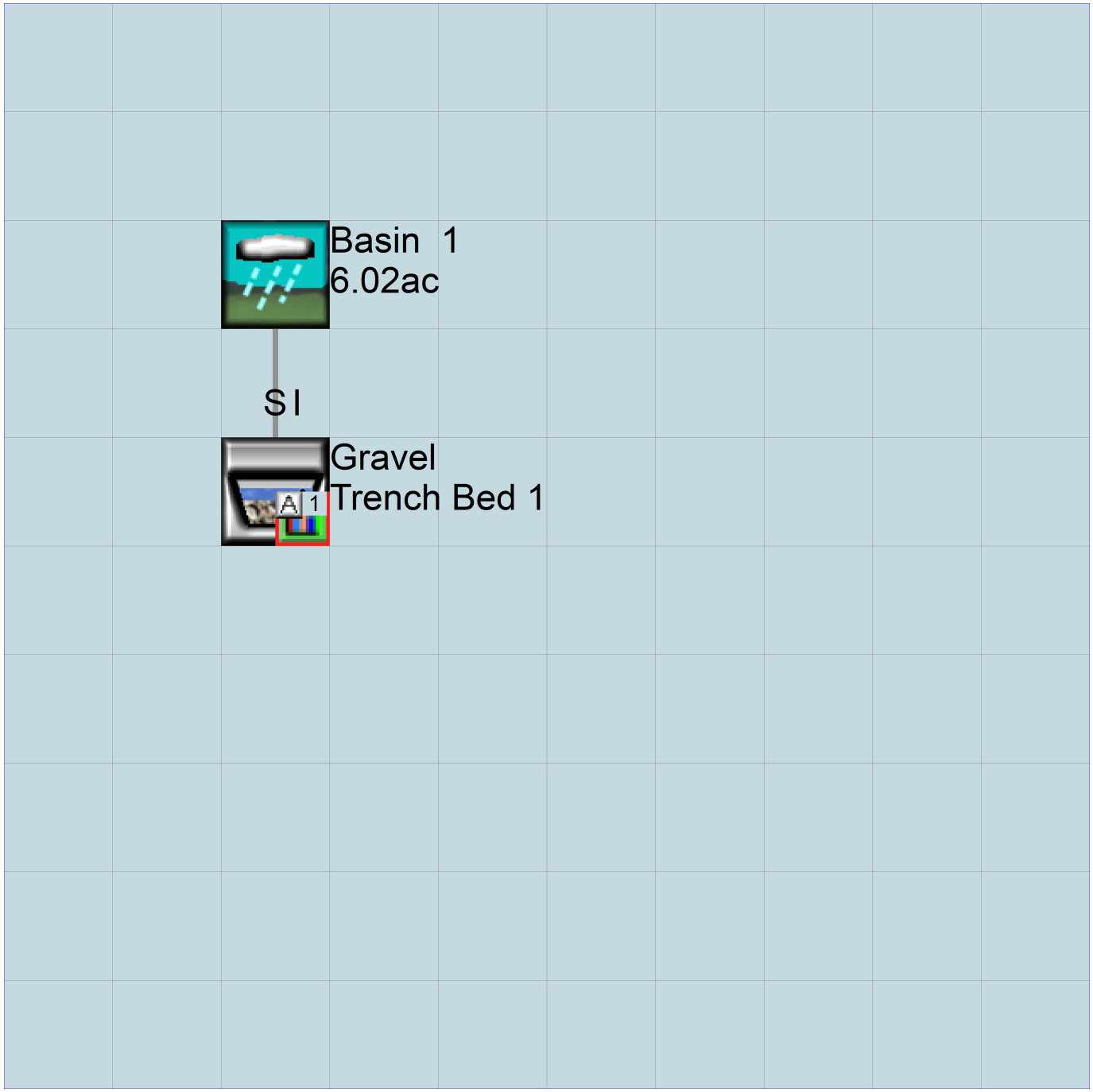
81	0.2851	0.0000
82	0.2848	0.0000
83	0.2818	0.0000
84	0.2797	0.0000
85	0.2784	0.0000
86	0.2748	0.0000
87	0.2715	0.0000
88	0.2701	0.0000
89	0.2697	0.0000
90	0.2664	0.0000
91	0.2609	0.0000
92	0.2605	0.0000
93	0.2583	0.0000
94	0.2557	0.0000
95	0.2506	0.0000
96	0.2489	0.0000
97	0.2479	0.0000
98	0.2430	0.0000
99	0.2410	0.0000
100	0.2369	0.0000
101	0.2366	0.0000
102	0.2340	0.0000
103	0.2325	0.0000
104	0.2304	0.0000
105	0.2271	0.0000
106	0.2259	0.0000
107	0.2192	0.0000
108	0.2192	0.0000
109	0.2187	0.0000
110	0.2143	0.0000
111	0.2131	0.0000
112	0.2095	0.0000
113	0.2013	0.0000
114	0.1984	0.0000
115	0.1965	0.0000
116	0.1960	0.0000
117	0.1957	0.0000
118	0.1949	0.0000
119	0.1930	0.0000
120	0.1894	0.0000
121	0.1888	0.0000
122	0.1882	0.0000
123	0.1867	0.0000
124	0.1826	0.0000
125	0.1741	0.0000
126	0.1722	0.0000
127	0.1717	0.0000
128	0.1715	0.0000
129	0.1702	0.0000
130	0.1669	0.0000
131	0.1664	0.0000
132	0.1659	0.0000
133	0.1644	0.0000
134	0.1641	0.0000
135	0.1590	0.0000
136	0.1571	0.0000
137	0.1506	0.0000
138	0.1429	0.0000

139	0.1425	0.0000
140	0.1412	0.0000
141	0.1406	0.0000
142	0.1373	0.0000
143	0.1373	0.0000
144	0.1324	0.0000
145	0.1310	0.0000
146	0.1309	0.0000
147	0.1246	0.0000
148	0.1176	0.0000
149	0.1174	0.0000
150	0.1135	0.0000
151	0.1121	0.0000
152	0.1092	0.0000
153	0.1090	0.0000
154	0.0987	0.0000
155	0.0732	0.0000
156	0.0409	0.0000
157	0.0391	0.0000
158	0.0207	0.0000

Appendix
Predeveloped Schematic



Mitigated Schematic



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WWHM2012

PROJECT REPORT

18666 - DuPont Industrial Warehouse
Infiltration Calculations - Road Basin

General Model Information

Project Name:	18666 FC Road
Site Name:	
Site Address:	
City:	
Report Date:	11/16/2022
Gage:	40 IN WEST
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

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	12.47
Pervious Total	12.47
Impervious Land Use	acre
Impervious Total	0
Basin Total	12.47

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.3
Pervious Total	0.3

Impervious Land Use	acre
PARKING FLAT	0.87
Impervious Total	0.87
Basin Total	1.17

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	70.00 ft.
Bottom Width:	20.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	1
Pour Space of material for first layer:	0.3
Material thickness of second layer:	2.5
Pour Space of material for second layer:	0.7
Material thickness of third layer:	1
Pour Space of material for third layer:	0.3
Infiltration On	
Infiltration rate:	6
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	373.115
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	373.115
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	4.5 ft.
Riser Diameter:	18 in.
Element Flows To:	
Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

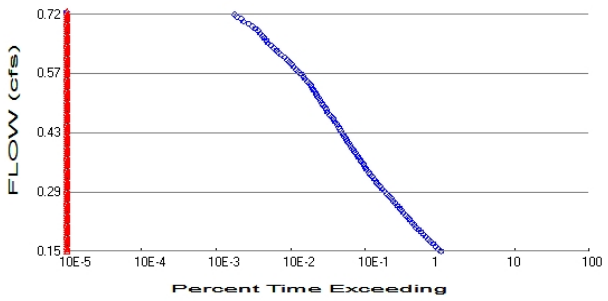
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.032	0.000	0.000	0.000
0.0611	0.032	0.000	0.000	0.194
0.1222	0.032	0.001	0.000	0.194
0.1833	0.032	0.001	0.000	0.194
0.2444	0.032	0.002	0.000	0.194
0.3056	0.032	0.002	0.000	0.194
0.3667	0.032	0.003	0.000	0.194
0.4278	0.032	0.004	0.000	0.194
0.4889	0.032	0.004	0.000	0.194
0.5500	0.032	0.005	0.000	0.194
0.6111	0.032	0.005	0.000	0.194
0.6722	0.032	0.006	0.000	0.194
0.7333	0.032	0.007	0.000	0.194
0.7944	0.032	0.007	0.000	0.194
0.8556	0.032	0.008	0.000	0.194
0.9167	0.032	0.008	0.000	0.194
0.9778	0.032	0.009	0.000	0.194
1.0389	0.032	0.010	0.000	0.194
1.1000	0.032	0.012	0.000	0.194
1.1611	0.032	0.013	0.000	0.194
1.2222	0.032	0.014	0.000	0.194
1.2833	0.032	0.016	0.000	0.194
1.3444	0.032	0.017	0.000	0.194
1.4056	0.032	0.019	0.000	0.194

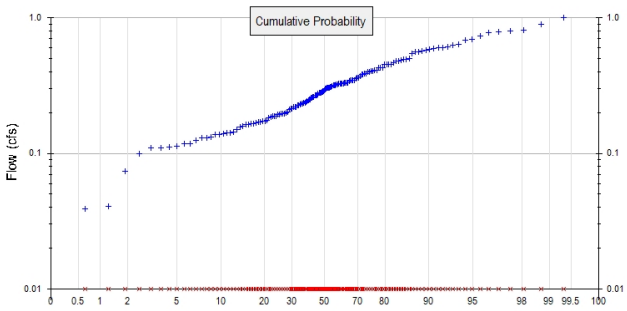
1.4667	0.032	0.020	0.000	0.194
1.5278	0.032	0.021	0.000	0.194
1.5889	0.032	0.023	0.000	0.194
1.6500	0.032	0.024	0.000	0.194
1.7111	0.032	0.025	0.000	0.194
1.7722	0.032	0.027	0.000	0.194
1.8333	0.032	0.028	0.000	0.194
1.8944	0.032	0.030	0.000	0.194
1.9556	0.032	0.031	0.000	0.194
2.0167	0.032	0.032	0.000	0.194
2.0778	0.032	0.034	0.000	0.194
2.1389	0.032	0.035	0.000	0.194
2.2000	0.032	0.036	0.000	0.194
2.2611	0.032	0.038	0.000	0.194
2.3222	0.032	0.039	0.000	0.194
2.3833	0.032	0.041	0.000	0.194
2.4444	0.032	0.042	0.000	0.194
2.5056	0.032	0.043	0.000	0.194
2.5667	0.032	0.045	0.000	0.194
2.6278	0.032	0.046	0.000	0.194
2.6889	0.032	0.047	0.000	0.194
2.7500	0.032	0.049	0.000	0.194
2.8111	0.032	0.050	0.000	0.194
2.8722	0.032	0.052	0.000	0.194
2.9333	0.032	0.053	0.000	0.194
2.9944	0.032	0.054	0.000	0.194
3.0556	0.032	0.056	0.000	0.194
3.1167	0.032	0.057	0.000	0.194
3.1778	0.032	0.058	0.000	0.194
3.2389	0.032	0.060	0.000	0.194
3.3000	0.032	0.061	0.000	0.194
3.3611	0.032	0.063	0.000	0.194
3.4222	0.032	0.064	0.000	0.194
3.4833	0.032	0.065	0.000	0.194
3.5444	0.032	0.066	0.000	0.194
3.6056	0.032	0.067	0.000	0.194
3.6667	0.032	0.067	0.000	0.194
3.7278	0.032	0.068	0.000	0.194
3.7889	0.032	0.068	0.000	0.194
3.8500	0.032	0.069	0.000	0.194
3.9111	0.032	0.069	0.000	0.194
3.9722	0.032	0.070	0.000	0.194
4.0333	0.032	0.071	0.000	0.194
4.0944	0.032	0.071	0.000	0.194
4.1556	0.032	0.072	0.000	0.194
4.2167	0.032	0.072	0.000	0.194
4.2778	0.032	0.073	0.000	0.194
4.3389	0.032	0.074	0.000	0.194
4.4000	0.032	0.074	0.000	0.194
4.4611	0.032	0.075	0.000	0.194
4.5222	0.032	0.077	0.052	0.194
4.5833	0.032	0.079	0.382	0.194
4.6444	0.032	0.081	0.869	0.194
4.7056	0.032	0.083	1.461	0.194
4.7667	0.032	0.085	2.123	0.194
4.8278	0.032	0.087	2.819	0.194
4.8889	0.032	0.089	3.509	0.194
4.9500	0.032	0.090	4.160	0.194

5.0111	0.032	0.092	4.737	0.194
5.0722	0.032	0.094	5.218	0.194
5.1333	0.032	0.096	5.592	0.194
5.1944	0.032	0.098	5.870	0.194
5.2556	0.032	0.100	6.159	0.194
5.3167	0.032	0.102	6.404	0.194
5.3778	0.032	0.104	6.639	0.194
5.4389	0.032	0.106	6.866	0.194
5.5000	0.032	0.108	7.086	0.194

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 12.47
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.3
Total Impervious Area: 0.87

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.29752
5 year	0.457921
10 year	0.550659
25 year	0.651119
50 year	0.715749
100 year	0.771831

Flow Frequency Return Periods for Mitigated. POC #1

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

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.210	0.000
1903	0.196	0.000
1904	0.319	0.000
1905	0.159	0.000
1906	0.073	0.000
1907	0.456	0.000
1908	0.334	0.000
1909	0.325	0.000
1910	0.452	0.000
1911	0.307	0.000

1912	0.997	0.000
1913	0.463	0.000
1914	0.117	0.000
1915	0.201	0.000
1916	0.305	0.000
1917	0.113	0.000
1918	0.321	0.000
1919	0.251	0.000
1920	0.304	0.000
1921	0.326	0.000
1922	0.328	0.000
1923	0.271	0.000
1924	0.131	0.000
1925	0.166	0.000
1926	0.287	0.000
1927	0.189	0.000
1928	0.227	0.000
1929	0.455	0.000
1930	0.293	0.000
1931	0.278	0.000
1932	0.213	0.000
1933	0.232	0.000
1934	0.597	0.000
1935	0.282	0.000
1936	0.260	0.000
1937	0.403	0.000
1938	0.258	0.000
1939	0.021	0.000
1940	0.270	0.000
1941	0.151	0.000
1942	0.412	0.000
1943	0.214	0.000
1944	0.430	0.000
1945	0.345	0.000
1946	0.198	0.000
1947	0.137	0.000
1948	0.630	0.000
1949	0.557	0.000
1950	0.164	0.000
1951	0.183	0.000
1952	0.810	0.000
1953	0.737	0.000
1954	0.270	0.000
1955	0.219	0.000
1956	0.109	0.000
1957	0.402	0.000
1958	0.785	0.000
1959	0.482	0.000
1960	0.141	0.000
1961	0.487	0.000
1962	0.280	0.000
1963	0.142	0.000
1964	0.141	0.000
1965	0.557	0.000
1966	0.164	0.000
1967	0.243	0.000
1968	0.248	0.000
1969	0.249	0.000

1970	0.390	0.000
1971	0.578	0.000
1972	0.381	0.000
1973	0.501	0.000
1974	0.275	0.000
1975	0.606	0.000
1976	0.333	0.000
1977	0.132	0.000
1978	0.542	0.000
1979	0.157	0.000
1980	0.317	0.000
1981	0.308	0.000
1982	0.131	0.000
1983	0.491	0.000
1984	0.234	0.000
1985	0.358	0.000
1986	0.304	0.000
1987	0.569	0.000
1988	0.361	0.000
1989	0.327	0.000
1990	0.380	0.000
1991	0.298	0.000
1992	0.386	0.000
1993	0.400	0.000
1994	0.581	0.000
1995	0.125	0.000
1996	0.636	0.000
1997	0.237	0.000
1998	0.323	0.000
1999	0.039	0.000
2000	0.237	0.000
2001	0.112	0.000
2002	0.429	0.000
2003	0.373	0.000
2004	0.326	0.000
2005	0.609	0.000
2006	0.188	0.000
2007	0.167	0.000
2008	0.318	0.000
2009	0.219	0.000
2010	0.193	0.000
2011	0.143	0.000
2012	0.256	0.000
2013	0.170	0.000
2014	0.137	0.000
2015	0.261	0.000
2016	0.109	0.000
2017	0.428	0.000
2018	0.802	0.000
2019	0.782	0.000
2020	0.241	0.000
2021	0.403	0.000
2022	0.172	0.000
2023	0.346	0.000
2024	0.893	0.000
2025	0.314	0.000
2026	0.493	0.000
2027	0.197	0.000

2028	0.172	0.000
2029	0.328	0.000
2030	0.603	0.000
2031	0.196	0.000
2032	0.118	0.000
2033	0.187	0.000
2034	0.174	0.000
2035	0.696	0.000
2036	0.359	0.000
2037	0.099	0.000
2038	0.285	0.000
2039	0.041	0.000
2040	0.189	0.000
2041	0.219	0.000
2042	0.680	0.000
2043	0.341	0.000
2044	0.456	0.000
2045	0.298	0.000
2046	0.347	0.000
2047	0.266	0.000
2048	0.348	0.000
2049	0.307	0.000
2050	0.226	0.000
2051	0.331	0.000
2052	0.195	0.000
2053	0.332	0.000
2054	0.413	0.000
2055	0.171	0.000
2056	0.166	0.000
2057	0.230	0.000
2058	0.285	0.000
2059	0.478	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

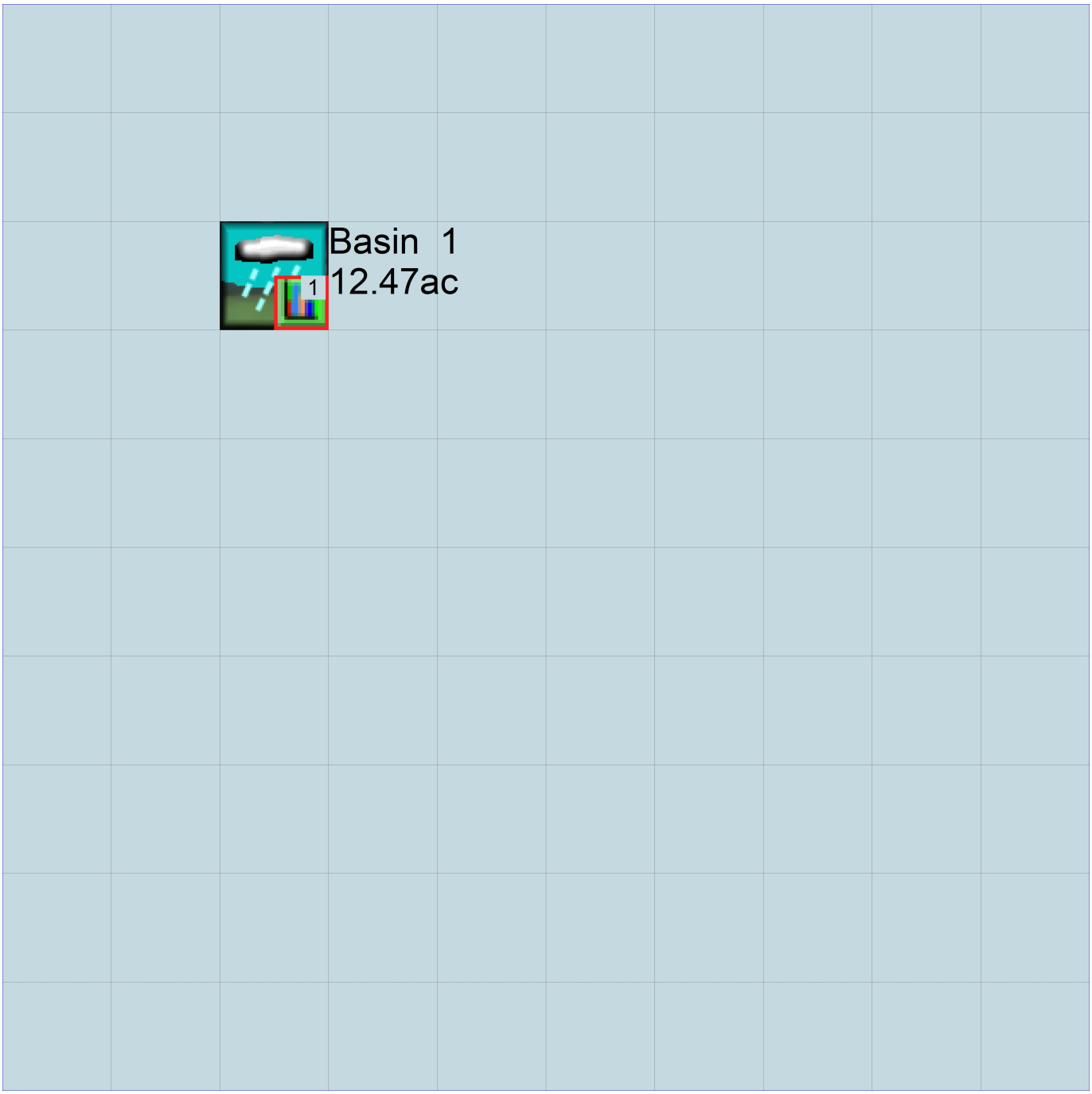
Rank	Predeveloped	Mitigated
1	0.9972	0.0000
2	0.8925	0.0000
3	0.8096	0.0000
4	0.8023	0.0000
5	0.7851	0.0000
6	0.7815	0.0000
7	0.7369	0.0000
8	0.6956	0.0000
9	0.6795	0.0000
10	0.6356	0.0000
11	0.6296	0.0000
12	0.6088	0.0000
13	0.6059	0.0000
14	0.6032	0.0000
15	0.5973	0.0000
16	0.5813	0.0000
17	0.5781	0.0000
18	0.5695	0.0000
19	0.5575	0.0000
20	0.5570	0.0000
21	0.5425	0.0000
22	0.5012	0.0000

