Drainage Report
Hidden Valley SP

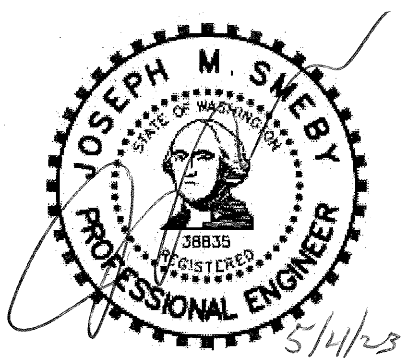
PFN:

for

OWNER:
Mark Gill & Darren Strangeland
12527 51st Ave NE
Marysville, WA 98271

APPLICANT:
James Funston
19705 38th Dr NW
Stanwood, WA 98292

SITE LOCATION:
12527 51st Ave NE
Marysville, WA 98271
TPN: 30050300302600



Prepared by:
Elias J. Troutman, E.I.T

Checked by:
Joseph M. Smeby, P.E.

Job No: 22-0903
May 2023 (Prelim.)

TABLE OF CONTENTS

LIST OF FIGURES

ITEM | **PAGE**

1. INTRODUCTION

This document is intended to provide the preliminary engineering information necessary to support the 5-lot preliminary short plat for this project which includes the development of 1.24 acres across three separate properties with frontage improvements to 51st Ave NE. This project will include 5 new lots and public roads.

The proposed improvements for this project will require the construction of a public road, frontage improvements, stormwater facilities and other utilities. Roof runoff from the new buildings will be connected to individual infiltration systems. Road runoff from the new roads and driveways on site will be collected, treated, and infiltrated within Tract 999 on-site.

The Geotechnical Engineer for this project (Nelson Geotechnical Associates, Inc.) has prepared a report summarizing their findings in the field. They found approximately 1 foot of topsoil underlain by undocumented fill to approximately 2.5 to 4 feet below grade underlain by fine to coarse sand with gravel (Marysville Sand) to 10 feet below grade. Groundwater was not observed in any of the test pits. In addition, they have provided a recommended long-term infiltration rate of 10 inches per hour for stormwater infiltration.

The site is located at 12527 51st Ave NE in the City of Marysville, and in Section 3, Township 30N, Range 5E, Willamette Meridian. See Figure 1 - Vicinity Map.

A. DRAINAGE INFORMATION SUMMARY FORM

Project: **Hidden Valley SP**

PFN:

Engineer: **Omega Engineering, Inc.**
2707 Wetmore Ave
Everett, WA 98201
Attention: Joseph Smeby, P.E.

On-site Project area: **1.24 acres**
Offsite area: **0.09 acres**
Project area: **1.33 acres**

Applicant: **James Funston**
19705 38th Dr NW
Stanwood, WA 98292

New Lots: 5

Drainage Basin Information	**Basin A**
On-site Developed Area	1.24 acres
Off-site Improved Area	0.09 acres
Types of storage proposed on site	Infiltration
Approximate total storage volume	N/A
Soil Types	Type A/B Soils
Basin Data	
Multiple On-site Systems	
See Section 5	

2. EXISTING SITE CONDITIONS

The site is unaddressed in the City of Marysville, and in Section 3, Township 30N, Range 5E, Willamette Meridian. See Figure 1 - Vicinity Map.

Land use around the site is primarily single-family homes. The parcel associated with this project is currently developed with an existing single family home, two sheds and gravel driveway. The City has called for frontage improvements along 51st Ave NE. In addition, a public road (126th St NE) will be constructed to serve the new lots.

The existing developable site is rectangular in shape with a width of approximately 163 feet and length of approximately 332 feet. The grades on the site are mostly flat, with a small area in the northwestern portion of the property with slopes of up to 20 percent. The vegetation found on the existing property consists of lawn, pasture and some thick brush.

A site visit was conducted on April 20, 2023. The weather was sunny with temperatures in the 50's. No standing water was observed throughout the site.

Based on the geotechnical findings for this project, the site soils will be analyzed as Type A/B based on the sandy material found. Refer to the Geotech report in Appendix B.

This project proposes to create five buildable lots. Approximately 50% of this project will be impervious surface with the remaining area to be landscaped.