23	0.4932	0.0000
24	0.4914	0.0000
25	0.4872	0.0000
26	0.4821	0.0000
27	0.4777	0.0000
28	0.4635	0.0000
29	0.4560	0.0000
30	0.4559	0.0000
31	0.4547	0.0000
32	0.4517	0.0000
33	0.4298	0.0000
34	0.4290	0.0000
35	0.4277	0.0000
36	0.4129	0.0000
37	0.4120	0.0000
38	0.4029	0.0000
39	0.4029	0.0000
40	0.4017	0.0000
41	0.3996	0.0000
42	0.3903	0.0000
43	0.3859	0.0000
44	0.3807	0.0000
45	0.3804	0.0000
46	0.3732	0.0000
47	0.3607	0.0000
48	0.3594	0.0000
49	0.3579	0.0000
50	0.3483	0.0000
51	0.3469	0.0000
52	0.3465	0.0000
53	0.3445	0.0000
54	0.3408	0.0000
55	0.3339	0.0000
56	0.3327	0.0000
57	0.3320	0.0000
58	0.3306	0.0000
59	0.3282	0.0000
60	0.3277	0.0000
61	0.3267	0.0000
62	0.3264	0.0000
63	0.3264	0.0000
64	0.3252	0.0000
65	0.3226	0.0000
66	0.3212	0.0000
67	0.3193	0.0000
68	0.3182	0.0000
69	0.3170	0.0000
70	0.3137	0.0000
71	0.3084	0.0000
72	0.3075	0.0000
73	0.3068	0.0000
74	0.3046	0.0000
75	0.3042	0.0000
76	0.3039	0.0000
77	0.2984	0.0000
78	0.2984	0.0000
79	0.2933	0.0000
80	0.2865	0.0000

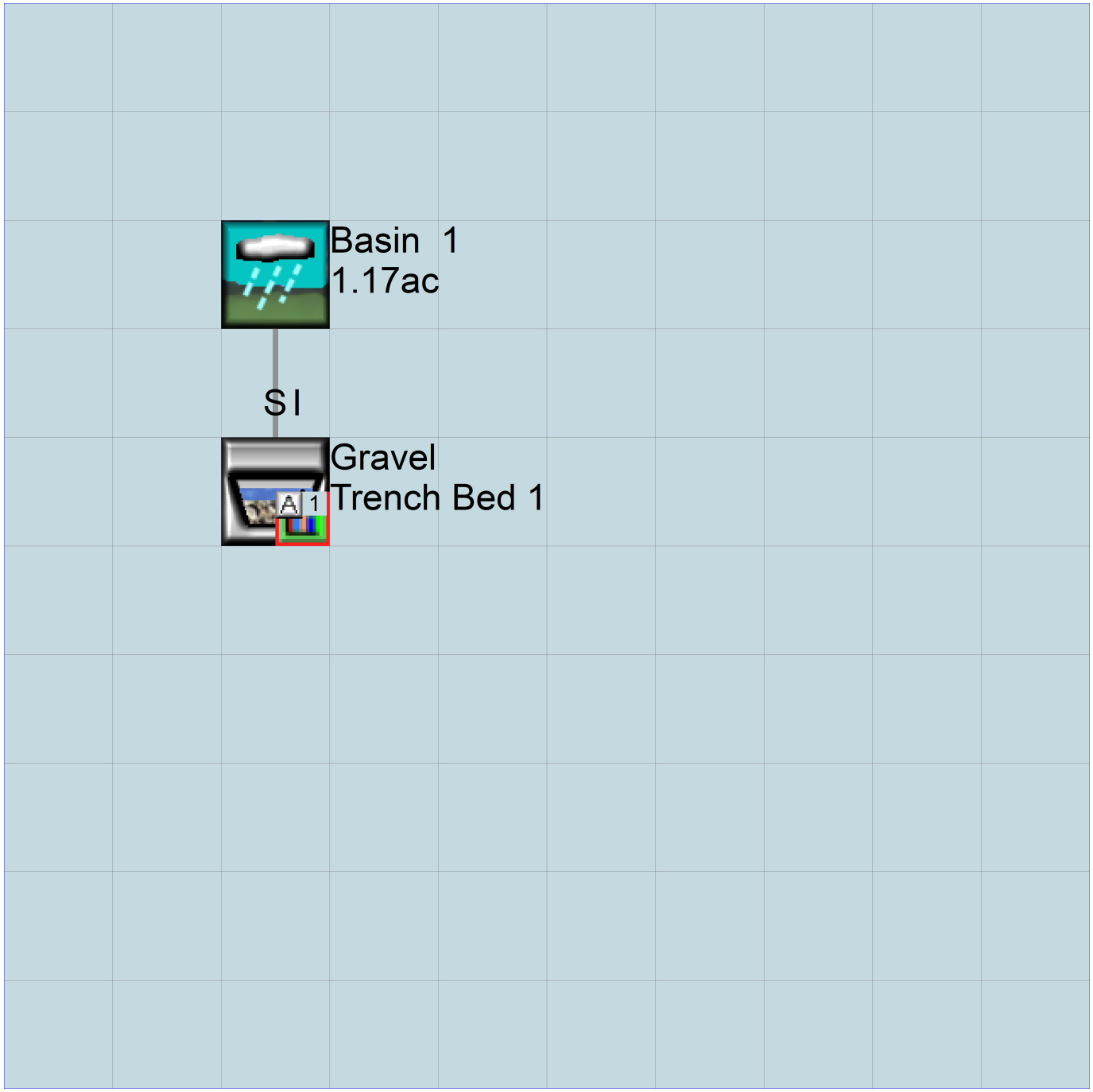
81	0.2851	0.0000
82	0.2848	0.0000
83	0.2818	0.0000
84	0.2797	0.0000
85	0.2784	0.0000
86	0.2748	0.0000
87	0.2715	0.0000
88	0.2701	0.0000
89	0.2697	0.0000
90	0.2664	0.0000
91	0.2609	0.0000
92	0.2605	0.0000
93	0.2583	0.0000
94	0.2557	0.0000
95	0.2506	0.0000
96	0.2489	0.0000
97	0.2479	0.0000
98	0.2430	0.0000
99	0.2410	0.0000
100	0.2369	0.0000
101	0.2366	0.0000
102	0.2340	0.0000
103	0.2325	0.0000
104	0.2304	0.0000
105	0.2271	0.0000
106	0.2259	0.0000
107	0.2192	0.0000
108	0.2192	0.0000
109	0.2187	0.0000
110	0.2143	0.0000
111	0.2131	0.0000
112	0.2095	0.0000
113	0.2013	0.0000
114	0.1984	0.0000
115	0.1965	0.0000
116	0.1960	0.0000
117	0.1957	0.0000
118	0.1949	0.0000
119	0.1930	0.0000
120	0.1894	0.0000
121	0.1888	0.0000
122	0.1882	0.0000
123	0.1867	0.0000
124	0.1826	0.0000
125	0.1741	0.0000
126	0.1722	0.0000
127	0.1717	0.0000
128	0.1715	0.0000
129	0.1702	0.0000
130	0.1669	0.0000
131	0.1664	0.0000
132	0.1659	0.0000
133	0.1644	0.0000
134	0.1641	0.0000
135	0.1590	0.0000
136	0.1571	0.0000
137	0.1506	0.0000
138	0.1429	0.0000

139	0.1425	0.0000
140	0.1412	0.0000
141	0.1406	0.0000
142	0.1373	0.0000
143	0.1373	0.0000
144	0.1324	0.0000
145	0.1310	0.0000
146	0.1309	0.0000
147	0.1246	0.0000
148	0.1176	0.0000
149	0.1174	0.0000
150	0.1135	0.0000
151	0.1121	0.0000
152	0.1092	0.0000
153	0.1090	0.0000
154	0.0987	0.0000
155	0.0732	0.0000
156	0.0409	0.0000
157	0.0391	0.0000
158	0.0207	0.0000

Appendix
Predeveloped Schematic



Mitigated Schematic



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PIPE CONVEYANCE BASIN MAP

Pipe Conveyance Calculations will be included in the final Stormwater Site Plan.

PIPE CONVEYANCE CALCULATIONS

Pipe Conveyance Calculations will be included in the final Stormwater Site Plan.

6.0 STORMWATER POLLUTION PREVENTION PLAN

Construction Stormwater General Permit

Stormwater Pollution Prevention Plan (SWPPP)

for

Proposed DuPont 243

Prepared for:

The Washington State Department of Ecology

Southwest Regional Office

Permittee / Owner	Developer	Operator / Contractor
Avenue 55, LLC 601 Union Street, Suite 2930 Seattle, WA 98101	Avenue 55, LLC 601 Union Street, Suite 2930 Seattle, WA 98101	TBD

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
TBD by contractor	TBD	TBD

SWPPP Prepared By

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

SWPPP Preparation Date

November 11, 2022

Project Construction Dates

Activity / Phase	Start Date	End Date
Phase 1	May 2023	May 2024

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Appendix/Glossary

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: DuPont Industrial Warehouse
Street/Location: 1700 Center Drive
City: DuPont State: WA Zip code: 98327
Subdivision: N/A
Receiving waterbody: N/A

1.1 Existing Conditions

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

Total acreage:	25.3
Disturbed acreage:	16.37
Existing structures:	0
Landscape topography:	The existing site is approximately 25.3 acres of forested land. There is an existing gravel area near the center of the site, which depresses at a slopes ranging from 30% to 45%. There are existing1:1 slopes to the south of the property. The majority of the site is moderately steep, with slopes ranging from 2% to 20%. The east side of the site has slopes ranging from 13% to 70%. The site generally slopes southwest. This site lies within Spanaway gravelly sandy loam, according to the USDA Web Soil survey.
Drainage patterns:	The site currently infiltrates, as it is undeveloped land.
Existing Vegetation:	The site is a grassy area with several trees throughout the site.
Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes):	There are no known sensitive areas on this site, according to Pierce County PublicGIS.

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: This does not apply to this project

Table 1 includes a list of suspected and/or known contaminants associated with the construction activity.

Table 1 – Summary of Site Pollutant Constituents

Constituent (Pollutant)	Location	Depth	Concentration
Hydraulic Fluid	Spill from equipment maintenance	Surface	

1.2 Proposed Construction Activities

Description of site development (example: subdivision):
The proposed conditions for this site will include one commercial building with asphalt parking.

Description of construction activities (example: site preparation, demolition, excavation):
This project is proposing two warehouse buildings: one with a footprint of approximately 243,180 square feet, and the other with a footprint of approximately 25,200 square feet. A half street is also proposed to connect into the existing portion of Sequalitchew road to the southeast of the site. The remaining eastern side of Sequalitchew road will be constructed during the development of the eastern side of the site. This project also proposes sidewalks, asphalt pavement, landscaping area, and retaining walls. These improvements will total 13.57 acres of impervious surfaces, of which 6.1 acres will be asphalt pavement. The remaining area of the site will be pervious surfaces in the form of landscaping and undisturbed land, which totals 5.79 acres.

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:
The existing sites surrounding this project are undeveloped, so they are expected to infiltrate all stormwater. The surrounding properties also generally slope away from this site, so there are no upstream basins that contribute runoff to this site.

Description of final stabilization (example: extent of revegetation, paving, landscaping):
At the completion of construction of the proposed site, the site wil be approximately 69% impervious surfaces with 31% pervious areas. The buildings will be approximately 33% of the site while roughly 35% of the site will be paved.

Contaminated Site Information:
Proposed activities regarding contaminated soils or groundwater (example: on-site treatment system, authorized sanitary sewer discharge):
With the construction activities of this site, contaminated groundwater is not anticipated to be encountered, as the site will be covered in clean, imported fill. If contaminated groundwater is encountered, the groundwater will be pumped to a Baker Tank where it will be treated and discharged to the sanitary sewer.

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

To protect adjacent properties and to reduce the area of soil exposed to construction, the limits of construction will be clearly marked before land-disturbing activities begin. Areas that are to be preserved, as well as all sensitive areas and their buffers, shall be clearly delineated, both in the field and on the plans. A silt fence will be installed around the perimeter of the project site to mark the limits of construction as well as protect surrounding properties from any possible sediment laden runoff. As this site has contaminated soils present, the existing topsoils will be left in place with imported clean fill placed on top.

List and describe BMPs:

- High Visibility Plastic or Metal Fence (BMP C103)

Installation Schedules: TBD

Inspection and Maintenance plan:

Silt Fence Maintenance

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment pond.
- Check the uphill side of the 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 or 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 filter fabric that has deteriorated due to ultraviolet breakdown.

Responsible Staff: Contractor/CESL

2.1.2 Element 2: Establish Construction Access

Construction access or activities occurring on unpaved areas shall be minimized, yet where necessary, access points shall be stabilized to minimize the tracking of sediment onto public roads, street sweeping, and street cleaning shall be employed to prevent sediment from entering state waters. One stabilized construction entrance will be installed to the northeast entrance to the project site. Wheel washing will occur onsite in order to prevent sediment from leaving the site, especially from any possible contaminated soils on the site. A wheel wash will also be installed because the volume of import required for grades to this site and therefore expected traffic on and off the site. Street sweeping and street cleaning may be necessary if the stabilized construction access is not effective. The roads shall be swept daily should sediment collect on them. All wheel wash wastewater shall be controlled on-site and will not be discharged into waters of the State.

List and describe BMPs:

- Stabilized Construction Entrance/ Exit (BMP C105)

Installation Schedules: TBD

Inspection and Maintenance plan:

Stabilized Construction Entrance Maintenance

- Quarry spalls shall be added if the pad is no longer in accordance with the specifications.
- If the entrance 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 entrance, or the installation of a 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 entrance(s), fencing (see BMP C103) 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.

Responsible Staff: Contractor/CESL

2.1.3 Element 3: Control Flow Rates

In order to protect the properties and waterways downstream of the project site, stormwater discharges from the site will be controlled by construction of a temporary sediment pond and a temporary sediment trap as one of the first items of construction as well as a silt fence around the property boundary. Stormwater during construction will be captured through v-ditches with rock check dams in order to control the flow of stormwater runoff before reaching the sediment trap or sediment pond. The sediment trap and sediment pond are located at low points on the site with adequate surface area for sediment settlement per the DOE requirements from BMP C240 and C241. Because the site has been designed to minimize cut into the contaminated soils on site, it is less of a concern that contaminated soils will be tracked offsite.

Detention facilities must be functioning property before construction of site improvements.

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:

- Sediment Trap (BMP C240)
- Check Dams (BMP C207)

Installation Schedules: TBD

Inspection and Maintenance plan:

Sediment Pond/Trap Maintenance

- Sediment shall be removed from the trap/pond when it reaches 1-foot in depth.
- Any damage to the pond embankments or slopes shall be repaired.

Check Dam Maintenance

- Check dams shall be monitored for performance and sediment accumulation during and after each runoff producing rainfall.
- 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

Responsible Staff: Contractor/CESL

2.1.4 Element 4: Install Sediment Controls

All stormwater runoff from disturbed areas shall pass through an appropriate sediment removal BMP before leaving the construction site or prior to being discharged to the downstream drainage course. Constructing the sediment control ponds and traps is one of the first steps of grading and must be done before other land disturbing activities take place. Rock check dams and v-ditches will be used to convey stormwater runoff into the sediment pond and sediment trap to settle out sediment as well. Infiltration is not feasible for stormwater discharge from this site, as contaminated soils are present below ground. There are no juvenile Salmonids attempting to enter off-channel areas or drainages within the vicinity. The combination of a sediment trap and pond alone are expected to be adequate for sediment control on the site because most of the site work will not cut into existing contaminated soils. The surface area requirements for the TESC pond and trap are met with the designed TESC plan and it is not expected that further treatment or other sediment controlling measures are necessary.

However, if the proposed sediment controls are ineffective as determined by the CESCL, they will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix B.

List and describe BMPs:

- Silt Fence (BMP C233)
- Temporary Sediment Trap (BMP C241)
- Check Dams (BMP C207)

Installation Schedules: TBD

Inspection and Maintenance plan:

Silt Fence Maintenance

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment pond.
- Check the uphill side of the 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 or 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 filter fabric that has deteriorated due to ultraviolet breakdown.

Sediment Pond/Trap Maintenance

- Sediment shall be removed from the trap/pond when it reaches 1-foot in depth.
- Any damage to the pond embankments or slopes shall be repaired.

Check Dam Maintenance

- Check dams shall be monitored for performance and sediment accumulation during and after each runoff producing rainfall.
- 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.

Responsible Staff: Contractor/CESL

2.1.5 Element 5: Stabilize Soils

Exposed and unworked soils shall be stabilized with the application of effective BMPs to prevent erosion throughout the life of the project. Temporary seeding shall occur on all areas to remain unworked pursuant to below. In general, cut and fill slopes will be stabilized as soon as possible and soil stockpiles will be temporarily covered with plastic sheeting. All stockpiled soils shall be stabilized from erosion, protected with sediment trapping measures, and where possible, be located away from storm drain inlets, waterways, and drainage channels. To the northwest of the site, there is an area that will be used for stockpiling any contaminated soils uncovered during the project. These stockpiles will be covered with plastic sheeting while being stored and waiting for testing to determine any present contaminants before disposal or reuse depending on the testing outcome. To minimize the amount of soil exposed through the life of the project, grading will be completed within a reasonable time frame after the preloading of the building footprints is completed. To minimize soil compaction, a construction entrance will be used as well as keeping heavy equipment and machinery off unpaved areas as much as possible.

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: October 2017 End date: October 2018

Will you construct during the wet season?
☒ Yes ☐ No

List and describe BMPs:

- Temporary and Permanent Seeding (BMP C120)
- Mulching (BMP C121)
- Dust Control (BMP C140)

Installation Schedules: TBD

Inspection and Maintenance plan: Temporary and Permanent Seeding Maintenance

- Reseed any seeded areas that fail to establish at least 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows). If reseeding is ineffective, use an alternate method such as sodding, mulching, or nets/blankets. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the local authority when sensitive areas would otherwise be protected.
- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. Reseed and protect by mulch any eroded area.
- Supply seeded areas with adequate moisture, but do not water to the extent that it causes runoff.

Mulching Maintenance

- The thickness of the cover must be maintained.
- Any areas that experience erosion shall be remulched and/or protected with a net or blanket. If the erosion problem is drainage related, then the problem shall be fixed and the eroded area remulched.

Dust Control Maintenance

- Respray area as necessary to keep dust to a minimum.

Responsible Staff: Contractor/CESL

2.1.6 Element 6: Protect Slopes

All cut and fill slopes will be designed, constructed, and protected in a manner that minimizes erosion. It is required that any temporary pipe slope drains must handle the peak 10-minute flow rate from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. For modeling the condition with the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas have been modeled as “landscaped area”. Scouring will be reduced by using v-ditches with rock check dams to convey stormwater to the sediment pond and trap on site. However, if the proposed BMPs to protect slopes are ineffective as determined by the CESCL, they will promptly initiate the implementation of one or more of the alternative BMPs listed in Appendix B.

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

List and describe BMPs:

- Temporary and Permanent Seeding (BMP C120)

Installation Schedules: TBD

Inspection and Maintenance plan:

Temporary and Permanent Seeding Maintenance

- Reseed any seeded areas that fail to establish at least 80 percent cover (100 percent cover for areas that receive sheet or concentrated flows). If reseeding is ineffective, use an alternate method such as sodding, mulching, or nets/blankets. If winter weather prevents adequate grass growth, this time limit may be relaxed at the discretion of the local authority when sensitive areas would otherwise be protected.
- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. Reseed and protect by mulch any eroded area.
- Supply seeded areas with adequate moisture, but do not water to the extent that it causes runoff.