3. DEVELOPED SITE CONDITIONS

This development proposes to cover the site with nearly 50% impervious surfaces. The runoff from these surfaces will be collected and infiltrated in different ways. First the runoff from the future SFR roofs will be collected and infiltrated via infiltration trenches on each lot. The runoff from the frontage improvements, new public road and driveways on each lot will also be collected and infiltrated via an infiltration trench. This approach will allow for the infiltration of runoff throughout the site to mimic the existing conditions.

By fully infiltrating the runoff from the new impervious surfaces, the new drainage system will not increase the peak flow rates or durations to the downstream system. Refer to section 5 of this report along with the attached calculations contained in Appendix A.

Based on the recommendations of the project Geotechnical Engineer in the soils report, the proposed infiltration systems will be designed with a 10"/hr infiltration rate and the bottom of the trenches will extend past the surficial topsoil into the native sandy soils beneath the site. The geotechnical engineer found no evidence of groundwater to at least 10 feet below grade. Refer to the included document in Appendix B.

4. OFFSITE ANALYSIS

DEFINE STUDY AREA:

From observations made during the field visit, and the topographic survey, no significant off-site area drains toward the project site.

Due to the permeable soils found on and around this site, limited amounts of surface flow are expected in the existing condition.

REVIEW AVAILABLE INFORMATION:

This project is not located within a FEMA floodplain and no other basin plans or drainage resource information has been located as this time.

FIELD INSPECTION:

The site slopes gradually in a generally southwestern direction with slopes ranging from 0 to 20 percent.

DESCRIPTION OF DRAINAGE SYSTEM AND ANY EXISTING OR PREDICTED PROBLEMS:

Runoff in the current conditions sheet flows west and onto 51st Ave NE. A curb gutter or thickened edge does not exist along the eastern edge of the road, so runoff simply collects along this edge and flows very gradually in a southern direction where it collects and sits in several low points at the existing gravel driveway entrance. This existing drainage issue will be resolved with the installation of a new curb gutter along the eastern edge of 51st Ave NE that will collect all runoff and route it to an infiltration trench.

5. STORMWATER CONTROL PLAN

A. Site Hydrology Analysis

Pre-Developed Site Hydrology

The existing site drains in a generally southwestern direction toward 51st Ave NE. Runoff currently collects along the easter edge of the road and flows very gradually in a southern direction where it collects and sits in several low points at the existing gravel driveway entrance.

Developed Site Hydrology

For the developed site hydrology, all the new impervious surfaces will be collected and infiltrated on-site.

By fully infiltrating the site runoff generated by the impervious surfaces, this drainage design will decrease the peak flows in the downstream system and will protect those areas from additional risk of flooding or erosion.

B. PERFORMANCE STANDARDS

The proposed infiltration systems designed for the new roadways, along with all of the other infiltration facilities proposed for this project have been sized using the WWMH2012 software as required in the DOE 2012 manual.

C. FLOW CONTROL SYSTEM

As noted above, the site drainage will utilize full infiltration of all developed surfaces up to the 100-year storm event. The following provides the input information for WWHM12 along with the required trench sizes for each system. The following table summarizes the impervious surfaces accounted for in each system.

DEVELOPED INFILTRATION BASINS		
	Impervious area (sf)	Impervious area (ac)
Lot 1 Roof	2,600	0.06
Lot 2 Roof	2,600	0.06
Lot 3 Roof	2,600	0.06
Lot 4 Roof	2,600	0.06
Lot 5 Roof	3,400	0.08
Frontage, Public Rd & D/Ws	20,000	0.46

The road infiltration trench will collect runoff from the entire new public road, frontage improvements, sidewalk and planter strip along with driveways from lots

1 through 5 and some additional lawn areas. The results of sizing was a 90'x10' trench.

A roof area has been assumed on each new lot based on maximum allowed building lot coverage, and individual 'roof' infiltration trenches are proposed on each new lot to infiltrate all new roof runoff.

This project will not trigger flow Control (MR #7), as all new impervious surface runoff will be infiltrated and essentially no land conversion will take place, as the lot is currently developed and cleared.