Check Dam Maintenance

- Check dams shall be monitored for performance and sediment accumulation during and after each runoff producing rainfall.
- 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.

Responsible Staff: Contractor/CESL

2.1.7 Element 7: Protect Drain Inlets

All storm drain inlets and culverts made operable during construction shall 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 wash water separate from entering storm drains until treatment can be provided. Storm Drain Inlet Protection (BMP C220) will be implemented for all drainage inlets and culverts that could potentially be impacted by sediment-laden runoff on and near the project site. The temporary sediment pond and trap on site will function to settle out sediment particles before discharge to the existing storm system in order to prevent sediment from entering the system. If this is deemed ineffective by the CESCL, additional BMPs may be necessary, as listed in Appendix B. Inlet protection is the last component of a treatment train and protection of drain inlets include additional sediment and erosion control measures. Inlet protection devices will be cleaned (or removed and replaced), when sediment has filled the device by one third (1/3) or as specified by the manufacturer.

List and describe BMPs:

- Storm Drain Inlet Protection (BMP C220)

Installation Schedules: TBD

Inspection and Maintenance plan:

Storm Drain Inlet Protection Maintenance

- Inspect catch basin filters frequently, especially after storm events. Clean and replace clogged inserts. For systems with clogged stone filters: pull away the stones from the inlet and clean or replace. An alternative approach would be to use the clogged stone as fill and put fresh stone around the inlet.
- Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.
- Inlets to be inspected weekly and a minimum of daily during storm events

Responsible Staff: Contractor/CESL

2.1.8 Element 8: Stabilize Channels and Outlets

Where site runoff is to be conveyed in channels, or discharged to a stream or some other natural drainage point, efforts will be taken to prevent downstream erosion. For construction stormwater conveyance, v-ditches with rock check dams will be installed to stabilize channels. Stabilization, including armoring material, adequate to prevent erosion of outlets, adjacent streambanks, slopes, and downstream reaches shall be provided at the outlets of all conveyance systems. The project site is located west of the Cascade Mountain Crest. As such, all temporary on-site conveyance channels 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 frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used. The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits. For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates. If using the WWHM to predict flows, bare soil areas should be modeled as "landscaped area".

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:

- Check Dams (BMP C207)

Installation Schedules: TBD

Inspection and Maintenance plan:

Check Dam Maintenance

- Check dams shall be monitored for performance and sediment accumulation during and after each runoff producing rainfall. 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.

Responsible Staff: Contractor/CESL

2.1.9 Element 9: Control Pollutants

The following pollutants are anticipated to be present on-site:

Table 2 – Pollutants

Pollutant (List pollutants and source, if applicable)
Hydraulic fluid- May be present on sie with construct ion equipment.
Diesel – May be present on site with construction equipment.
Motor Oil – May be presne on site with construction equipment.

All pollutants, including waste materials and demolition debris, that occur onsite shall 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. If required, BMPs to be implemented to control specific sources of pollutants are discussed below. Vehicles, construction equipment, and/or petroleum product storage/dispensing:

- 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.
- On-site fueling tanks and petroleum product storage containers shall include secondary containment.
- Spill prevention measures, such as drip pans, will be used when conducting maintenance and repair of vehicles or equipment.
- In order to perform emergency repairs on site, temporary plastic will be placed beneath and, if raining, over the vehicle.
- Contaminated surfaces shall be cleaned immediately following any discharge or spill incident.

Demolition:

- Dust released from demolished sidewalks, buildings, or structures will be controlled using Dust Control measures (BMP C140).
- Storm drain inlets vulnerable to stormwater discharge carrying dust, soil, or debris will be protected using Storm Drain Inlet Protection (BMP C220 as described above for Element 7).
- Process water and slurry resulting from sawcutting and surfacing operations will be prevented from entering the waters of the State by implementing Sawcutting and Surfacing Pollution Prevention measures (BMP C152).

Concrete and grout:

- Process water and slurry resulting from concrete work will be prevented from entering the waters of the State by implementing Concrete Handling measures (BMP C151).

List and describe BMPs:

- Concrete Handling (BMP C151)

Installation Schedules: TBD

Inspection and Maintenance plan:

Concrete Handling Maintenance

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

Responsible Staff: Contractor/CESL

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

In order to prevent spills and minimize risk, the following list should be applied

- Temporary storage area should be located away from vehicular traffic, near the construction entrance(s), and away from waterways or storm drains.
- Material Safety Data Sheets (MSDS) 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 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, and 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.

List and describe BMPs:

- Material Delivery, Storage and Containment (BMP C153)

Installation Schedules: TBD

Inspection and Maintenance plan: 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

Responsible Staff: Contractor/CESL

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

If yes, provide disposal methods for wastewater generated by BMPs.

If discharging to the sanitary sewer, include the approval letter from your local sewer district under Correspondence in Appendix C.

List and describe BMPs: N/A

Installation Schedules: N/A

Inspection and Maintenance plan: N/A

Responsible Staff: N/A

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

Table 3 – 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:]

Describe BMPs you will use to prevent pH-modifying sources from contaminating stormwater.

List and describe BMPs: N/A

Installation Schedules: N/A

Inspection and Maintenance plan: N/A

Responsible Staff: N/A

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

List and describe BMPs: N/A

Installation Schedules: N/A

Inspection and Maintenance plan: N/A

Responsible Staff: N/A

2.1.10 Element 10: Control Dewatering

All dewatering water from open cut excavation, tunneling, foundation work, trench, or underground vaults shall be discharged into a controlled conveyance system prior to discharge to the downstream drainage course. Channels will be stabilized, per Element #8. Clean, non-turbid dewatering water will not be routed through stormwater sediment ponds, and will be discharged to systems tributary to the receiving waters of the State in a manner that does not cause erosion, flooding, or a violation of State water quality standards in the receiving water. Highly turbid dewatering water from soils known or suspected to be contaminated, or from use of construction equipment, will require additional monitoring and treatment as required for the specific pollutants based on the receiving waters into which the discharge is occurring. Such monitoring is the responsibility of the contractor. Because there are contaminated soils on site, any cut into these will be closely monitored and all cut soils will be stockpiled for testing before appropriate disposal or reuse. The dewatering water from excavation will be tested and treated if the testing shows contamination.

However, the dewatering of soils known to be free of contamination will trigger BMPs to trap sediment and reduce turbidity. At a minimum, geotextile fabric socks/bags/cells will be used to filter this material.

If BMP C250: Construction Stormwater Chemical Treatment and BMP C251: Construction Stormwater Filtration are required for treatment, approval from Ecology is required prior,

Table 4 – Dewatering BMPs

☐	Infiltration
☒	Transport off-site in a vehicle (vacuum truck for legal disposal)
☐	Ecology-approved on-site chemical treatment or other suitable treatment technologies
☐	Sanitary or combined sewer discharge with local sewer district approval (last resort)
☐	Use of sedimentation bag with discharge to ditch or swale (small volumes of localized dewatering)

List and describe BMPs:

- Construciton Stormwater Chemical Treatement (BMP C250)
- Construction Stormwater Filtration (BMP C251)

Installation Schedules: TBD

Inspection and Maintenance plan:

Construction Stormwater Chemical Treatment Maintenance

Monitoring: At a minimum, the following monitoring shall be conducted. Test results shall be recorded on a daily log kept on site. Additional testing may be required by the NPDES permit based on site conditions.

Operational Monitoring:

- Total volume treated and discharged.
- Flow must be continuously monitored and recorded at not greater than 15-minute intervals.
- Type and amount of chemical used for pH adjustment.
- Amount of polymer used for treatment.
- Settling time.

Compliance Monitoring:

- Influent and effluent pH, flocculent chemical concentration, and turbidity must be continuously monitored and recorded at not greater than 15-minute intervals. pH and turbidity of the receiving water.

Biomonitoring:

Treated stormwater must be non-toxic to aquatic organisms. Treated stormwater must be tested for aquatic toxicity or residual chemicals. Frequency of biomonitoring will be determined by Ecology.

Residual chemical tests must be approved by Ecology prior to their use.

If testing treated stormwater for aquatic toxicity, you must test for acute (lethal) toxicity. Bioassays shall be conducted by a laboratory accredited by Ecology, unless otherwise approved by Ecology. Acute toxicity tests shall be conducted per the CTAPE protocol.

Discharge Compliance: Prior to discharge, treated stormwater must be sampled and tested for compliance with pH, flocculent chemical concentration, and turbidity limits. These limits may be established by the Construction Stormwater General Permit or a site-specific discharge permit. Sampling and testing for other pollutants may also be necessary at some sites. pH must be within the range of 6.5 to 8.5 standard units and not cause a change in the pH of the receiving water of more than 0.2 standard units. Treated stormwater samples and measurements shall be taken from the discharge pipe or another location representative of the nature of the treated stormwater discharge. Samples used for determining compliance with the water quality standards in the receiving water shall not be taken from the treatment pond prior to decanting. Compliance with the water quality standards is determined in the receiving water.

Operator Training: Each contractor who intends to use chemical treatment shall be trained by an experienced contractor . Each site using chemical treatment must have an operator trained and certified by an organization approved by Ecology.

Standard BMPs: Surface stabilization BMPs should be implemented on site to prevent significant erosion. All sites shall use a truck wheel wash to prevent tracking of sediment off site.

Sediment Removal and Disposal:

- Sediment shall be removed from the storage or treatment cells as necessary. Typically, sediment removal is required at least once during a wet season and at the

decommissioning of the cells. Sediment remaining in the cells between batches may enhance the settling process and reduce the required chemical dosage.
- Sediment that is known to be non-toxic may be incorporated into the site away from drainages.

Construction Stormwater Filtration Maintenance

Rapid sand filters typically have automatic backwash systems that are triggered by a pre-set pressure drop across the filter. If the backwash water volume is not large or substantially more turbid than the untreated stormwater stored in the holding pond or tank, backwash return to the untreated stormwater pond or tank may be appropriate. However, other means of treatment and disposal may be necessary.

- Screen, bag, and fiber filters must be cleaned and/or replaced when they become clogged.
- Sediment shall be removed from the storage and/or treatment ponds as necessary. Typically, sediment removal is required once or twice during a wet season and at the decommissioning of the ponds.

Responsible Staff: Contractor/CESL

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 5 – 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)

Table 6 – BMP Implementation Schedule

Phase of Construction Project	Stormwater BMPs	Date	Wet/Dry Season
TBD			

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

Low Impact Developed (LID) BMPs are practices that emphasize pre-disturbance hydrologic processes of infiltration, filtration, storage, evaporation and transpiration integrated into project design. The idea behind these is to emphasize conservation, use of on-site natural features, and site planning to minimize impervious surfaces, native vegetation loss, and stormwater runoff. At this time, there are no LID BMPs in place, however the following shall apply in the event of additional LID BMPs added to the project:

- Permittees must protect all Bioretention and Rain Garden facilities from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the Bioretention and/or Rain Garden facilities. Restore the facilities to their fully functioning condition if they accumulate sediment during construction. Restoring the facility must include removal of sediment and any sediment-laden Bioretention/Rain Garden soils, and replacing the removed soils with soils meeting the design specification.
- Permittees must maintain the infiltration capabilities of Bioretention and Rain Garden facilities by protecting against compaction by construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.
- Permittees must control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements.
- Permittees must clean permeable pavements fouled with sediments or no longer passing an initial infiltration test using local stormwater manual methodology or the manufacturer's procedures.
- Permittees must keep all heavy equipment off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soils.

3 Pollution Prevention Team

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	TBD	
Resident Engineer	Costa Philippides	(425) 251-6222
Emergency Ecology Contact	TBD	TBD
Emergency Permittee/ Owner Contact	TBD	TBD
Non-Emergency Owner Contact	TBD	TBD
Monitoring Personnel	TBD	TBD
Ecology Regional Office	Northwest Regional Office	425-649-7000

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

File a blank form under Appendix D.

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:

Table 8 – 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:

Table 9 – 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

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

☐ Yes ☒ No

List the impairment(s):

N/A

5.2 TMDL Waterbodies

Waste Load Allocation for CWSGP discharges:

N/A

List and describe BMPs:

N/A

Discharges to TMDL receiving waterbodies will meet in-stream water quality criteria at the point of discharge.

The Construction Stormwater General Permit Proposed New Discharge to an Impaired Water Body form is included in Appendix F.

6 Reporting and Record Keeping

6.1 Record Keeping

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.

A. Site Map

PRELIMINARY TESC AND DEMOLITION PLAN-WEST

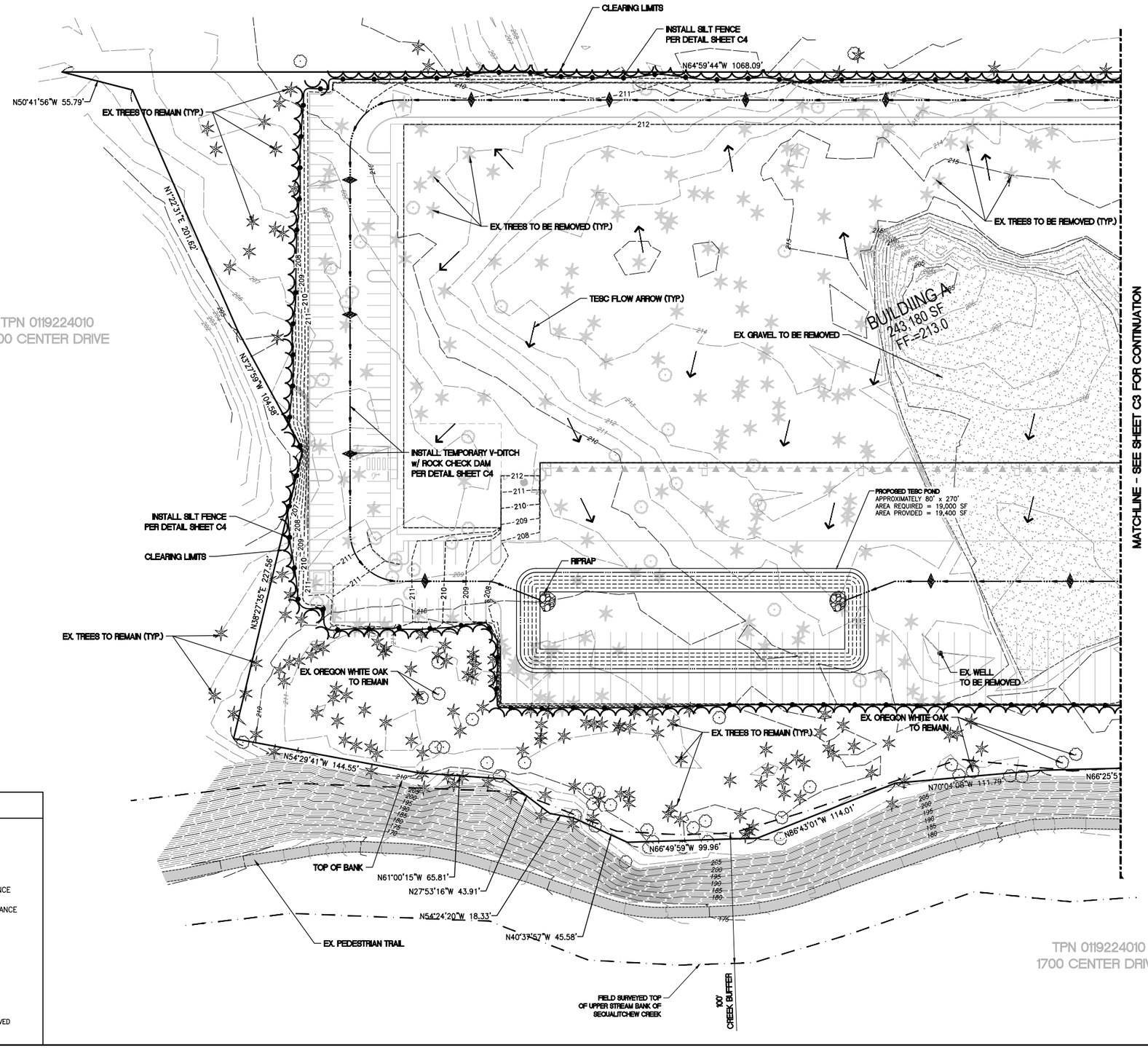
FOR

DUPONT 243

A PORTION OF THE NW 1/4 OF SECTION 26, TOWNSHIP 19N, RANGE 01E, W.M.
CITY OF DUPONT, PIERCE COUNTY, WASHINGTON

1"=40'

0 20 40 80



TESC LEGEND:

- INLET PROTECTION
- SILT FENCE
- LIMITS OF DISTURBANCE
- CONSTRUCTION ENTRANCE
- TEMPORARY V-DITCH
- ROCK CHECK DAM
- EX. TREE TO REMAIN
- EX. TREE TO BE REMOVED

APPROVED FOR CONSTRUCTION

BY: _____ DATE: _____
CITY OF DUPONT

THESE DRAWINGS ARE APPROVED FOR CONSTRUCTION FOR A PERIOD OF 12 MONTHS FROM THE DATE SHOWN HEREON. THE CITY RESERVES THE RIGHT TO MAKE REVISIONS, ADDITIONS, DELETIONS, OR MODIFICATIONS SHOULD CONSTRUCTION BE DELAYED BEYOND THIS TIME LIMITATION. THE CITY, BY APPROVING THESE DRAWINGS, ASSUMES NO LIABILITY IN REGARDS TO THEIR ACCURACY OR OMISSIONS.

No.	Date	By	Ckd.	Appr.	Revision

Title:
PRELIMINARY
TESC AND DEMOLITION PLAN-WEST
FOR
DUPONT 243

For:
AVENUE 55, LLC
601 UNION STREET, SUITE 2930
SEATTLE, WA 98101
(206) 707-9696

DANIEL K. BALMELLI
STATE OF WASHINGTON
25672
REGISTERED
PROFESSIONAL ENGINEER
11/18/2022

Scale: Horizontal 1"=40' Vertical N/A

Designed MAT
Drawn MAT
Checked DKB
Approved DKB
Date 11/18/22

BARGHAUSEN CONSULTING ENGINEERS, INC.
18215 72ND AVENUE SOUTH
KENT, WA 98032
(425)251-6222
(425)251-8782 FAX
CIVIL ENGINEERING, LAND PLANNING, SURVEYING, ENVIRONMENTAL SERVICES

Job Number 18666

Sheet C2 of 13

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PRELIMINARY TESC AND DEMOLITION PLAN-EAST
FOR
DUPONT 243
A PORTION OF THE NW 1/4 OF SECTION 26, TOWNSHIP 19N, RANGE 01E, W.M.
CITY OF DUPONT, PIERCE COUNTY, WASHINGTON

1"=40'
0 20 40 80

APPROVED FOR CONSTRUCTION

BY: _____ DATE: _____
CITY OF DUPONT

THESE DRAWINGS ARE APPROVED FOR CONSTRUCTION FOR A PERIOD OF 12 MONTHS FROM THE DATE SHOWN HEREON. THE CITY RESERVES THE RIGHT TO MAKE REVISIONS, ADDITIONS, DELETIONS, OR MODIFICATIONS SHOULD CONSTRUCTION BE DELAYED BEYOND THIS TIME LIMITATION. THE CITY, BY APPROVING THESE DRAWINGS, ASSUMES NO LIABILITY IN REGARDS TO THEIR ACCURACY OR OMISSIONS.

TPN 0119262016
1700 CENTER DRIVE

MATCHLINE - SEE SHEET C2 FOR CONTINUATION

CLEARING LIMITS

INSTALL SILT FENCE PER DETAIL SHEET C4

EX. WELL TO BE REMOVED

EX. GRAVEL TO BE REMOVED

INSTALL TEMPORARY V-DITCH w/ ROCK CHECK DAM PER DETAIL SHEET C4

EX. HISTORICAL MARKER 2.0' W x3.0'L x2.5'H w/ COMMEMORATIVE PLAQUE TO REMAIN

EX. TREES TO BE REMOVED (TYP.)

EX. SIGN TO BE REMOVED

EX. GRAVEL ROAD TO BE REMOVED

EX. SIGN TO BE REMOVED

EX. MONITOR WELL TO REMAIN RIM=212.78 TOP PVC=212.08

EX. GRAVEL TO BE REMOVED

APPROXIMATE CENTERLINE TEMPORARY ACCESS EASEMENT PER REC. NOs. 200906040666 AND 200911190365 (18)

EX. GRAVEL ROAD TO BE REMOVED

BUILDING B
25,200 SF
FF=213.0

EX. PEDESTRIAN TRAIL

EX. TREES TO REMAIN (TYP.)

30' TRAIL CONSTRUCTION EASEMENT PER REC. NO. 201009301052 (24)

15' TRAIL EASEMENT PER REC. NO. 201009301052 (24)

17.5' TRAIL CONST. EASEMENT PER REC. NO. 201009301052

EX. OREGON WHITE OAK TO REMAIN

NE 15' TRAIL EASEMENT AND TRAIL CONSTRUCTION EASEMENT PER 201009301052 (24)

FIELD SURVEYED TOP OF UPPER STREAM BANK OF SEQUALITCHEW CREEK

100' CREEK BUFFER

TPN 0119224010
1700 CENTER DRIVE

S87°59'34"W 665.45'

FOUND 5/8" REBAR, CAP "ESM LS 29294/29281"

60' ACCESS AND UTILITIES EASEMENT PER REC. NO. 200911180327

CHAIN LINK FENCE

NOT A PART

N33°00'08"W 355.69'

"NO BUILDINGS"

CHAIN LINK FENCE

TPN 0119262019
1700 CENTER DRIVE

CLEARING LIMITS

INSTALL SILT FENCE PER DETAIL SHEET C4

RAISED CONCRETE PLINTH (AVG HT = 4.5')

OLD NARROW RAILROAD LI

EX. GRAVEL ROAD EAST OF CLEARING LIMITS TO REMAIN

N1°40'48"E 409.25'

42.5' PROPOSED ROW

42.5' FUTURE ROW

EX. OREGON WHITE OAK IN POPOSED ROW TO BE REMOVED

17.5' TRAIL CONST. EASEMENT PER REC. NO. 201009301052 (24)

EX. CB TO REMAIN
INSTALL CB PROTECTION PER DETAIL SHEET C4

EX. CUL-DE-SAC TO BE REMOVED

15' TRAIL EASEMENT PER REC. NO. 201009301052 (24)

EX. SSMH TO REMAIN

FOUND ESM LS

TPOB TRAIL ESMT (24) PER 201009301052

N82°02'31"W 12.42'

N88°58'18"W 126.13'

N89°48'29"W 151.67'

N87°20'08"W 194.51'

N84°13'45"W 134.11'

N84°52'39"W 90.84'

N47°28'29"W 15.52'

N64°55'26"W 45.93'

N80°55'04"W 64.30'

N89°05'40"W 57.87'

N80°54'14"W 135.48'

S86°29'27"W 87.56'

N55°38'1"W 116.16'

N12°47'43"W 121.16'

GATE

TESC LEGEND:

- INLET PROTECTION
- SILT FENCE
- LIMITS OF DISTURBANCE
- CONSTRUCTION ENTRANCE
- TEMPORARY V-DITCH
- ROCK CHECK DAM
- EX. TREE TO REMAIN
- EX. TREE TO BE REMOVED

No.	Date	By	Chd.	Appr.	Revision

Title: PRELIMINARY TESC AND DEMOLITION PLAN-EAST FOR DUPONT 243

For: AVENUE 55, LLC
601 UNION STREET, SUITE 2930
SEATTLE, WA 98101
(206) 707-9696

DANIEL K. BALMELLI — STATE OF WASHINGTON — 25672 — REGISTERED PROFESSIONAL ENGINEER — 11/18/2022

Scale: Horizontal 1"=40' Vertical N/A

Designed JAT Drawn JAT Checked DKB Approved DKB Date 11/18/22

BARGHAUSEN CONSULTING ENGINEERS, INC.
18215 72ND AVENUE SOUTH
KENT, WA 98032
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CIVIL ENGINEERING, LAND PLANNING, SURVEYING, ENVIRONMENTAL SERVICES

Job Number 18666

Sheet C3 of 13

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B. BMP Detail

Please see following pages for appropriate BMP details.

Below is a list of Alternative BMPs the be used if the BMPs listed in the body of this document are deemed ineffective by the CESCL.

Element #1 - Mark Clearing Limits
BMP C101: Preserving Natural Vegetation
BMP C102: Buffer Zones
BMP C103: High Visibility Fence

Element #2 - Establish Construction Access
BMP C107: Construction Road/Parking Area Stabilization

Element #3 - Control Flow Rates
BMP C203: Water Bars
BMP C209: Outlet Protection
BMP C235: Wattles

Element #4 - Install Sediment Controls
BMP C231: Brush Barrier
BMP C232: Gravel Filter Berm
BMP C234: Vegetated Strip
BMP C235: Wattles
BMP C250: Construction Stormwater Chemical Treatment
BMP C251: Construction Stormwater Filtration
Other Proprietary Sediment Control Technologies

Element #5 - Stabilize Soils
BMP C122: Nets and Blankets
BMP C124: Sodding
BMP C125 Compost
BMP C126: Topsoiling
BMP C127: Polyacrylamide for Soil Erosion Protection
BMP C130: Surface Roughening
BMP C131: Gradient Terraces

Element #6 - Protect Slopes
BMP C121: Mulching
BMP C122: Nets and Blankets
BMP C131: Gradient Terraces
BMP C200: Interceptor Dike and Swale
BMP C201: Grass-Lined Channels
BMP C203: Water Bars
BMP C204: Pipe Slope Drains
BMP C205: Subsurface Drains
BMP C206: Level Spreader
BMP C208: Triangular Silt Dike (Geotextile-Encased Check Dam)

Element #7 - Protect Drain Inlets
BMP C220: Storm Drain Inlet Protection

Element #8 - Stabilize Channels and Outlets
BMP C122: Nets and Blankets
BMP C202: Channel Lining
BMP C209: Outlet Protection

Element #9 - Control Pollutants
BMP C152: Sawcutting and Surface Pollution Prevention
BMP C153: Material Delivery, Storage, Containment
BMP C154: Concrete Washout Area
BMP C250: Construction Stormwater Chemical Treatment
BMP C251: Construction Stormwater Filtration
BMP C252: High pH Neutralization Using Co_2
BMP C253: pH Control for High pH Water
Source Control BMPs As Appropriate

Element #10 - Control Dewatering
BMP C203: Water Bars
BMP C226: Vegetative Filtration

Element #11 - Maintain BMPs
BMP C150: Materials on Hand
BMP C160 Erosion and Sedimentation Control Lead

Element #12 - Manage the Project
BMP C150: Materials on Hand
BMP C160: Erosion and Sediment Control Lead
BMP C162: Scheduling

Element #13: Protect Low Impact Development
BMP C102: Buffer Zone
BMP C103: High Visibility Fence
BMP C200: Interceptor Dike and Swale
BMP C201: Grass-Lined Channels
BMP C207: Check Dams
BMP C208: Triangular Silt Dike (TSD) (Geotextile-Encased Check Dam)
BMP C231: Brush Barrier
BMP C233: Silt Fence
BMP C234: Vegetated Strip

C. Correspondence

Any pertinent correspondence regarding this project will be included in this section.

D. Site Inspection Form

Please see the following pages for the site intspection form.

E. Construction Stormwater General Permit (CSWGP)

The CSWGP will be included in the final SWPPP.

F. 303(d) List Waterbodies / TMDL Waterbodies Information

There are no 303(d) List Waterbodies in this project, so this section is not required.

G. Contaminated Site Information

There is no contaminated site at this time.

H. Engineering Calculations

Please see the following for calculations.

WWHM2012

PROJECT REPORT

18666 - DuPont Industrial Warehouse
TESC Calculations

General Model Information

Project Name:	18666 ESC
Site Name:	
Site Address:	
City:	
Report Date:	11/16/2022
Gage:	38 IN CENTRAL
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

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	16.37
Pervious Total	16.37
Impervious Land Use	acre
Impervious Total	0
Basin Total	16.37

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

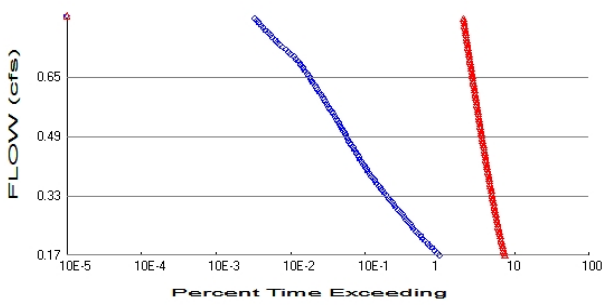
Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
DRIVEWAYS FLAT	16.37
Impervious Total	16.37
Basin Total	16.37

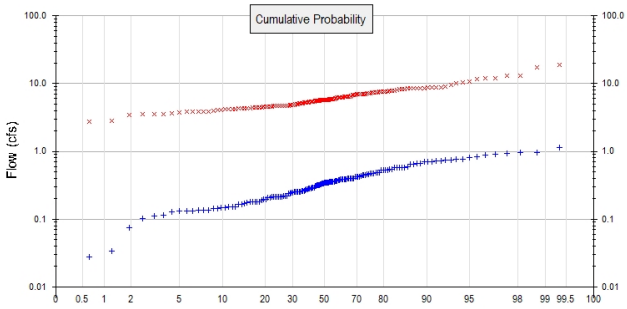
Element Flows To:

Surface	Interflow	Groundwater

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 16.37
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0
Total Impervious Area: 16.37

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.344962
5 year	0.536659
10 year	0.64082
25 year	0.746836
50 year	0.80985
100 year	0.861666

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	5.73688
5 year	7.700762
10 year	9.128123
25 year	11.081664
50 year	12.649509
100 year	14.316934

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	0.253	6.783
1903	0.210	7.519
1904	0.344	8.511
1905	0.166	3.816
1906	0.074	4.267
1907	0.529	5.708
1908	0.392	4.693
1909	0.388	5.791
1910	0.535	5.534
1911	0.348	6.210

1912	1.148	10.291
1913	0.550	4.484
1914	0.134	18.825
1915	0.222	3.861
1916	0.344	7.222
1917	0.115	2.728
1918	0.369	5.783
1919	0.272	3.538
1920	0.351	4.708
1921	0.392	4.038
1922	0.394	6.334
1923	0.316	4.413
1924	0.145	8.352
1925	0.179	3.486
1926	0.334	6.804
1927	0.217	5.543
1928	0.267	4.111
1929	0.548	8.205
1930	0.352	8.589
1931	0.326	4.139
1932	0.255	4.468
1933	0.246	4.430
1934	0.722	7.197
1935	0.335	3.815
1936	0.291	5.340
1937	0.465	7.941
1938	0.284	3.882
1939	0.018	4.881
1940	0.314	8.613
1941	0.150	8.510
1942	0.473	6.401
1943	0.244	6.338
1944	0.446	9.113
1945	0.394	6.906
1946	0.213	5.360
1947	0.135	4.179
1948	0.742	5.750
1949	0.636	8.881
1950	0.180	5.024
1951	0.222	7.601
1952	0.968	8.519
1953	0.873	7.885
1954	0.315	4.669
1955	0.257	4.342
1956	0.126	4.282
1957	0.447	4.629
1958	0.934	5.743
1959	0.577	5.754
1960	0.154	4.568
1961	0.580	13.034
1962	0.312	5.604
1963	0.149	4.163
1964	0.164	12.069
1965	0.650	5.414
1966	0.182	4.530
1967	0.279	6.347
1968	0.285	5.350
1969	0.284	4.824

1970	0.445	5.484
1971	0.701	5.314
1972	0.454	17.572
1973	0.579	10.207
1974	0.313	7.387
1975	0.735	7.623
1976	0.389	8.130
1977	0.131	3.491
1978	0.655	5.887
1979	0.180	6.189
1980	0.371	6.103
1981	0.355	5.743
1982	0.145	4.680
1983	0.581	6.346
1984	0.237	6.309
1985	0.385	7.177
1986	0.345	3.645
1987	0.659	6.400
1988	0.418	3.817
1989	0.375	3.492
1990	0.425	4.613
1991	0.333	6.893
1992	0.476	6.555
1993	0.461	7.490
1994	0.692	5.123
1995	0.133	3.982
1996	0.758	5.337
1997	0.291	4.785
1998	0.346	5.686
1999	0.028	6.179
2000	0.263	5.432
2001	0.135	4.357
2002	0.481	7.909
2003	0.419	4.616
2004	0.385	6.924
2005	0.709	13.229
2006	0.214	6.206
2007	0.215	6.943
2008	0.366	5.722
2009	0.251	4.366
2010	0.214	5.605
2011	0.173	5.897
2012	0.251	5.474
2013	0.196	5.163
2014	0.146	4.993
2015	0.279	8.393
2016	0.111	5.244
2017	0.532	8.417
2018	0.967	5.042
2019	0.902	7.463
2020	0.294	6.109
2021	0.479	5.151
2022	0.198	8.758
2023	0.403	10.821
2024	0.757	11.570
2025	0.355	5.633
2026	0.580	6.186
2027	0.209	6.900

2028	0.181	2.701
2029	0.393	4.434
2030	0.729	8.888
2031	0.241	2.792
2032	0.131	4.731
2033	0.211	5.943
2034	0.208	4.653
2035	0.823	5.726
2036	0.427	4.645
2037	0.102	6.249
2038	0.341	5.930
2039	0.034	11.917
2040	0.189	4.664
2041	0.255	5.918
2042	0.801	6.829
2043	0.387	7.552
2044	0.522	5.188
2045	0.355	4.199
2046	0.416	4.657
2047	0.306	5.748
2048	0.396	4.739
2049	0.354	7.032
2050	0.254	5.238
2051	0.369	7.381
2052	0.212	5.639
2053	0.380	4.791
2054	0.483	9.510
2055	0.150	5.823
2056	0.168	7.513
2057	0.261	3.694
2058	0.330	7.072
2059	0.584	8.818

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

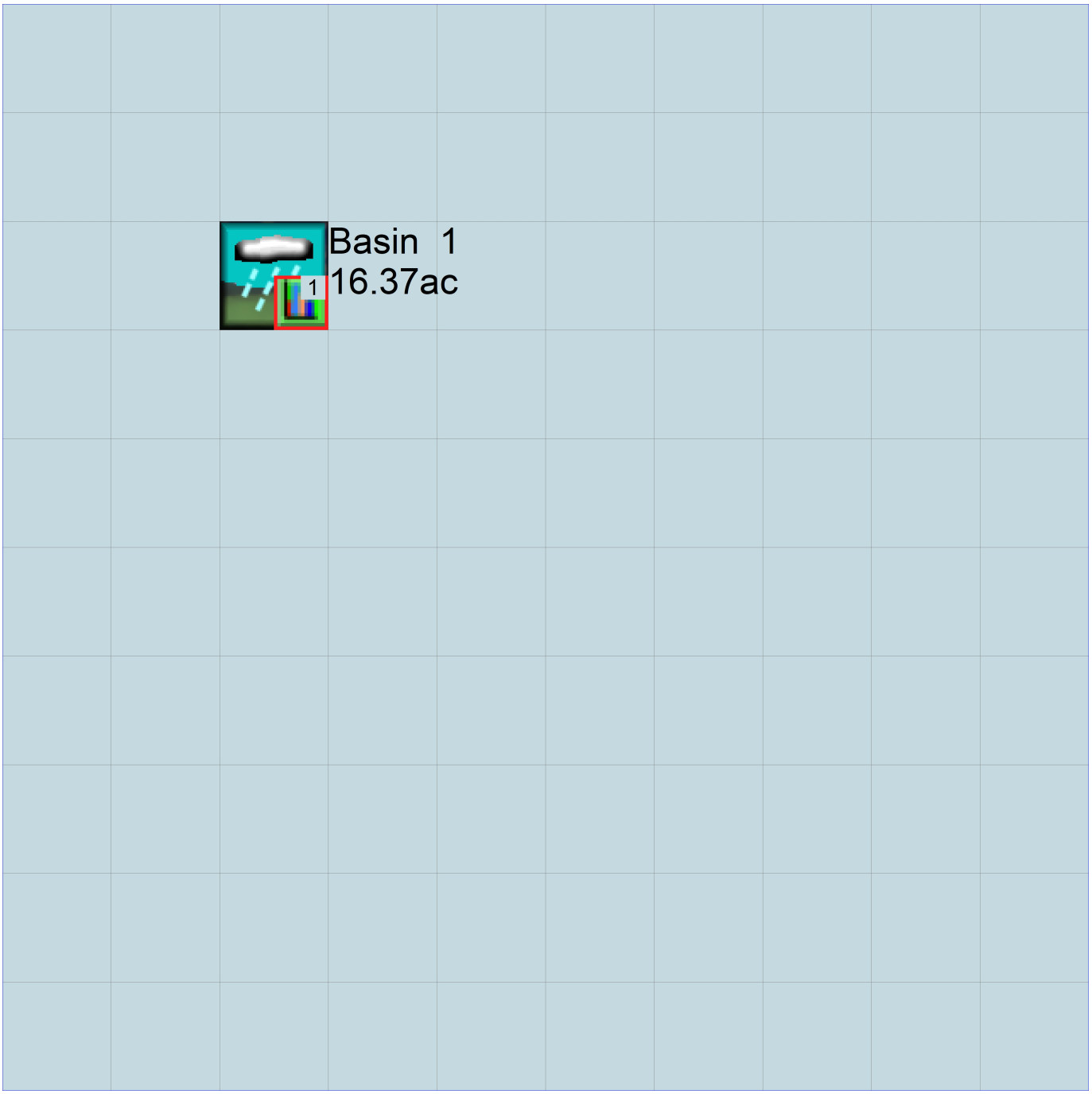
Rank	Predeveloped	Mitigated
1	1.1483	18.8246
2	0.9676	17.5724
3	0.9666	13.2287
4	0.9338	13.0341
5	0.9016	12.0685
6	0.8729	11.9171
7	0.8229	11.5697
8	0.8006	10.8205
9	0.7581	10.2911
10	0.7570	10.2067
11	0.7421	9.5097
12	0.7352	9.1128
13	0.7295	8.8877
14	0.7223	8.8806
15	0.7092	8.8185
16	0.7005	8.7578
17	0.6918	8.6130
18	0.6585	8.5890
19	0.6546	8.5195
20	0.6496	8.5112
21	0.6358	8.5102
22	0.5836	8.4165

23	0.5805	8.3928
24	0.5804	8.3522
25	0.5803	8.2053
26	0.5789	8.1303
27	0.5773	7.9411
28	0.5502	7.9086
29	0.5479	7.8850
30	0.5346	7.6228
31	0.5316	7.6013
32	0.5294	7.5518
33	0.5216	7.5193
34	0.4831	7.5126
35	0.4809	7.4901
36	0.4787	7.4626
37	0.4758	7.3866
38	0.4734	7.3810
39	0.4653	7.2223
40	0.4612	7.1973
41	0.4542	7.1769
42	0.4470	7.0718
43	0.4461	7.0318
44	0.4449	6.9434
45	0.4273	6.9237
46	0.4249	6.9063
47	0.4187	6.9004
48	0.4175	6.8934
49	0.4161	6.8286
50	0.4026	6.8044
51	0.3964	6.7835
52	0.3943	6.5548
53	0.3935	6.4011
54	0.3933	6.4004
55	0.3924	6.3473
56	0.3921	6.3458
57	0.3893	6.3385
58	0.3878	6.3343
59	0.3866	6.3088
60	0.3852	6.2491
61	0.3849	6.2099
62	0.3801	6.2062
63	0.3754	6.1893
64	0.3707	6.1856
65	0.3694	6.1790
66	0.3686	6.1088
67	0.3664	6.1028
68	0.3554	5.9429
69	0.3552	5.9298
70	0.3549	5.9184
71	0.3544	5.8973
72	0.3521	5.8874
73	0.3508	5.8229
74	0.3481	5.7908
75	0.3460	5.7831
76	0.3452	5.7536
77	0.3444	5.7500
78	0.3442	5.7480
79	0.3408	5.7432
80	0.3353	5.7427