D. WATER QUALITY SYSTEM

The project Geotech has determined that the on-site soils are highly permeable, but per the DOE Manual, infiltration of PGIS requires pretreatment. To provide pretreatment for the runoff from the pollution-generating hard surfaces, a two-cartridge Contech filter is proposed to provide pretreatment and basic treatment for the runoff from all new PGHS. This was sized using the Western Washington Hydrology Model which found a required water quality flow rate of 0.080 cfs (36 gpm) to CB #2. Each individual 27" PSORB cartridge can treat up to 18.79 gpm, so a 2-cartridge catch basin will be used. A detail of this Contech StormFilter will be included on the construction plans.

E. CONVEYANCE SYSTEM ANALYSIS

This project does not intend to collect large areas and/or convey those flows. So, the proposed 8-inch and 12-inch pipes with minimum slopes of 0.5% will be more than adequate to handle the expected flows from the new impervious surfaces. An official flow capacity analysis will be performed at the time of construction level review.

6. SWPPP NARRATIVE

The intent of this section is to provide the information necessary to support the engineering plans to implement a design that will; reduce, eliminate or prevent the discharge of stormwater pollutants, meet or exceed the water quality and sediment management standards for the City and State, and prevent adverse impacts to the receiving waters for this project. Note; this narrative is intended to support the SWPPP that is included with the Drainage Plans also a part of this submittal package to the City.

A. SITE GRADING/EROSION CONTROL RISK ASSESSMENT

Area proposed to be cleared/worked:	1.33 acres
Average slope for the site:	5% (Area of Disturbance Only)
Erosion Hazard of Soil	Low
Critical Areas downslope	No
Site is upstream of an ESA Stream	No

Based on the above information and the fact that significant areas of vegetation can be retained along the perimeter of the area of disturbance along with the permeable on-site soils, and that if site conditions warrant, additional BMP's can be implemented as corrective measures the Risk Category for this site is **Low Risk.**

B. SWPPP Minimum Elements

1: Preserve Vegetation and Mark Clearing Limits
The first step in the construction process is for the contractor to flag or fence the limits of clearing/disturbance prior to any other construction activity. The engineering plans locate and provide the square footages for the areas of grading, clearing, impervious surfaces and un-disturbed areas on the proposed site. Existing vegetation can be preserved around the perimeter of the site during the initial construction phases on this project. Approximately 100% of the entire site will be cleared or disturbed for this project.

2: Establish Construction Access
The SWPPP calls for the existing gravel on-site to be used as the construction entrance. At this time winter work is expected during the wet season.

3: Control Flow Rates
The site will be graded, and the permeable on-site soils will be available to infiltrate runoff from the construction site. The contractor will be able to construct small low areas as needed around the project to aid in collecting and infiltrating runoff. However, these low areas shall not be in the location of the future infiltration areas.

4: Install Sediment Controls
This site SWPPP proposes to construct/maintain gravel entrances, silt fencing or a brush barrier if necessary. The construction of these features should be completed before the clearing and grading of the site. Mulch will also be used on the exposed soil as necessary to limit erosion.

5: Stabilize Soils
The “Construction Sequence” calls for the stabilization of soils that remain unworked for certain lengths of time based on the time of year. Stabilization techniques may include but not limited to mulching, plastic sheeting or hydroseeding, notes have been added to the plan regarding protection for the stock pile area if necessary. Stockpile areas have been identified on the SWPPP and are setback a minimum of 25-feet from any down slope property line.

6: Protect Slopes
All disturbed slopes on site during construction are required to be protected with mulch or other means as specified in the construction sequence. No concentrated runoff or significant amounts of sheet flow will be directed to new cut or fill slopes during construction.

7: Protect Drain Inlets
All existing catch basins adjacent to this project and immediately downstream will be protected with inlet protection. All new catch basins will also be installed with plugs to prevent runoff from entering the infiltration system until the site has been fully stabilized.

8: Stabilize Channels and Outlets
No new or existing channels/outlets are proposed or will be impacted by this project.

9: Control Pollutants
No outside chemicals are expected to be necessary for the construction of this project. All vehicles working on and around the site would need to meet the State requirements for emissions. Vehicle fueling locations will be used to limit the potential impacts from any spills and concrete washout areas will also be provided well away from the critical areas.