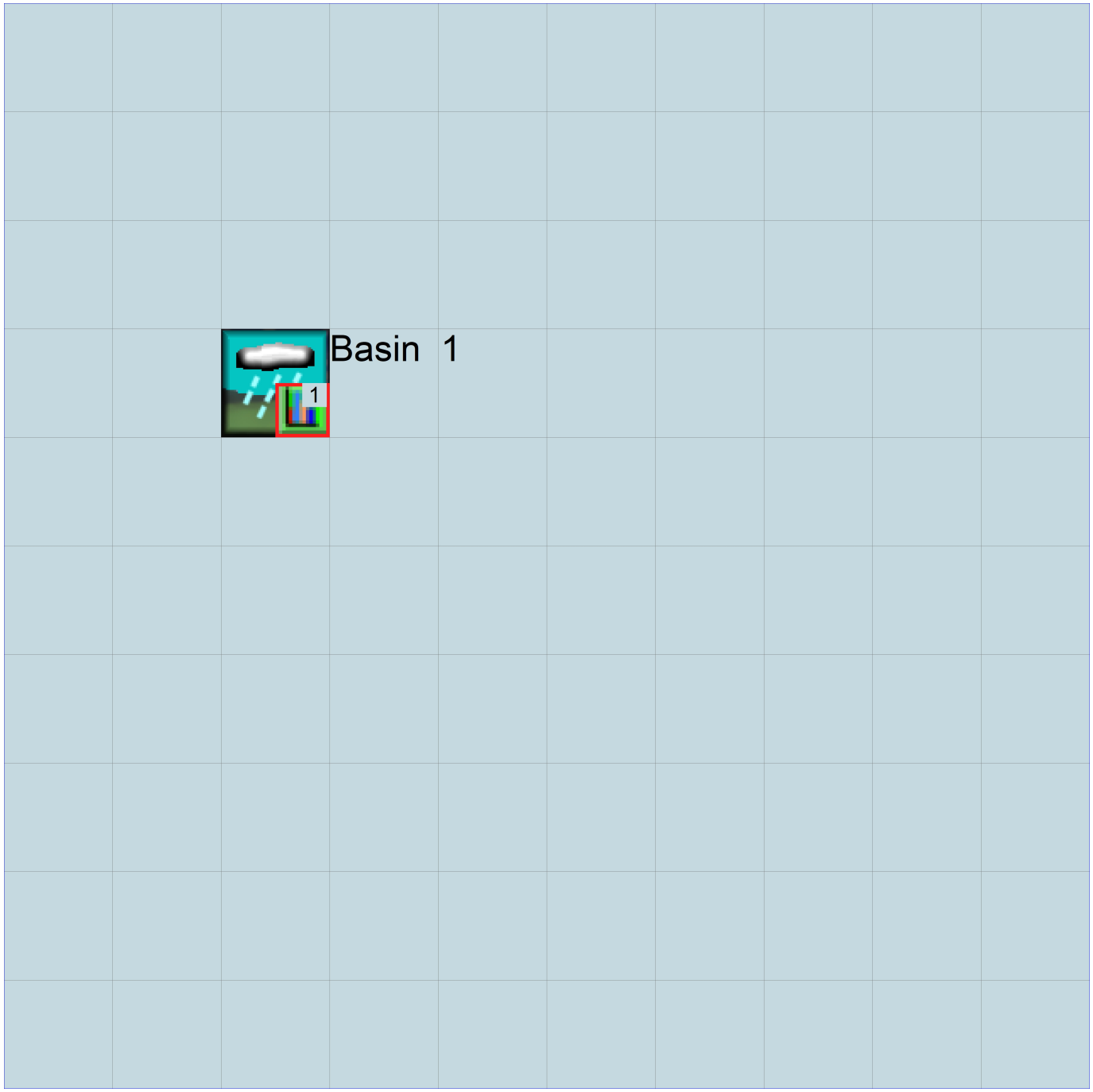
81	0.3341	5.7258
82	0.3327	5.7216
83	0.3305	5.7080
84	0.3257	5.6857
85	0.3163	5.6387
86	0.3150	5.6326
87	0.3142	5.6049
88	0.3134	5.6043
89	0.3117	5.5434
90	0.3063	5.5337
91	0.2941	5.4840
92	0.2915	5.4737
93	0.2908	5.4317
94	0.2847	5.4140
95	0.2841	5.3595
96	0.2836	5.3499
97	0.2795	5.3396
98	0.2790	5.3371
99	0.2725	5.3136
100	0.2674	5.2441
101	0.2632	5.2379
102	0.2610	5.1882
103	0.2574	5.1626
104	0.2554	5.1511
105	0.2550	5.1230
106	0.2544	5.0422
107	0.2530	5.0244
108	0.2514	4.9933
109	0.2508	4.8814
110	0.2460	4.8241
111	0.2435	4.7913
112	0.2410	4.7851
113	0.2365	4.7392
114	0.2217	4.7308
115	0.2217	4.7076
116	0.2167	4.6932
117	0.2151	4.6797
118	0.2145	4.6695
119	0.2140	4.6642
120	0.2132	4.6569
121	0.2125	4.6528
122	0.2110	4.6451
123	0.2104	4.6285
124	0.2085	4.6156
125	0.2076	4.6128
126	0.1982	4.5681
127	0.1958	4.5296
128	0.1894	4.4842
129	0.1821	4.4681
130	0.1807	4.4336
131	0.1802	4.4303
132	0.1795	4.4134
133	0.1794	4.3659
134	0.1729	4.3565
135	0.1679	4.3415
136	0.1656	4.2818
137	0.1643	4.2670
138	0.1536	4.1991

139	0.1497	4.1793
140	0.1497	4.1627
141	0.1494	4.1386
142	0.1459	4.1112
143	0.1450	4.0375
144	0.1445	3.9824
145	0.1347	3.8817
146	0.1347	3.8606
147	0.1344	3.8170
148	0.1327	3.8157
149	0.1312	3.8149
150	0.1311	3.6935
151	0.1262	3.6448
152	0.1149	3.5379
153	0.1112	3.4924
154	0.1021	3.4910
155	0.0741	3.4862
156	0.0342	2.7921
157	0.0279	2.7277
158	0.0177	2.7010

Appendix
Predeveloped Schematic



Mitigated Schematic



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TESC Calculations

Project: DuPont 243
BCE #: 18666

REQUIRED SURFACE AREA

SA = (2,080)(Q_{10})	=	**18990**	SF

Flow	cfs
Q2*	**5.73**
Q10	**9.13**
Q100	**14.32**

PRINCIPAL SPILLWAY SIZING

D = [(Q_{10}) / (3.782)(H)$^{0.5}$]$^{0.5}$	=	1.554	FT
	=	**18.64**	IN
**H MIN (DEFAULT 1)*	=	*1*	*FT*

∴ USE RISER DIAMETER 12 INCHES

KEY

INPUT
OUTPUT
CHECK

EMERGENCY OVERFLOW SPILLWAY

L = [Q_{100} / (3.21)(H)$^{1.5}$] - 2.4H	=	11.42	FT
**H MIN (DEFAULT .5)*	=	*0.5*	*FT*

∴ USE SPILLWAY LENGTH 5 FEET

DEWATERING ORIFICE

A_0 = (S.A.)(2H)$^{0.5}$/(0.6)(3,600)(T)(g)$^{0.5}$	=	0.171	SF
DIAM. = 13.54 (A_0)$^{0.5}$	=	**5.60**	IN
**H MIN (DEFAULT 3.5')*	=	*3.5*	*FT*

∴ USE ORIFICE DIAMETER 1"

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

7.0 SPECIAL REPORTS AND STUDIES

7.0 SPECIAL REPORTS AND STUDIES

- Geotechnical report by GeoEngineers dated October 10, 2011
- Geotechnical report addendum by GeoEngineers dated May 11, 2018

Geotechnical Engineering Services

DuPont Apartment Complex/Lot X
DuPont, Washington

for
Creekside DuPont Partners, LLC

May 10, 2011

GeoEngineers
Earth Science + Technology

Geotechnical Engineering Services

DuPont Apartment Complex/Lot X
DuPont, Washington

for
Creekside DuPont Partners, LLC

May 10, 2011

GeoEngineers

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Tacoma, Washington 98402
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30 YEARS 2010

Geotechnical Engineering Services

DuPont Apartment Complex/Lot X
DuPont, Washington

File No. 16785-002-00

May 10, 2011

Prepared for:

Creekside DuPont Partners, LLC
1201 Pacific Avenue, Suite 1501
Tacoma, Washington 98402

Attention: Lia Estigoy

Prepared by:

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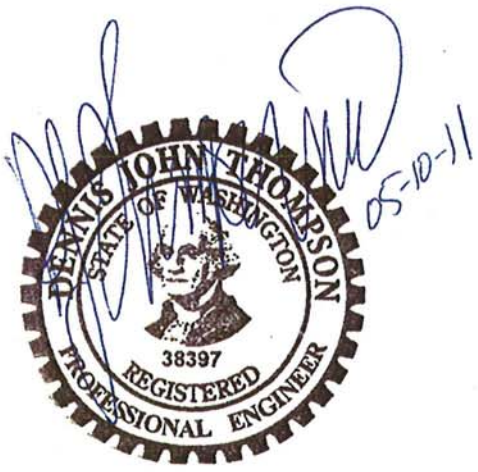

Dennis (D.J.) Thompson, PE
Senior Geotechnical Engineer

Garry Squires

Garry H. Squires, PE, LG, LEG
Principal

DJT:GHS:tt

GeoEngineers

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APPENDICES

INTRODUCTION AND PROJECT UNDERSTANDING

GeoEngineers is pleased to present this proposal to provide geotechnical engineering services to support development and construction of the apartment complex to be constructed at 14464 Center Drive in DuPont, Washington, otherwise referred to as Lot X. A Vicinity Map is included as Figure 1. Our understanding of the project is based on our discussion with you and the project civil engineer (Barghausen Consulting Engineers), project architect (BCRA), and our review of preliminary site plans and a topographic survey.

The final site layout and number of apartment units has not been determined. At this time, proposed plans might include construction of approximately 180 apartment units in 14 to 15 buildings. Balanced cuts and fills are anticipated. We understand the buildings will be constructed near existing grade and deep excavations are not anticipated. Additional improvements will include construction of parking areas and installation of underground utilities. Stormwater will be conveyed to on-site infiltration galleries or ponds. Stormwater facilities will be designed in accordance with the 2005 Washington State Department of Ecology (Ecology) Stormwater Management Manual.

SCOPE OF SERVICES

The purpose of our services is to conduct subsurface investigations to use as a basis for developing geotechnical recommendations for the proposed site improvements. Our specific scope of services includes:

1. Reviewing readily available published geologic data, select in-house files, and existing subsurface information on soil and groundwater conditions in the site vicinity.
2. Coordinating clearance and location of existing utilities in the project area. We contacted the Washington Utilities Coordinating Council "One Call" service prior to beginning explorations.
3. Exploring subsurface conditions at the project site by observing nine test pits. The explorations extended to depths between 10 and 12 feet below surrounding grade.
4. Performing laboratory tests on selected soil samples obtained from the explorations to assist in evaluating the physical and engineering properties of the site soils. Laboratory testing consisted of eight moisture content and grain size analyses.
5. Providing a general discussion of site soil and groundwater conditions based on our review, explorations and testing.
6. Evaluating the results of the sieve analyses with the infiltration criteria presented in the 2005 Ecology Stormwater Management Manual. We include preliminary infiltration rates for the samples tested.
7. Providing recommendations for site preparation and earthwork. We discuss clearing and stripping, temporary and permanent slopes, suitability of on-site soils for use as structural fill, including constraints for wet weather construction, specifications for imported soil for use as structural fill, and fill placement and compaction requirements.

8. Providing general recommendations for site drainage and control of groundwater.
9. Classifying the Seismic Site Class and soil profile in accordance with Table 1613.5.2 of the International Building Code (IBC) and providing our opinion of soil liquefaction susceptibility based on the results of our review and explorations.
10. Providing recommendations for design of shallow foundations and conventional below grade and retaining wall structures. We provide allowable soil bearing pressures, settlement (total and differential) estimates, lateral earth pressures (active and passive) and coefficient of friction for evaluating sliding resistance. We discuss suitable foundation material and bearing surface preparation, including removal of uncontrolled fill, soft, organic or otherwise unsuitable material, and backfill compaction.
11. Providing recommendations for support of on-grade floor slabs including capillary break, vapor retarder, underslab drainage, and modulus of subgrade reaction, as appropriate.
12. Providing recommendations for asphalt concrete pavement (ACP) design, including base and subbase requirements for proposed parking areas. We provide typical minimum ACP section recommendations based on our experience. We can provide other recommendations based on actual traffic data, if requested.

SITE CONDITIONS

Published Literature

Based on review of geologic maps in our files, Vashon recessional outwash sand and gravel is the dominant, near-surface, geologic material mapped in the immediate project area. This material is commonly known as Steilacoom gravel. Vashon recessional outwash was deposited by melt water streams in front of the most recent glacier during its retreat from the Puget Sound region approximately 10,000 to 15,000 years ago. These deposits generally consist of permeable sand, or sand and gravel. Cobbles and boulders can also be encountered in this deposit, depending on the depositional history. Glacial till and/or advance outwash is commonly encountered at depth below the recessional outwash.

The United States Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey of Pierce County Area, Washington, maps the project area as Spanaway gravelly sandy loam (41A). This soil unit is described as being formed in glacial outwash. It is further described as somewhat excessively drained with moderately rapid permeability, slow surface runoff and little erosion hazard.

Surface Conditions

The project area is located west of the intersection of Center Drive and Power Line Road in DuPont, Washington. Power Line Road and Center Drive make up the eastern boundary of the site. Sequalitchew Creek flows along the southern boundary of the site. A chain link fence is located along the northern and western edges of the site.

The project area is irregular in shape and is flat or slightly sloping down to the southwest. A gravel road extends generally east-west in the southern part of the site. Overhead power lines extend

north-south within the property near the eastern border of the site. Sewer, power and water manholes and junction boxes were observed within the property near the intersection of Center Drive and Power Line Road. Vegetation in the approximate southeast half of the property is low growing and sparse to moderately thick and is mostly grasses and scotch broom. The approximate northwest half of the property is densely forested with large evergreen fir trees and some oak trees. We did not observe standing water or indications of wet surface conditions during our time on site.

Subsurface Explorations

Our understanding of subsurface conditions at the project site is based on conditions disclosed in nine test pits excavated at the approximate locations shown in Figure 2. Details of the exploratory program, laboratory testing program and test pit logs completed for this study are presented in Appendix A.

Subsurface Conditions

We observed approximately 3 inches of forest duff or sod at the surface in all of the explorations with the exception of test pit TP-3. From the surface to a depth of 1 foot in test pit TP-3 we observed fill consisting of gravel with silt and sand. Underlying the duff or fill, we observed a weathered zone of soil, consisting of silty sand with gravel and traces of organic material in a medium dense condition. Underlying the weathered zone we typically observed glacial outwash consisting of gravel with sand and trace silt and variable cobbles. Exceptions to this include test pit TP-1 where gravel with silt and sand was observed below a depth of 7½ feet and in test pit TP-9 where sand with gravel and trace silt was observed from below a depth of 7 feet. The outwash was observed to be in a dense condition. Caving was typically noted below a depths of about 4 feet.

No groundwater seepage was observed during exploration. Groundwater conditions should be expected to vary as a result of season, precipitation and other factors. Based on our observations and previous explorations completed in the project vicinity, static groundwater elevation is expected to be well below the depths of the test pit explorations completed for this project.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on the results of our study, it is our opinion that the site is generally suitable for the proposed development with regard to geotechnical considerations. A summary of the primary geotechnical considerations for the proposed development is provided below, and is followed by our detailed recommendations

- Organic-rich surficial material should be stripped from all areas to be improved.
- Granular soils were generally encountered; however, we did observe that some of the near-surface site soil has a higher fines (silt and clay-sized particles passing the U.S. Standard No. 200 sieve) content. Soil with a higher fines content is more sensitive to small changes in moisture content and may be difficult, if not impossible, to work and compact during wet weather conditions. This material can also be susceptible to disturbance from construction traffic when wet, or if earthwork is performed during wet weather.

- The proposed structures may be satisfactorily supported on continuous and isolated shallow foundations supported on the medium dense or dense native soils or on structural fill that extends to native soil.
- Floor slabs may be supported on compacted fill or native soils.
- The glacial outwash deposits can contain cobbles and boulders. The contractor should be prepared for this possibility.
- On-site stormwater infiltration appears feasible based on the subsurface conditions observed. We provide preliminary infiltration rate recommendations below.

Stormwater Infiltration

General

Soil consisting of gravel with sand or gravel with silt and sand was typically encountered below a depth of 1 to 2 feet in the explorations completed in the project area. In general, it is our opinion that the natural soils encountered in our explorations should have adequate permeability to infiltrate stormwater from the site. We did not encounter groundwater seepage, staining or other indications of seasonal shallow groundwater in the explorations.

Soil Infiltration Rates

Stormwater infiltration rates for the site soils were established based on the 2005 Ecology Stormwater Management Manual for Western Washington Volume III in conjunction with the sieve analysis results presented in Appendix A, Figures A-11 and A-12.

TABLE 1. SOIL INFILTRATION RATES[1]

Test Pit No.	Soil Sample No.	Soil Sample Depth (feet)	Percent Fines[2]	D10 Size (mm)[3]	USCS[4] Soil Classification	Long-term Design Infiltration Rate[6] (Inches per Hour)
1	5	7.5	7.5	0.14	GP-GM	2.0
2	3	5.5	2.6	0.49	GP	9
3	4	5.5	3.8	0.44	GP	9
5	2	3.5	3.0	0.82	GW	9
7	3	5.5	2.5	0.51	GP	9
8	3	7.5	4.7	0.25	GW	3.5
9	3	5.5	1.7	0.48	GP	9
9	4	7.5	2.2	0.25	SP	3.5

Notes:

[1] For selected soil samples.

[2] Fines = Silt and clay-sized particles passing U.S. No. 200 (0.75 mm) sieve.

[3] Based on ASTM C 136 Soil Gradation Test.

[4] Unified Soil Classification System (USCS).

[5] Based on grain-size analysis and the procedures outlined in the 2005 Ecology Stormwater Management Manual for Western Washington Volume III Table 3.8.

These rates are an estimate of subsurface infiltration properties. We expect that the relatively clean gravel soils encountered in the test pits should have adequate permeability and storage capacity to infiltrate stormwater. We did not complete explorations at specific pond locations because this information was not available at the time of our explorations. We recommend that the project plans include provisions for GeoEngineers to observe subsurface explorations during construction to check that the preliminary infiltration rate(s) used for design are appropriate for the conditions encountered. Site- and location-specific testing may also be required by local jurisdictions. It should be noted that infiltration through fill is not permissible according to the 2005 Ecology Stormwater Management Manual for Western Washington Volume III.

Stormwater should be treated in accordance with current regulations prior to infiltration. To help reduce clogging of infiltration facilities, we recommend they be protected during construction with siltation control facilities such as temporary settling basins, silt fences and hay bales. Suspended solids can clog the soil and reduce the infiltration rate. Periodic sweeping of paved areas, during and following construction, will help extend the life of the infiltration facilities. Equipment should not be permitted in the infiltration areas after they are excavated to grade because of the potential for compaction of the subgrade that could reduce the infiltration rate of the soil.

Site Development and Earthwork

General

We anticipate that site development and earthwork will include clearing and stripping of surface vegetation, constructing foundations and then placing and compacting fill and backfill materials. We expect that the majority of site grading can be accomplished with conventional earthmoving equipment. The following sections provide recommendations for stripping, excavation, erosion control, subgrade development, fill materials, fill placement and compaction.

Clearing and Stripping

Based on our observations at the site, we estimate that the depth of stripping could be on the order of 3 to 6 inches. Greater stripping depths may be required to remove localized zones of loose or organic-rich soil. In addition, the primary root systems of shrubs should be completely removed. Stripped material should be transported off site for disposal or processed and used as fill in landscaping areas.

Although we did not encounter boulders during our subsurface investigation, it is our experience they can be present in the glacial deposits in the area. Accordingly, the contractor should be prepared to remove boulders, if encountered during grading or utility excavations. Boulders may be removed from the site or buried in landscape areas. Voids caused by boulder removal should be backfilled with structural fill.

Temporary Excavations, Support and Dewatering

Excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Shoring and temporary slope inclinations must conform to the provisions of Title 296 Washington Administrative Code (WAC), Part N, "Excavation, Trenching and Shoring." Regardless of the soil type encountered in the excavation, shoring, trench boxes or sloped sidewalls will be required under Washington Industrial Safety and Health Act (WISHA). The contract

documents should specify that the contractor is responsible for selecting excavation and dewatering methods, monitoring the excavations for safety and providing shoring, as required, to protect personnel and structures. We provide additional recommendations in regard to temporary and permanent shoring below.

In general, temporary cut slopes should be inclined no steeper than about 1-1/2H to 1V (horizontal to vertical). This guideline assumes that all surface loads are kept at a minimum distance of at least one-half the depth of the cut away from the top of the slope and that seepage is not present on the slope face. Flatter cut slopes will be necessary where seepage occurs or if surcharge loads are anticipated. We observed caving in our explorations; therefore, some sloughing and raveling of cut slopes should be expected. Temporary covering with heavy plastic sheeting should be used to protect these slopes during periods of wet weather.

Based on our explorations, we do not expect groundwater to be a major factor during shallow excavations and earthwork. However, some perched groundwater could occur in the near-surface soil depending on the time of year of construction. We anticipate that groundwater handling needs will typically be lower during the late summer and early fall months. We anticipate that shallow perched groundwater can typically be handled adequately with sumps, pumps, and/or diversion ditches, as necessary. Ultimately, we recommend that the contractor performing the work be made responsible for controlling and collecting groundwater encountered.

Permanent Cut and Fill Slopes

Based on site grades and the proposed construction, we anticipate that only minor cutting and filling will be required for this project. However, if permanent slopes are necessary, we recommend they be constructed at a maximum inclination of 2H to 1V. Where 2H to 1V permanent slopes are not feasible, protective facings and/or retaining structures should be considered.

To achieve uniform compaction, we recommend that fill slopes be overbuilt slightly and subsequently cut back to expose well-compacted fill. Fill placement on slopes steeper than 5H to 1V should be benched into the slope face and include keyways. The configuration of the bench and keyway depends on the equipment being used. Bench excavations should be level and extend into the slope face. We recommend that a vertical cut of about 3 feet be maintained for benched excavations. Keyways should be about 1-1/2 times the width of the equipment used for grading or compaction.

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

Surface Drainage

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

Erosion and Sedimentation Control

Potential sources or causes of erosion and sedimentation can be influenced by construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. Implementing an erosion and sedimentation control plan will reduce the project impact on erosion-prone areas. The plan should be designed in accordance with applicable city, county and/or state standards. The plan should incorporate basic planning principles, including:

- Scheduling grading and construction to reduce soil exposure.
- Re-vegetating or mulching denuded areas.
- Directing runoff away from denuded areas.
- Reducing the length and steepness of slopes with exposed soils.
- Decreasing runoff velocities.
- Preparing drainage ways and outlets to handle concentrated or increased runoff.
- Confining sediment to the project site.
- Inspecting and maintaining control measures frequently.

Some sloughing and raveling of exposed or disturbed soil on slopes should be expected. We recommend that disturbed soil be restored promptly so that surface runoff does not become channeled.

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

Until the permanent erosion protection is established and the site is stabilized, site monitoring may be required by qualified personnel to evaluate the effectiveness of the erosion control measures and to repair and/or modify them as appropriate. Provision for modifications to the erosion control system based on monitoring observations should be included in the erosion and sedimentation control plan.

Subgrade Preparation and Evaluation

Subgrade areas should be thoroughly compacted with heavy, smooth-drum vibratory equipment to a uniformly dense and unyielding condition prior to placement of structural fill or structural elements. We recommend that prepared subgrades be observed by a member of our firm, who will evaluate the suitability of the subgrade and identify any areas of yielding which are indicative of soft or loose soil. The exposed subgrade soil should be proof-rolled with heavy rubber-tired equipment or probed with a 1/2-inch-diameter steel rod, as appropriate depending on prevailing conditions. If soft or otherwise unsuitable areas revealed during probing or proof-rolling cannot be compacted to a stable and uniformly firm condition, we recommend that: 1) the subgrade soils be scarified (e.g., with a ripper or a farmer's disc), aerated and recompacted; or 2) the unsuitable soils be removed and replaced with structural fill, as needed.

Subgrade Protection and Wet Weather Considerations

The wet weather season generally begins in October and continues through May in western Washington; however, periods of wet weather can occur during any month of the year. In our opinion, site grading and fill placement could be considered during wet weather, but it should be noted that some of the soils encountered in our explorations contain a significant amount of fines and will be susceptible to disturbance during extended periods of wet weather. Soil with high fines content is very sensitive to small changes in moisture and is susceptible to disturbance from construction traffic when wet or if earthwork is performed during wet weather. If wet weather earthwork is unavoidable, we recommend that the following steps be taken.

- The ground surface in and around the work area should be sloped so that surface water is directed away from the work area. The ground surface should be graded so that areas of ponded water do not develop. Measures should be taken by the contractor to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.
- Earthwork activities should not take place during periods of heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and other soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting, sumps with pumps and grading. The site soils should not be left uncompacted and exposed to moisture. Sealing the surficial soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent to which these soils become wet or unstable.
- Construction traffic should be restricted to specific areas of the site, preferably areas that are surfaced with working pad materials not susceptible to wet weather disturbance.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.
- Protective surfacing such as placing asphalt-treated base (ATB) or haul roads made of quarry spalls or a layer of free-draining material such as well graded pit-run sand and gravel may be necessary to protect completed areas. Typically, minimum gravel thicknesses on the order of 24 inches are necessary to provide adequate subgrade protection.
- During periods of wet weather, concrete should be placed as soon as practical after preparation of the footing excavations. Foundation bearing surfaces should not be exposed to standing water. Should water infiltrate and pool in the excavation, it should be removed before placing structural fill or reinforcing steel. Subgrade protection for foundations consisting of a lean concrete mat should be considered if footing excavations are exposed to extended wet weather conditions.

Fill Materials

General

Material used for structural fill should be free of debris, organic contaminants and rock fragments larger than 6 inches. The workability of material for use as structural fill will depend on the

gradation and moisture content of the soil. As the amount of fines increases, soil becomes increasingly more sensitive to small changes in moisture content. We recommend that select granular fill or crushed rock be used for structural fill during the rainy season. If prolonged dry weather prevails during the earthwork phase of construction, materials with a somewhat higher fines content may be acceptable. The following paragraphs summarize the material requirements for fill and backfill.

Select Granular Fill

We recommend select granular fill for construction during wet weather conditions, consist of well-graded sand and gravel or crushed rock with a maximum particle size of 6 inches and less than 5 percent fines by weight based on the minus 3/4-inch fraction. Organic matter, debris or other deleterious material should not be present. In our opinion, material conforming to Washington State Department of Transportation (WSDOT) Specification 9-03.9 (Aggregates for Ballast and Crushed Surfacing), 9-03.10 (Aggregate for Gravel Base), or 9-03.14 (Borrow) is suitable for use as import fill material during wet weather with the exception that the fines content should be less than 5 percent based on the minus 3/4-inch fraction. In addition, some larger particle sizes are acceptable, as described above.

On-Site Soil

During dry weather and periods of light rain fall any non-organic on-site soil may be considered for use as fill provided it meets the criteria described above and can be compacted as recommended. When the fines content in the soil exceeds about 5 percent, the soil becomes more sensitive to moisture. Portions of the on-site soil contain enough fines to be moisture sensitive and may not be suitable for use as fill during extended periods of wet weather and/or if exposed to wet conditions. Even when properly compacted, this material can be easily disturbed and will soften when exposed to moisture. Based on our subsurface explorations, on-site material will typically not be suitable for use as drainage material, for use behind retaining walls or as a capillary break material.

Fill Placement and Compaction

General

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

Area Fills and Bases

Fill placed to raise site grades and materials under pavements should be placed on subgrades prepared as previously recommended. In general, area fills and bases should be compacted to at

least 95 percent of the maximum dry density (MDD) determined by ASTM International (ASTM) Test Method D 1557 (modified Proctor).

Trench Backfill

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

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

Seismic Design Considerations

General

The site is located within the Puget Sound region, which is seismically active. Seismicity in this region is attributed primarily to the interaction between the Pacific, Juan de Fuca, and North American plates. The Juan de Fuca plate is subducting beneath the North American plate. It is thought that the resulting deformation and breakup of the Juan de Fuca plate might account for the deep focus earthquakes in the region. Hundreds of earthquakes have been recorded in the Puget Sound area. In recent history, four of these earthquakes were large events: 1) in 1946, a Richter magnitude 7.2 earthquake occurred in the Vancouver Island, British Columbia area; 2) in 1949, a Richter magnitude 7.1 earthquake occurred in the Olympia area; 3) in 1965, a Richter magnitude 6.5 earthquake occurred between Seattle and Tacoma; and 4) on February 28, 2001, a magnitude 6.8 earthquake occurred at Nisqually near Olympia.

Research is currently underway regarding historical large magnitude subduction-related earthquake activity along the Washington and Oregon coasts. Geologists are reporting evidence that suggests several large magnitude earthquakes (Richter magnitude 8 to 9) have occurred in the last 1,500 years, the most recent of which occurred about 300 years ago. No earthquakes of this magnitude have been documented during the recorded history of the Pacific Northwest. Local design practice in Puget Sound assumes that the magnitude felt from such an earthquake is about the same as from the existing design earthquake because of the distance.

Seismic Design Criteria

Seismic design may be performed using the equivalent static force procedure outlined in the 2009 IBC using the design parameters provided below.

TABLE 2. SEISMIC DESIGN PARAMETERS

2009 IBC
Spectral Response Accel. at Short Periods (SS) = 1.18
Spectral Response Accel. at 1 Second Periods (S1) = 0.42
Site Class = C
Site Coefficient (FA) = 1.0
Site Coefficient (FV) = 1.38

Liquefaction Potential

Liquefaction refers to a condition where vibration or shaking of the ground, usually from earthquake forces, results in development of excess pore pressures in loose, saturated soils and subsequent loss of strength in the deposit of soil so affected. In general, soils that are susceptible to liquefaction include loose to medium dense "clean" to silty sands that are below the water table. In our opinion, the potential for liquefaction at this site is low.

Shallow Foundations

Foundation Support

Proposed structures can be satisfactorily founded on continuous wall or isolated column footings supported on undisturbed native soils, or on structural fill placed over native soils. If the bearing surface is loose or disturbed it must be compacted to a dense, unyielding condition and the loose soil removed and replaced with compacted structural fill. The exterior footings should be established at least 18 inches below the lowest adjacent grade. The recommended minimum footing depth is greater than the anticipated frost depth. Interior footings can be founded a minimum of 12 inches below the top of the floor slab. Isolated column and continuous wall footings should have minimum widths of 24 and 18 inches, respectively.

Bearing Capacity

We recommend that footings founded as recommended be proportioned using an allowable soil bearing pressure of 3,500 pounds per square foot (psf). The allowable soil bearing pressure may be increased to 4,500 psf for footings greater than 4 feet in width. The bearing pressures apply to the total of dead and long-term live loads and may be increased by one third when considering total loads, including earthquake or wind loads. These are net bearing pressures. The weight of the footing and overlying backfill can be ignored in calculating footing sizes.

Footing Bearing Surface Preparation

Footing excavations should be performed using a smooth-edged bucket to limit bearing surface disturbance. The foundation bearing surface should be recompacted as necessary to a dense, non-yielding condition. Loose or disturbed materials present at the base of footing excavations should be removed or compacted. Foundation bearing surfaces should not be exposed to standing water. Should water infiltrate and pool in the excavation, it should be removed before placing structural fill or reinforcing steel.

We recommend that a member from our firm observe foundation excavations before placing reinforcing steel in order to confirm that adequate bearing surfaces have been prepared or provide recommendations for removal of unsuitable soil. Unsuitable bearing materials should be recompacted or removed and replaced with compacted structural fill as recommended by the geotechnical engineer.

Foundation Settlement

We estimate that settlement of footings designed and constructed as recommended will be less than 1 inch, for an assumed loading condition of up to 300 kips per column. Differential settlements between comparably loaded isolated column footings or along 50 feet of continuous footing should be less than 1/2 inch. Settlement is expected to occur rapidly as loads are applied. Settlements could be larger than estimated if footings are placed on loose or disturbed soil.

Lateral Resistance

The ability of the soil to resist lateral loads is a function of frictional resistance, which can develop on the base of footings and slabs and the passive resistance, which can develop on the face of below-grade elements of the structure as these elements tend to move into the soil. For footings and floor slabs founded in accordance with the recommendations presented above, the allowable frictional resistance may be computed using a coefficient of friction of 0.40 applied to vertical dead-load forces. The allowable passive resistance on the face of footings, grade beams or other embedded foundation elements may be computed using an equivalent fluid density of 300 pounds per cubic foot (pcf) for undisturbed on-site soils or structural fill extending out from the face of the foundation element a distance at least equal to two and one-half times the depth of the element.

The passive earth pressure and friction components may be combined provided that the passive component does not exceed two-thirds of the total. The passive earth pressure value is based on the assumptions that the adjacent grade is level and that groundwater remains below the base of the footing throughout the year. The top foot of soil should be neglected when calculating passive lateral earth pressures unless the foundation area is covered with pavement or slab-on-grade. The lateral resistance values include a safety factor of approximately 1.5.

Conventional Subgrade and Retaining Walls

Drainage

Positive drainage is imperative behind any retaining structure. This can be accomplished by providing a zone of free-draining material behind the wall with perforated pipes to collect seepage water. The drainage material should consist of coarse sand and gravel containing less than 5 percent fines based on the fraction of material passing the 3/4-inch sieve. The wall drainage zone should extend horizontally at least 18 inches from the back of the wall.

Perforated smooth-walled rigid PVC pipe having a minimum diameter of 4 inches should be placed at the bottom of the drainage zone along the entire length of the wall, with the pipe invert at or below the elevation of the base of the wall footing. The drainpipes should discharge to a tightline leading to an appropriate collection and disposal system. An adequate number of cleanouts should be incorporated into the design of the drains in order to provide access for regular

maintenance. In general, roof downspouts, perimeter drains or other types of drainage systems should not be connected to retaining wall drain systems.

Design Parameters

The pressures presented assume that backfill placed within 2 feet of the wall is compacted by hand-operated equipment to a density of 90 percent of the MDD and that wall drainage measures are included as previously recommended. For walls constructed as described above, we recommend using an active lateral earth pressure corresponding to an equivalent fluid density of 35 pcf for the level backfill condition. For walls with backfill sloping upward behind the wall at 2H to 1V, an equivalent fluid density of 55 pcf should be used. This assumes that the tops of the walls are not structurally restrained and are free to rotate. For the at-rest condition (walls restrained from movement at the top) an equivalent fluid density of 55 pcf should be used for design. For seismic conditions, we recommend a uniform lateral pressure of 6H (where H is the height of the wall) psf be added to these lateral pressures. Note that if the retaining system is designed as a braced system but is expected to yield a small amount during a seismic event, an active earth pressure condition may be assumed and combined with the uniform seismic surcharge pressure.

The recommended pressures do not include the effects of surcharges from surface loads. If vehicles will be operated within one-half the height of the wall, a traffic surcharge should be added to the wall pressure. The traffic surcharge can be approximated by the equivalent weight of an additional 2 feet of backfill behind the wall. Additional surcharge loading conditions should also be considered on a case-by-case basis.

Retaining walls founded on native soil or structural fill extending to these materials may be designed using the allowable soil bearing values and lateral resistance values presented above in the "Shallow Foundations" section of this report. We estimate settlement of retaining structures will be similar to the values previously presented for building foundations.

Building Pads and Floor Slabs

A modulus of subgrade reaction of 300 pounds per cubic inch (pci) can be used for designing the building floor slab provided that the subgrade consists of dense native soil or structural fill and has been prepared in accordance with the "Site Development and Earthwork" section of this report. Settlement for floor slabs designed and constructed as recommended are estimated to be less than 3/4 inch for a floor load of 500 psf. We estimate that differential settlement of floor slabs will be 1/2 inch or less over a span of 50 feet providing that the fill below the slab is compacted as specified. The subgrade soils are non-expansive, so heave is not anticipated beneath the floor slab.

We recommend that on-grade slabs be underlain by a minimum 6-inch-thick capillary break layer to reduce the potential for moisture migration into the slab. The capillary break material should consist of a well-graded sand and gravel or crushed rock with a maximum particle size of 3/4 inch and less than 5 percent fines. The material should be placed as recommended in the "Fill Placement and Compaction" section of this report. If dry slabs are required (e.g., where adhesives are used to anchor carpet or tile to the slab), a waterproof liner may be placed as a vapor barrier below the slab.

Pavement Recommendations

Asphaltic Concrete Pavement

Pavement subgrades and fill should be prepared and placed as previously described. The crushed rock base course should be moisture conditioned near the optimum moisture content and compacted to at least 95 percent of the MDD determined in accordance with ASTM D 1557 test procedures. An appropriate number of in-place density tests should be conducted on the compacted base course to check that adequate compaction has been obtained. Crushed rock base course should conform to applicable sections of 4-04 and 9-03.9(3) of the WSDOT Standards.

For this project, we based the recommended pavement sections described below on an assumed in-situ California Bearing Ratio (CBR) between 15 and 20. The heavy-duty pavement section thickness is based on a traffic loading of about 1,000,000, 18-kip equivalent single-axle loads (ESALs); we used a design life of 10 years. The standard-duty section is appropriate for areas that will not be exposed to heavy truck loads. Hot mix asphalt (HMA) should conform to applicable sections of 5-04, 9-02 and 9-03 of the WSDOT Standards. The recommended pavement sections assume that final improvements surrounding the pavement will be designed and constructed such that stormwater or excess irrigation water from landscape areas does not infiltrate below the pavement section into the crushed base.

STANDARD-DUTY ASPHALTIC CONCRETE PAVEMENT

- 2 inches of hot mix asphalt.
- 3 inches of crushed surfacing base course and/or top course compacted as recommended.
- 12 inches compacted depth of native subgrades and/or existing fill compacted to 95 percent MDD (ASTM D 1557) and in a firm and unyielding condition.

HEAVY-DUTY ASPHALTIC CONCRETE PAVEMENT

- 3 inches of hot mix asphalt.
- 4 inches of crushed surfacing base course and/or top course compacted as recommended.
- 12 inches compacted depth of native subgrades and/or existing fill at 95 percent MDD (ASTM D 1557) and in a firm and unyielding condition.

LIMITATIONS

We have prepared this report for the exclusive use by Creekside DuPont Partners, LLC and their authorized agents for the DuPont Apartment Complex/Lot X to be located west of the intersection of Center Drive and Power Line Road in DuPont, Washington. Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

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

T19N, R 1W, Section 26
USGS 7.5' Topographic Map Series, Nisqually (1981) Quad.

N
W E
S

2,000 0 2,000
Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps, Street Maps 2005

Transverse Mercator, Zone 10 N North, North American Datum 1983
North arrow oriented to grid north