10: Control DeWatering
DeWatering is not anticipated for this project, as the water table was not encountered to a depth of at least 9 to 10 feet below grade.

11: Maintain BMPs
The construction supervisor will be responsible for maintaining all BMPs during construction and working with the City to relocate or add BMPs as necessary as site conditions change.

12: Manage the Project
It will be the responsibility of the Contractor and Developer to manage this project and coordinate with the City Inspector and Engineer.

Inspection and Monitoring:
Site inspections shall be done by a person who is knowledgeable in the principles and practices of erosion and sediment control. The person must have skills to first assess the site conditions and construction activities that could impact the quality of stormwater, and second assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.
Whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible.

Maintaining an Updated Construction SWPPP:
The construction SWPPP shall be retained on-site or within reasonable access to the site. The SWPPP shall be modified whenever there is a change in the 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 shall be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or state regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven days following inspection.

13: Protect On-Site Stormwater Management BMPs for Runoff from Hard Surfaces
The use of on-site management BMPs for this project will allow for the installation of the infiltration systems for both the road and future lot runoff at the end of the project.

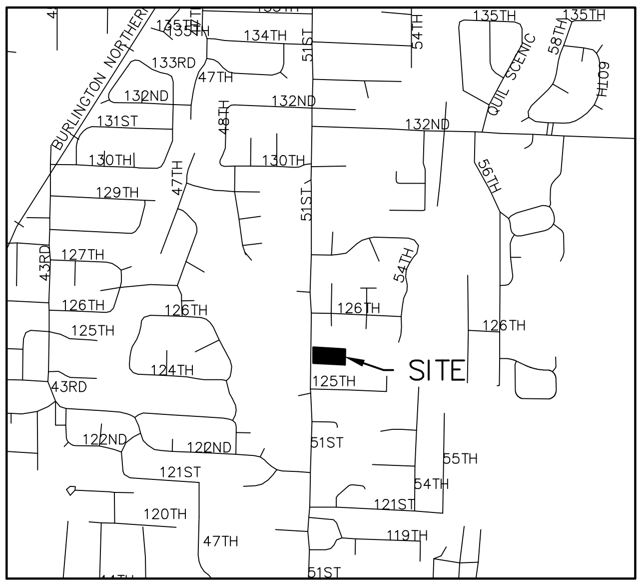
The areas for long-term infiltration have been shown on the plans and shall be noted on the construction plans to be protected from compaction/disturbance during construction.

The future road infiltration systems will be constructed as part of the plat improvements. So those areas must be protected at the time of lot building construction to ensure no sediment from those future phases of construction are allowed to enter the infiltration trenches. Lot infiltration trenches for roof and landscaping runoff will be installed at the time of building permit and shall also be protected at that time.

7. PROJECT OVERVIEW

This project proposes to 5 new buildable lots across three parcels. In addition, public road improvements will be required along with utilities to serve/mitigate the proposed improvements. Approximately 1.24 acres of the site and 0.09 acres off-site will be developed/disturbed under this project. All the new impervious surfaces will be infiltrated in trenches spread around the site. The existing ground cover is lawn, pasture and several trees.

The site grades for this project average approximately 5 percent. Some site grading will be necessary to achieve the necessary road slopes for drainage. The new road runoff will also be infiltrated on-site with no offsite flows expected from the on-site improvements. Sewer and water main extensions will be extended under the public road to serve the new lots. No existing drainfields were found on this site.



VICINITY MAP

SCALE 1" = 2000'

FIG. 1

OMEGA
ENGINEERING, INC.
2707 WETMORE AVE.
Everett, WA 98201
(o)425.387.3820 (f) 425.259.1958