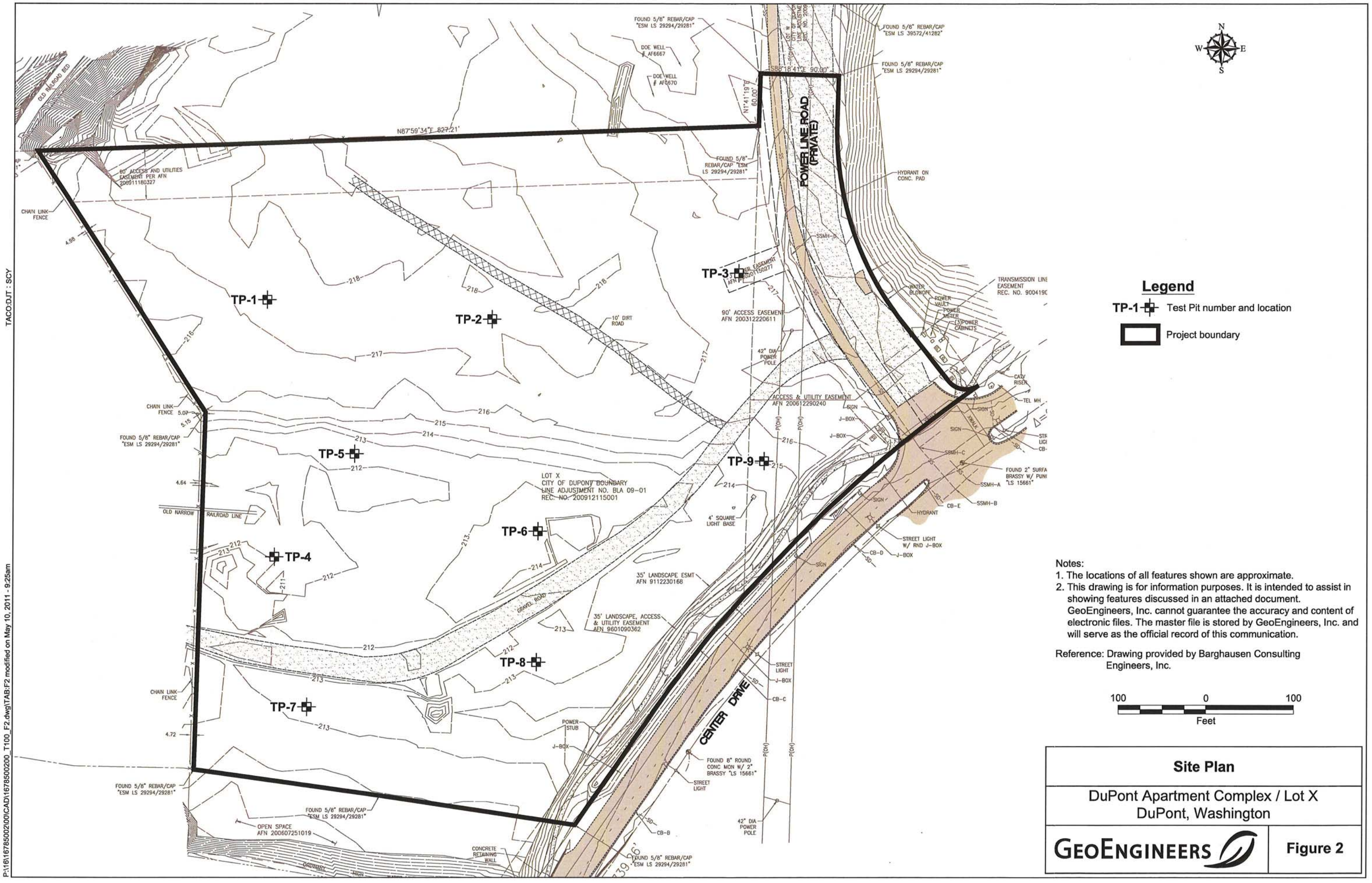
Vicinity Map

DuPont Apartment Complex / Lot X
DuPont, Washington

GeoEngineers

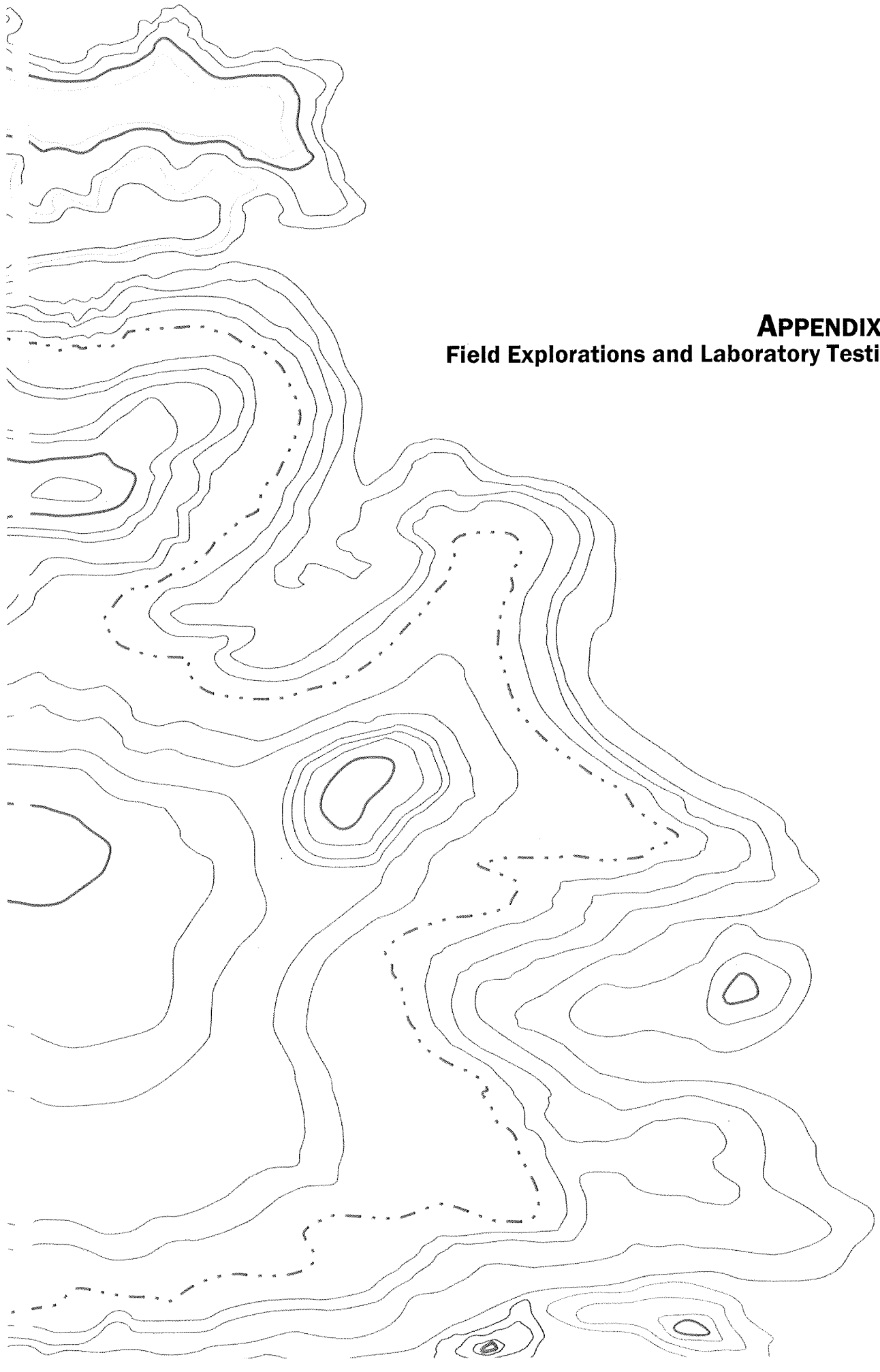
Figure 1

Office: Tacoma Path: W:\Tacoma\Projects\16116785002\GIS\16785000200_F1.mxd Map Revised: 05/11/2011 EL:SCY



TACO:DJT : SCY

P:\1\61\67850\200\CAD\1678500200_T100_F2.dwg\TAB:F2 modified on May 10, 2011 - 9:25am



APPENDIX A
Field Explorations and Laboratory Testing

APPENDIX A
FIELD EXPLORATIONS AND LABORATORY TESTING

Subsurface Explorations

Soil and groundwater conditions at the proposed development site were explored by excavating nine test pits on August 26, 2010. Subsurface exploratory services were subcontracted to GeoEngineers, Inc. The test pit explorations extended to depths between 10 and 12 feet below surrounding site grades.

The locations of the test pits were determined by electronic global positioning system (GPS) where available and by pacing and visual triangulation from existing site features such as roadways and property corners.. The elevations presented on the test pit logs are based on a site plan obtained from Barghausen Consulting Engineers. The locations and elevations of the explorations should be considered approximate. Locations of the explorations are provided on the Site Plan, Figure 2.

Our field representative obtained samples, classified the soils, maintained a detailed log of each exploration and observed groundwater conditions where applicable. The samples were retained in sealed plastic bags to prevent moisture loss. The soils were classified visually in general accordance with the system described in Figure A-1, which includes a key to the exploration logs. Summary logs of the explorations are included as Figures A-2 through A-10. The densities noted on the test pit exploration logs are based on the difficulty of excavation, observations of caving and our experience and judgment.

Laboratory Testing

Soil samples obtained from the test pits were transported to our laboratory and examined to confirm or modify field classifications, as well as to evaluate engineering properties of the soil. Representative samples were selected for laboratory testing. Laboratory testing included moisture content determination conducted in general accordance with ASTM International (ASTM) D 2216 and grain-size analyses conducted in general accordance with ASTM C 136. The sample test depths and moisture content test results are shown on the exploration logs. Sieve analysis results are presented in Figures A-11 and A-12.

SOIL CLASSIFICATION CHART

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

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

ADDITIONAL MATERIAL SYMBOLS

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

Measured groundwater level in exploration, well, or piezometer

Groundwater observed at time of exploration

Perched water observed at time of exploration

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Material Description Contact

Distinct contact between soil strata or geologic units

Approximate location of soil strata change within a geologic soil unit

Sampler Symbol Descriptions

2.4-inch I.D. split barrel

Standard Penetration Test (SPT)

Shelby tube

Piston

Direct-Push

Bulk or grab

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

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

Laboratory / Field Tests

%F	Percent fines
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
OC	Organic content
PM	Permeability or hydraulic conductivity
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
NT	Not Tested

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

KEY TO EXPLORATION LOGS

GeoEngineers

FIGURE A-1

Date Excavated: 8/26/2010 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 12.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
217					DUFF		3 inches duff		
	1	X	1		SM		Dark brown silty fine to coarse sand with gravel, trace organics (medium dense, moist)		
216					GP		Brown fine to coarse gravel with sand, trace silt, occasional cobbles (dense, moist)		
	2	X	2						
215									
	3								
214		X	3						
	4								
213									
	5								
212		X	4						
	6								
211									
	7								
210		X	5 SA		GP-GM		Brown fine to coarse gravel with silt and sand, occasional cobbles (dense, moist)	4	
	8								
209									
	9								
208		X	6						
	10								
207									
	11								
206		X	7						
	12								

Test pit completed at 12 feet on 8/26/10
No groundwater seepage observed
Moderate caving observed at approximately 4+ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-1

GeoEngineers

Project: DuPont Apartment Complex/Lot X
Project Location: DuPont, Washington
Project Number: 16785-002-00

Figure A-2
Sheet 1 of 1

Date Excavated: 8/26/2010 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 12.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
217	0				DUFF		3 inches duff		
		X	1		SM		Dark brown silty fine to coarse sand with gravel, occasional cobbles (medium dense, moist)		
216	1				GP		Brown fine to coarse gravel with sand, trace silt, occasional cobbles (dense, moist)		
		X	2						
215	2								
214	3								
213	4								
212	5								
		X	3 SA					3	
211	6								
210	7								
209	8								
208	9								
		X	4						
207	10								
206	11								
		X	5						
	12								

Test pit completed at 12 feet on 8/26/10
No groundwater seepage observed
Moderate caving observed at 8+ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-2

GeoEngineers

Project: DuPont Apartment Complex/Lot X
Project Location: DuPont, Washington
Project Number: 16785-002-00

Figure A-3
Sheet 1 of 1

Date Excavated: 8/26/2010 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 12.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
216	1	X	1		GP-GM		Gray fine to coarse gravel with silt and sand, occasional cobbles (medium dense, moist) (fill)		
215	2	X	2		SM		Dark brown silty fine to coarse sand with gravel, occasional cobbles, trace organics (medium dense, moist)		
214	3				GP		Brown fine to coarse gravel with sand, trace silt, occasional cobbles (dense, moist)		
213	4	X	3						
212	5								
211	6	X	4 SA					3	
210	7								
209	8	X	5						
208	9								
207	10								
206	11								
205	12	X	6						

Test pit completed at 12 feet on 8/26/10
No groundwater seepage observed
Moderate caving observed at 4+ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-3

GeoEngineers

Project: DuPont Apartment Complex/Lot X
Project Location: DuPont, Washington
Project Number: 16785-002-00

Figure A-4
Sheet 1 of 1

Date Excavated: 8/26/2010 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 10.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
211	1		1		DUFF		3 inches duff		
					SM		Dark brown silty fine to coarse sand with gravel (medium dense, moist)		
					GP		Brown fine to coarse gravel with sand, trace silt, occasional cobbles (dense, moist)		
210	2								
209	3								
208	4		2						
207	5								
206	6		3						
205	7								
204	8								
203	9								
202	10		4						

Test pit completed at 10 feet on 8/26/10
No groundwater seepage observed
Minor caving observed at 6+ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-4

GeoEngineers

Project: DuPont Apartment Complex/Lot X
Project Location: DuPont, Washington
Project Number: 16785-002-00

Figure A-5
Sheet 1 of 1

Date Excavated: 8/26/2010 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 10.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
212	0				DUFF		3 inches duff		
					SM		Dark brown silty fine to coarse sand with gravel, trace organics (medium dense, moist)		
211	1				GW		Brown fine to coarse gravel with sand, trace silt (dense, moist)		
210	2								
	3	X	1						
209		X	2 SA					2	
208	4								
	5								
207		X	3						
206	6								
	7								
205	8								
204	9								
203	10	X	4						

Test pit completed at 10 feet on 8/26/10
No groundwater seepage observed
Minor caving observed at approximately 4+ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-5

GeoEngineers

Project: DuPont Apartment Complex/Lot X
Project Location: DuPont, Washington
Project Number: 16785-002-00

Figure A-6
Sheet 1 of 1

Date Excavated: 8/26/2010 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 10.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
213					SOD		3 inches sod		
					SM		Dark brown silty fine to coarse sand with gravel, trace organics (medium dense, moist) (topsoil)		
212	1				GP		Brown fine to coarse gravel with sand, trace silt (dense, moist)		
211	2	X	1						
210	3								
209	4								
208	5	X	2						
207	6								
206	7								
205	8	X	3						
204	9								
	10	X	4						

Test pit completed at 10 feet on 8/26/10
No groundwater seepage observed
Minor caving observed at approximately 4+ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-6

GeoEngineers

Project: DuPont Apartment Complex/Lot X
Project Location: DuPont, Washington
Project Number: 16785-002-00

Figure A-7
Sheet 1 of 1

Date Excavated: 8/26/2010 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 12.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
212	1	X	1		DUFF		3 inches duff		
					SM		Dark brown silty fine to coarse sand with gravel (medium dense, moist)		
211	2				GP		Brown fine to coarse gravel with sand, trace silt (dense, moist)		
210	3	X	2						
209	4								
208	5								
207	6	X	3 SA					3	
206	7								
205	8	X	4						
204	9								
203	10	X	5						
202	11								
201	12	X	6						

Test pit completed at 12 feet on 8/26/10
No groundwater seepage observed
Moderate caving observed at approximately 4+ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-7

GeoEngineers

Project: DuPont Apartment Complex/Lot X
Project Location: DuPont, Washington
Project Number: 16785-002-00

Figure A-8
Sheet 1 of 1

Date Excavated: 8/26/2010 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 12.0

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
212	0				DUFF		3 inches duff		
					SM		Dark brown silty fine to coarse sand with gravel, trace organics (medium dense, moist) (topsoil)		
211	1				GP		Brown fine to coarse gravel with sand, trace silt (dense, moist)		
210	2	X	1						
209	3								
208	4								
207	5	X	2						
206	6								
205	7				GW		Brown fine to coarse gravel with sand, trace silt (dense, moist)		
	8	X	3 SA					4	
204	9								
203	10	X	4						
202	11								
201	12	X	5						

Test pit completed at 12 feet on 8/26/10
No groundwater seepage observed
Moderate caving observed at approximately 4+ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-8

GeoEngineers

Project: DuPont Apartment Complex/Lot X
Project Location: DuPont, Washington
Project Number: 16785-002-00

Figure A-9
Sheet 1 of 1

Date Excavated: 8/26/2010 Logged By: EAW

Equipment: Case 580 Super M Total Depth (ft) 12.0

Elevation (feet)	Depth (feet)	Sample: Testing Sample	Sample: Sample Name Testing	Graphic Log	Group Classification	Encountered Water	MATERIAL DESCRIPTION	Moisture Content, %	REMARKS
					DUFF		3 inches duff		
214	1	X	1		SM		Dark brown silty fine to coarse sand with gravel (medium dense, moist) (topsoil)		
					GP		Brown fine to coarse gravel with sand, trace silt (dense, moist)		
213	2	X	2						
212	3								
211	4								
210	5								
209	6	X	3 SA					3	
208	7				SP		Brown fine to coarse sand with gravel, trace silt (dense, moist)		
207	8	X	4 SA					5	
206	9								
205	10	X	5						
204	11						Grades to without gravel		
203	12	X	6						

Test pit completed at 12 feet on 8/26/10
No groundwater seepage observed
Moderate caving observed at approximately 4+ feet

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to 0.5 foot.

Log of Test Pit TP-9

GeoEngineers

Project: DuPont Apartment Complex/Lot X
Project Location: DuPont, Washington
Project Number: 16785-002-00

Figure A-10
Sheet 1 of 1

16785-002-00 MJH:AMD:tt 051011

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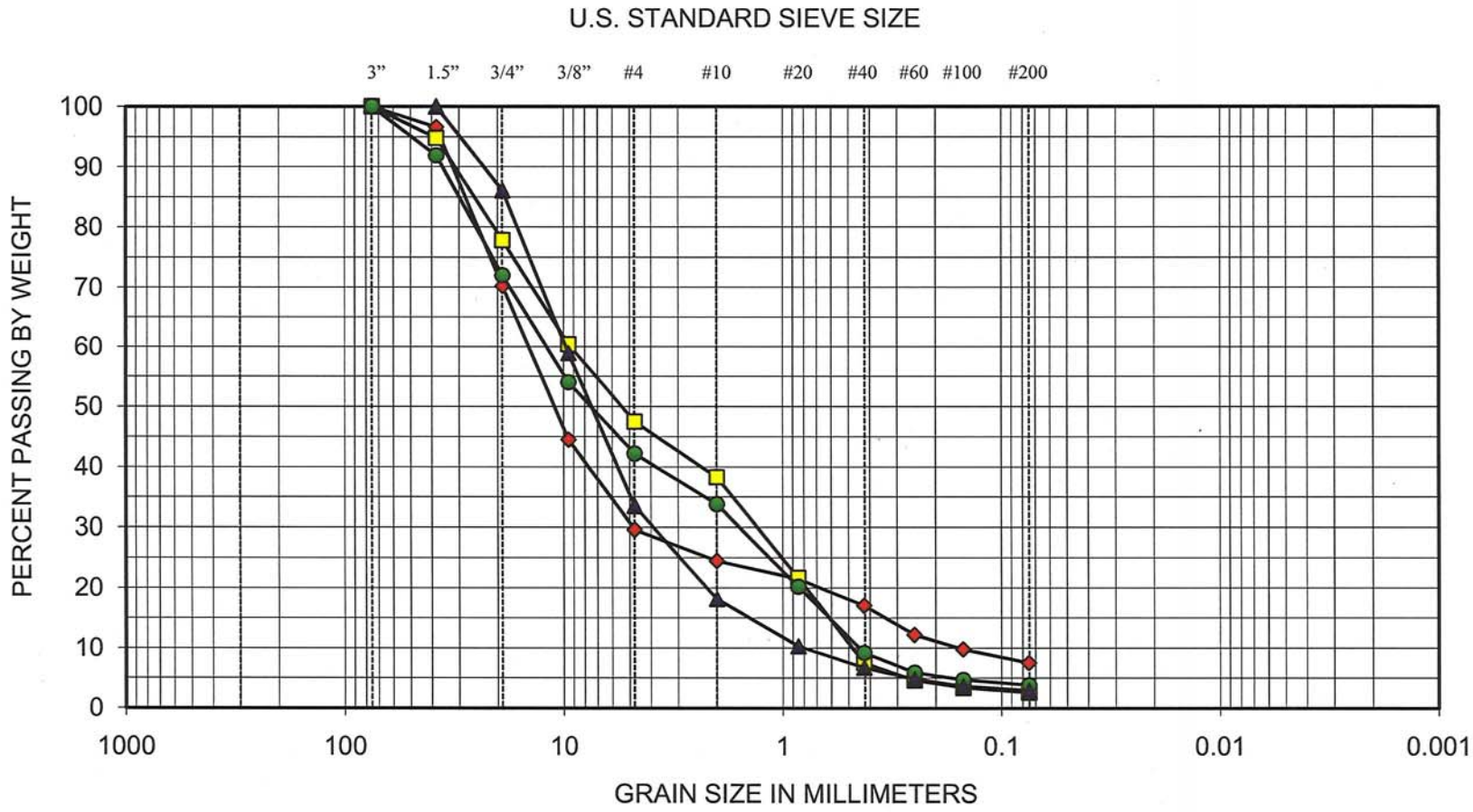
SIEVE ANALYSIS RESULTS