VICINITY MAP
HIDDEN VALLEY SP

DATE	JOB NO.	SCALE	SHEET
5/5/23	22-0903	1" = 2000'	1 OF 1

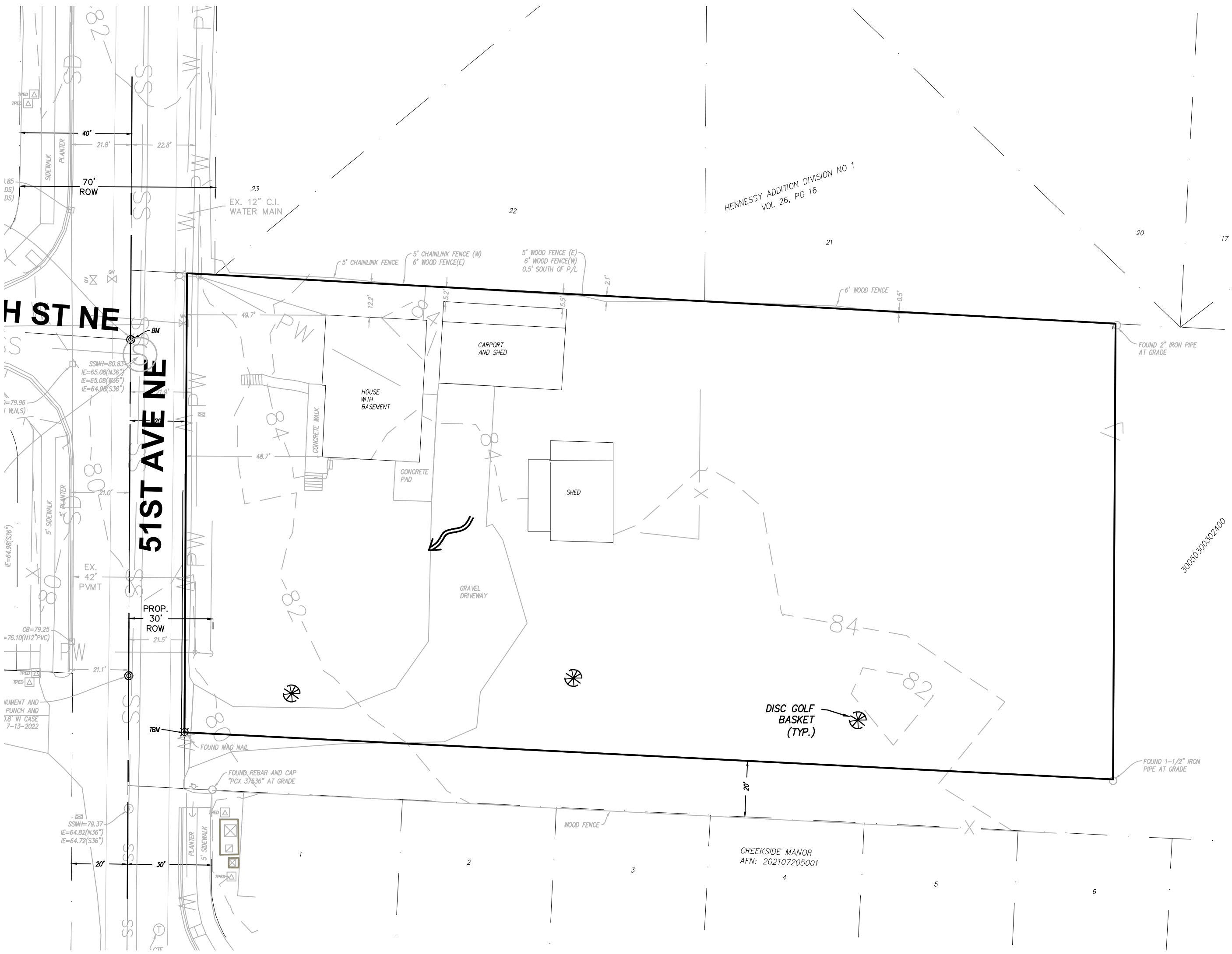


FIG. 2

OMEGA
ENGINEERING, INC.
2707 WETMORE AVE.
Everett, WA 98201
(o)425.387.3820 (f) 425.259.1958

EXISTING BASIN MAP
HIDDEN VALLEY SP

DATE	JOB NO.	SCALE	SHEET
5/5/23	22-0903	1" = 60'	1 OF 1

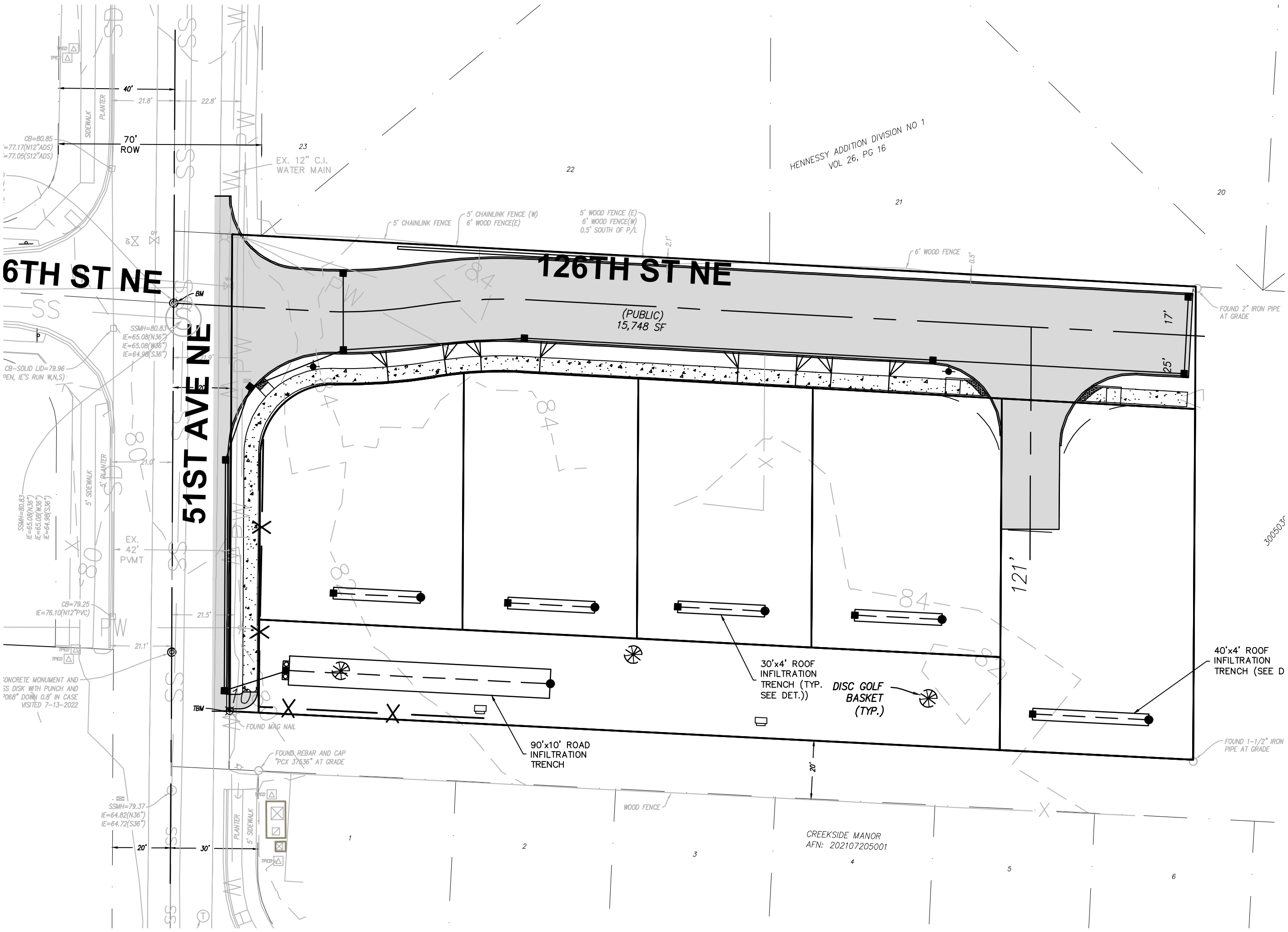


FIG. 3

OMEGA ENGINEERING, INC.
2707 WETMORE AVE.
Everett, WA 98201
(o)425.387.3820 (f) 425.259.1958

DEVELOPED BASIN MAP
HIDDEN VALLEY SP

DATE	JOB NO.	SCALE	SHEET
5/5/23	22-0903	1" = 60'	1 OF 1

APPENDIX A

STORMWATER CALCULATIONS

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	Infiltration Sizing
Site Name:	Hidden Valley SP
Site Address:	
City:	Marysville
Report Date:	5/5/2023
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.000 (adjusted)
Version Date:	2021/08/18
Version:	4.2.18