FIGURE A-11



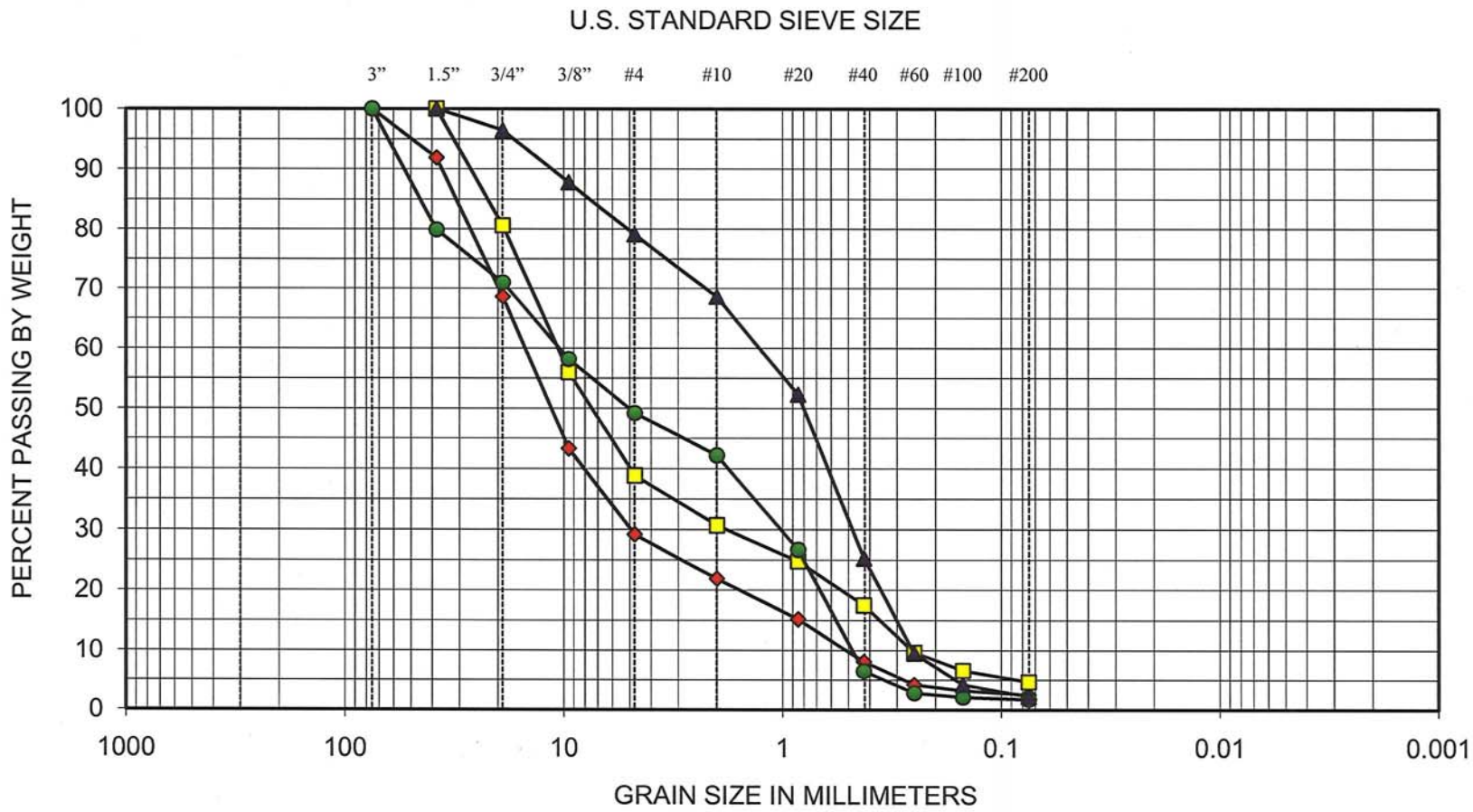
BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	SOIL CLASSIFICATION
◆	TP-1	7.5	Gravel with silt and sand (GP-GM)
■	TP-2	5.5	Gravel with sand (GP)
●	TP-3	5.5	Gravel with sand (GP)
▲	TP-5	3.5	Gravel with sand (GW)

GEOENGINEERS

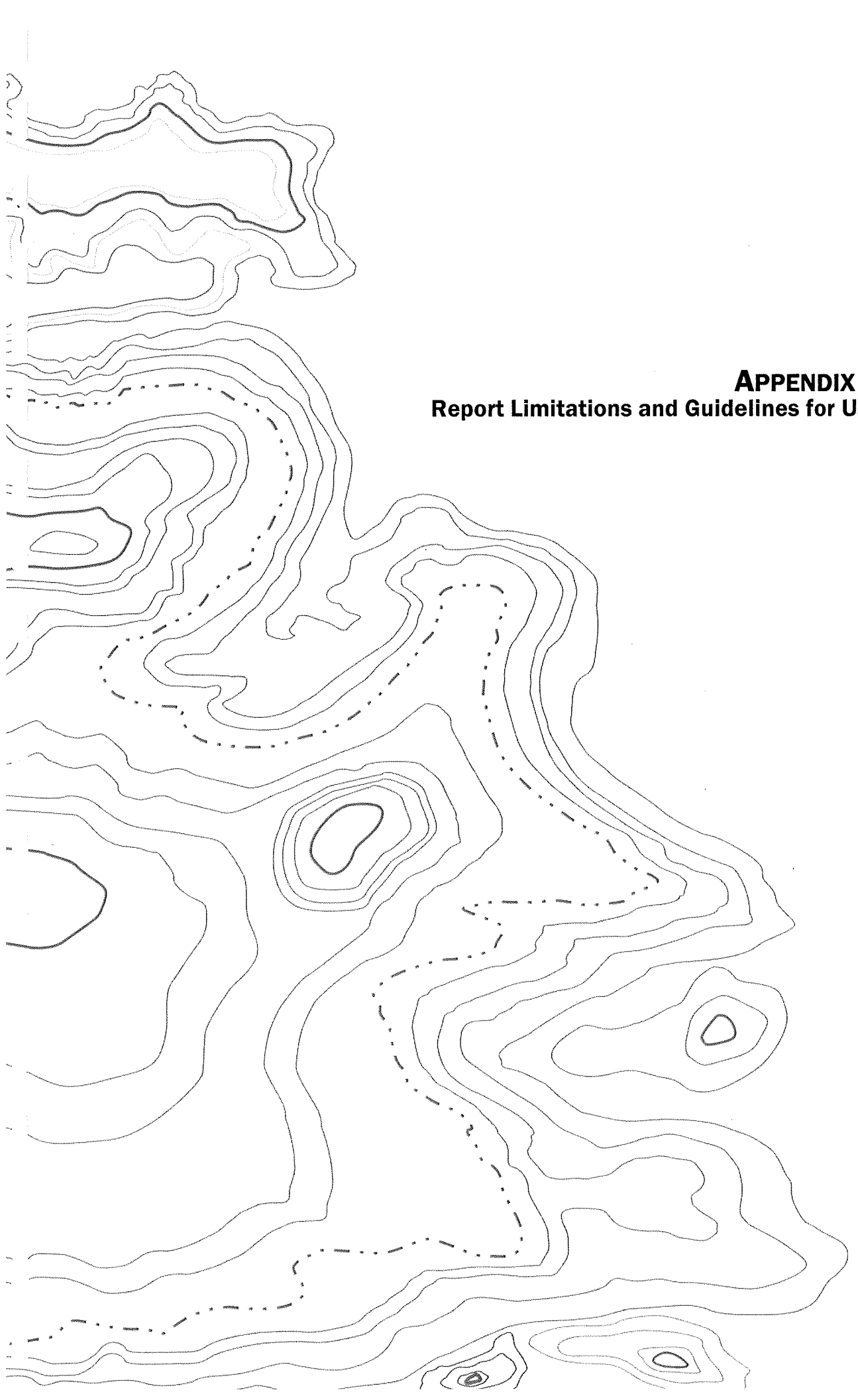
FIGURE A-12

SIEVE ANALYSIS RESULTS



BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	SOIL CLASSIFICATION
◆	TP-7	5.5	Gravel with sand (GP)
■	TP-8	7.5	Gravel with sand (GW)
●	TP-9	5.5	Gravel with sand (GP)
▲	TP-9	7.5	Sand with gravel (SP)



APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

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

Geotechnical Services are Performed for Specific Purposes, Persons and Projects

This report has been prepared for the exclusive use of Creekside DuPont Partners, LLC and their authorized agents. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project 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. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted geotechnical practices in this area at the time this report was prepared. This report should not be applied for any purpose or project except the one originally contemplated.

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

This report has been prepared for the DuPont Apartment Complex/Lot X. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

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

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

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;

---

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

- composition of the design team; or
- project ownership.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

Topsoil

For the purposes of this report, we consider topsoil to consist of generally fine-grained soil with an appreciable amount of organic matter based on visual examination, and to be unsuitable for direct support of the proposed improvements. However, the organic content and other mineralogical and gradational characteristics used to evaluate the suitability of soil for use in landscaping and agricultural purposes was not determined, nor considered in our analyses. Therefore, the information and recommendations in this report, and our logs and descriptions should not be used as a basis for estimating the volume of topsoil available for such purposes.

Most Geotechnical and Geologic Findings Are Professional Opinions

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

Geotechnical Engineering Report Recommendations Are Not Final

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from GeoEngineers' professional judgment and opinion. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by GeoEngineers should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction

observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A Geotechnical Engineering or Geologic Report Could be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GeoEngineers confer with appropriate members of the design team after submitting the report. Also retain GeoEngineers to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having GeoEngineers participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Exploration Logs

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

Contractors are Responsible for Site Safety on their Own Construction Projects

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

Read These Provisions Closely

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers

if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

Geotechnical, Geologic and Environmental Reports Should not be Interchanged

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention, or assessment of the presence of Biological Pollutants in or around any structure. Accordingly, this report includes no interpretations, recommendations, findings, or conclusions for the purpose of detecting, preventing, assessing, or abating Biological Pollutants. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

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

May 11, 2018

DuPont Industrial Partners, LLC
C/O Barghausen Consulting Engineers, Inc.
18215 72nd Avenue South
Kent, Washington 98032

Attention: Dan Balmelli, PE

Subject: Report Addendum
Geotechnical Engineering Services
DuPont Industrial Warehouse
DuPont, Washington
File No. 16785-003-01

INTRODUCTION AND PROJECT UNDERSTANDING

This report addendum presents supplemental geotechnical recommendations and considerations for the DuPont Industrial Warehouse (previously titled as Lot "Y" Industrial Park). As part of this addendum, we are addressing comments in the City of DuPont Type III Site Plan Review and SEPA Environmental Review (PLNG 2018-008, -009) letter dated February 23, 2018. We have prepaired a geotechnical study dated October 10, 2011 for this project (October report). We understand that plans are underway to design and construct two (approximately 130,000 square feet each) industrial buildings (Building A and Building B) in the west portion of the site. Finished floor will be near Elevation 214 to 215 feet (NGVD29). Additional improvements will include site grading, installation of utilities, asphalt paving and construction of retaining structures. We include a revised and updated Site Plan with the proposed buildings and construction, attached as Figure 1.

We have reviewed preliminary civil engineering plan sheets C1 through C13 (civil plans). We understand that a retaining wall will be constructed south of Building B. The retaining wall will be located in a current ravine/depression area that will retain fill as part of site grading. The retaining wall is also just north of the border of a 50-foot setback boundary or buffer from the steep slopes located north of the property. The wall foundations of the retaining wall may encroach into the buffer. From the grading plan, it appears that the retaining wall will retain approximately 7 feet of fill at it's deepest point and taper off in the east and west direction.

CONCLUSIONS AND RECOMMENDATIONS

Encroachment Into Buffer Setback Area

Based on our review of proposed plans and subsurface explorations completed as part of our October study, we provide the following:

- It is our opinion that the proposed final site development condition, as reviewed, will not create a hazard to the subject property, surrounding properties, erosion, or sedimentation to off-site properties or bodies of water. The property will be paved and stormwater will be managed and directed into stormwater infiltration galleries. The proposed construction appears to eliminate the potential for erosion and channeling of water onto the slope area.
- Proper erosion and sedimentation will be required during construction. A temporary erosion and sedimentation control (TESC) plan has been developed for the subject site (sheets C2, C3, and C4 of the civil plans). This plan includes TESC measures that surround the proposed retaining structure. Temporary slope inclinations, protection of temporary slopes and erosion control recommendations are provided in our report and should be followed during construction.
- Additional construction recommendations presented in DMC 25.105.04(2)(c) should be implemented during physical grading and site development. These include minimizing erosion and landslide potential and minimizing disruption of the existing topography and natural vegetation. Care should be taken to cut slopes at inclinations recommended in our report and disturb only areas required to complete the work. Contractors completing earthwork should be made aware of the requirements presented in the DMC 25.105.02(2)(c).
- Final erosion control measures, once construction is complete, should include provisions as described in our October report.
- Because the retaining wall will be constructed between a sloping ravine, foundation elements for the retaining wall should be embeded deep enough such that a 2H to 1V (horizontal:vertical) slope from the lowest outermost foundation element is maintained from the toe of surrounding slopes. This may require additional excavation for the foundation and subsequent burying of portions of the retaining wall. Subgrade and bearing surface preparation recommendations presented in our October report should be followed.

UPDATED SEISMIC DESIGN CONSIDERATIONS

During preparation of our report, the 2009 International Building Code (IBC) was cited for seismic design criteria. Based on the 2015 IBC, we still conclude that the site may be characterized as Class C. Seismic design parameters in accordance with the 2015 IBC are provided in Table 1 below.

TABLE 1. 2015 IBC SEISMIC DESIGN VALUES

Site Coefficient	Site Factor	MCE[1] Spectral Response	Design Spectral Response
S_s = 1.304 g	F_a = 1.000	S_{MS} = 1.304 g	S_{DS} = 0.869 g
S_1 = 0.520 g	F_v = 1.300	S_{M1} = 0.676 g	S_{D1} = 0.451 g

Note:

[1] MCE = Maximum Considered Earthquake

Based on our understanding of site conditions, we recommend using a peak ground acceleration (PGA) equal to 0.5g as determined in accordance with Section 11.8.3 of American Society of Civil Engineers (ASCE) Standard 7-10. This is the same value as sited in the 2009 IBC.

USE OF PREVIOUS REPORT

Except as modified herin, we conclude that the recommendations and design considerations presented in our Ocbober 10, 2011 are still appropriate for this site and may be used for this project.

LIMITATIONS

We have prepared this report addendum for DuPont Industrial Partners LLC and Barghausen Engineers Inc. for the DuPont Industrial Warehouse project. The client may distribute copies of this report addendum to owner and owner's authorized agents and regulatory agencies as may be required for the project.

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

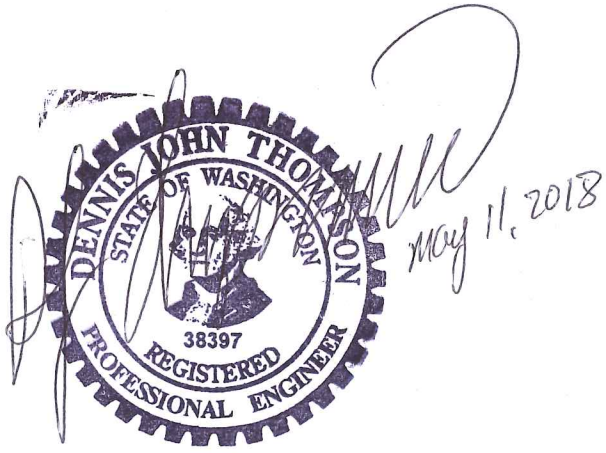
The limitations presented in our October 11, 2011 report apply to this addendum. Please refer to Appendix B titled "Report Limitations and Guidelines for Use" of our October 11, 2011 Geotechnical Engineering Services Report for additional information pertaining to use of this report addendum.

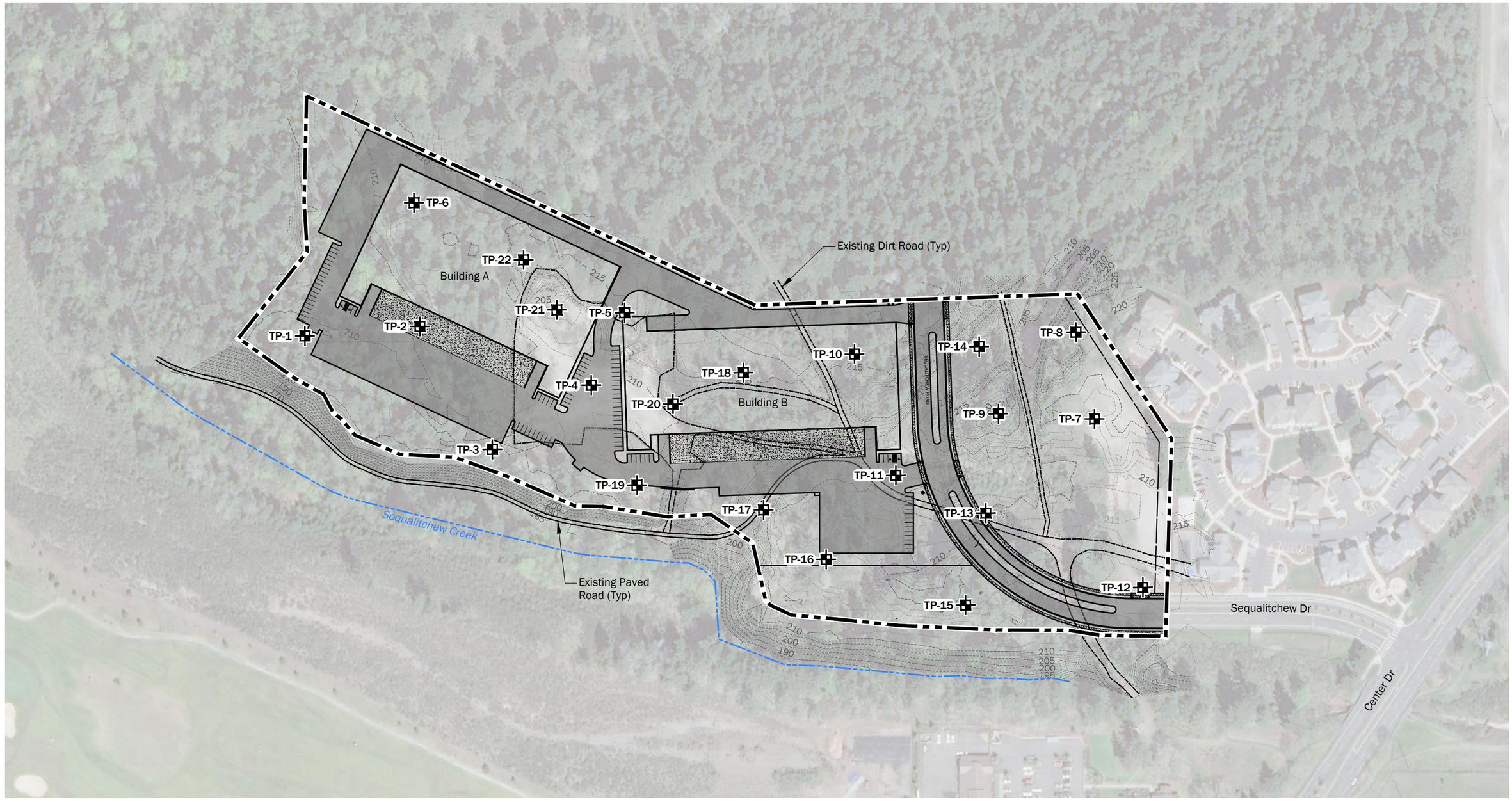
Respectfully Submitted,
GeoEngineers, Inc.

Dennis (DJ) Thompson, PE
Associate

DJT:tt

Attachment:
Figure 1 – Vicinity Map





Notes:

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

Data Source:
Aerial from Microsoft Bing. Survey background from Barghausen Consulting Engineers, Inc dated 8/8/2011. Proposed Plan from Barghausen Consulting Engineers, Inc dated 9/17/17.

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

Legend

Site Boundary

TP-X Test Pit

N W E S

200 0 200
Feet

Site Plan

Lot Y Industrial Park
DuPont, Washington

GeoEngineers

Figure 1

P:\16\16785003\CAD\00\GeoTech Report\16785003_F02_Site Plan.dwg TAB:F02 Date Exported: 05/04/18 - 12:49 by cstickel

8.0 OTHER PERMITS

8.0 OTHER PERMITS

Other permits for this project site include:

- NPDES General Permit from the Department of Ecology for construction on sites with areas of disturbance over an acre of land which this site qualifies for
- Site Development Permit
- Clear and Grade Permit
- Building Permit
- Right-of-Way Use Permit
- Forest Practices Permit
- Water Line Extension Permit
- Sanitary Sewer Extension Permit

9.0 OPERATIONS AND MAINTENANCE MANUAL

No. 2 – Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Poisonous/Noxious Vegetation	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Contaminants and Pollution	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Rodent Holes	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1)
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. (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).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
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 "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Piping	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway	Rock Missing	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
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.

No. 3 – 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.
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 “Catch Basins” (No. 5)	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).

No. 4 – 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 securely attached to wall and outlet pipe.
		Structure is not in upright position (allow up to 10% from plumb).	Structure in correct position.
		Connections to outlet pipe are not watertight and show signs of rust.	Connections to outlet pipe are water tight; structure repaired or replaced and works as designed.
		Any holes--other than designed holes--in the structure.	Structure has no holes other than designed holes.
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing.	Gate is watertight and works as designed.
		Gate cannot be moved up and down by one maintenance person.	Gate moves up and down easily and is watertight.
		Chain/rod leading to gate is missing or damaged.	Chain is in place and works as designed.
		Gate is rusted over 50% of its surface area.	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 “Closed Detention Systems” (No. 3).	See “Closed Detention Systems” (No. 3).	See “Closed Detention Systems” (No. 3).
Catch Basin	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).	See “Catch Basins” (No. 5).

No. 5 – 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%.	No Trash or debris located immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	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.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	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 and meets design standards.

No. 6 – Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe

No. 15 – Manufactured Media Filters)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below Ground Vault	Sediment Accumulation on Media.	Sediment depth exceeds 0.25-inches.	No sediment deposits which would impede permeability of the compost media.
	Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.	No sediment deposits in vault bottom of first chamber.
	Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.	Trash and debris removed from the compost filter bed.
	Sediment in Drain Pipes/Clean-Outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Includes Cracks in Wall, 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.
	Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.
Below Ground Cartridge Type	Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced.

No. 18 – Catchbasin 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 Normal 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.