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	0.4
Pervious Total	0
Impervious Land Use	acre
Impervious Total	0
Basin Total	0

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

ROAD IMPROVEMENTS & D/Ws

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.15
Pervious Total	0.15
Impervious Land Use	acre
ROADS FLAT	0.33
DRIVEWAYS FLAT	0.08
SIDEWALKS FLAT	0.05
Impervious Total	0.46
Basin Total	0.61

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

ROOF EACH LOT

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROOF TOPS FLAT	0.06
Impervious Total	0.06
Basin Total	0.06

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 2	Gravel Trench Bed 2	

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	90.00 ft.
Bottom Width:	10.00 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:	3.5
Pour Space of material for first layer:	0.35
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	10
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	104.829
Total Volume Through Riser (ac-ft.):	0.004
Total Volume Through Facility (ac-ft.):	104.833
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0

Discharge Structure

Riser Height: 3.5 ft.

Riser Diameter: 8 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	0.020	0.000	0.000	0.000
0.0500	0.020	0.000	0.000	0.208
0.1000	0.020	0.000	0.000	0.208
0.1500	0.020	0.001	0.000	0.208
0.2000	0.020	0.001	0.000	0.208
0.2500	0.020	0.001	0.000	0.208
0.3000	0.020	0.002	0.000	0.208
0.3500	0.020	0.002	0.000	0.208
0.4000	0.020	0.002	0.000	0.208
0.4500	0.020	0.003	0.000	0.208
0.5000	0.020	0.003	0.000	0.208
0.5500	0.020	0.004	0.000	0.208
0.6000	0.020	0.004	0.000	0.208
0.6500	0.020	0.004	0.000	0.208
0.7000	0.020	0.005	0.000	0.208
0.7500	0.020	0.005	0.000	0.208
0.8000	0.020	0.005	0.000	0.208
0.8500	0.020	0.006	0.000	0.208
0.9000	0.020	0.006	0.000	0.208
0.9500	0.020	0.006	0.000	0.208
1.0000	0.020	0.007	0.000	0.208
1.0500	0.020	0.007	0.000	0.208
1.1000	0.020	0.008	0.000	0.208
1.1500	0.020	0.008	0.000	0.208

1.2000	0.020	0.008	0.000	0.208
1.2500	0.020	0.009	0.000	0.208
1.3000	0.020	0.009	0.000	0.208
1.3500	0.020	0.009	0.000	0.208
1.4000	0.020	0.010	0.000	0.208
1.4500	0.020	0.010	0.000	0.208
1.5000	0.020	0.010	0.000	0.208
1.5500	0.020	0.011	0.000	0.208
1.6000	0.020	0.011	0.000	0.208
1.6500	0.020	0.011	0.000	0.208
1.7000	0.020	0.012	0.000	0.208
1.7500	0.020	0.012	0.000	0.208
1.8000	0.020	0.013	0.000	0.208
1.8500	0.020	0.013	0.000	0.208
1.9000	0.020	0.013	0.000	0.208
1.9500	0.020	0.014	0.000	0.208
2.0000	0.020	0.014	0.000	0.208
2.0500	0.020	0.014	0.000	0.208
2.1000	0.020	0.015	0.000	0.208
2.1500	0.020	0.015	0.000	0.208
2.2000	0.020	0.015	0.000	0.208
2.2500	0.020	0.016	0.000	0.208
2.3000	0.020	0.016	0.000	0.208
2.3500	0.020	0.017	0.000	0.208
2.4000	0.020	0.017	0.000	0.208
2.4500	0.020	0.017	0.000	0.208
2.5000	0.020	0.018	0.000	0.208
2.5500	0.020	0.018	0.000	0.208
2.6000	0.020	0.018	0.000	0.208
2.6500	0.020	0.019	0.000	0.208
2.7000	0.020	0.019	0.000	0.208
2.7500	0.020	0.019	0.000	0.208
2.8000	0.020	0.020	0.000	0.208
2.8500	0.020	0.020	0.000	0.208
2.9000	0.020	0.021	0.000	0.208
2.9500	0.020	0.021	0.000	0.208
3.0000	0.020	0.021	0.000	0.208
3.0500	0.020	0.022	0.000	0.208
3.1000	0.020	0.022	0.000	0.208
3.1500	0.020	0.022	0.000	0.208
3.2000	0.020	0.023	0.000	0.208
3.2500	0.020	0.023	0.000	0.208
3.3000	0.020	0.023	0.000	0.208
3.3500	0.020	0.024	0.000	0.208
3.4000	0.020	0.024	0.000	0.208
3.4500	0.020	0.024	0.000	0.208
3.5000	0.020	0.025	0.000	0.208
3.5500	0.020	0.026	0.078	0.208
3.6000	0.020	0.027	0.219	0.208
3.6500	0.020	0.028	0.385	0.208
3.7000	0.020	0.029	0.547	0.208
3.7500	0.020	0.030	0.678	0.208
3.8000	0.020	0.031	0.762	0.208
3.8500	0.020	0.032	0.828	0.208
3.9000	0.020	0.033	0.885	0.208
3.9500	0.020	0.034	0.939	0.208
4.0000	0.020	0.035	0.989	0.208
4.0500	0.020	0.036	1.038	0.208

4.1000	0.020	0.037	1.084	0.208
4.1500	0.020	0.038	1.128	0.208
4.2000	0.020	0.039	1.171	0.208
4.2500	0.020	0.040	1.212	0.208
4.3000	0.020	0.041	1.252	0.208
4.3500	0.020	0.042	1.290	0.208
4.4000	0.020	0.043	1.328	0.208
4.4500	0.020	0.044	1.364	0.208
4.5000	0.020	0.046	1.399	0.208

Gravel Trench Bed 2

Bottom Length:	30.00 ft.
Bottom Width:	4.00 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:	3
Pour Space of material for first layer:	0.35
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	10
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	11.316
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	11.316
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0

Discharge Structure

Riser Height: 3 ft.

Riser Diameter: 8 in.

Element Flows To:

Outlet 1 Outlet 2

Gravel Trench Bed Hydraulic Table

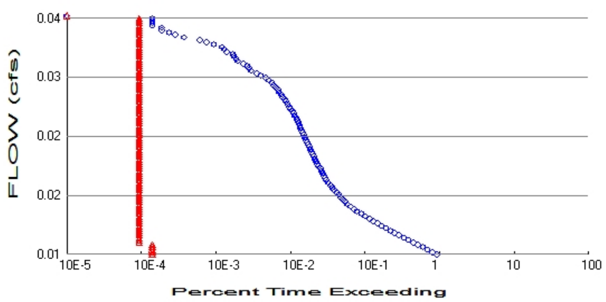
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.002	0.000	0.000	0.000
0.0444	0.002	0.000	0.000	0.027
0.0889	0.002	0.000	0.000	0.027
0.1333	0.002	0.000	0.000	0.027
0.1778	0.002	0.000	0.000	0.027
0.2222	0.002	0.000	0.000	0.027
0.2667	0.002	0.000	0.000	0.027
0.3111	0.002	0.000	0.000	0.027
0.3556	0.002	0.000	0.000	0.027
0.4000	0.002	0.000	0.000	0.027
0.4444	0.002	0.000	0.000	0.027
0.4889	0.002	0.000	0.000	0.027
0.5333	0.002	0.000	0.000	0.027
0.5778	0.002	0.000	0.000	0.027
0.6222	0.002	0.000	0.000	0.027
0.6667	0.002	0.000	0.000	0.027
0.7111	0.002	0.000	0.000	0.027
0.7556	0.002	0.000	0.000	0.027
0.8000	0.002	0.000	0.000	0.027
0.8444	0.002	0.000	0.000	0.027
0.8889	0.002	0.000	0.000	0.027
0.9333	0.002	0.000	0.000	0.027
0.9778	0.002	0.000	0.000	0.027
1.0222	0.002	0.001	0.000	0.027
1.0667	0.002	0.001	0.000	0.027
1.1111	0.002	0.001	0.000	0.027

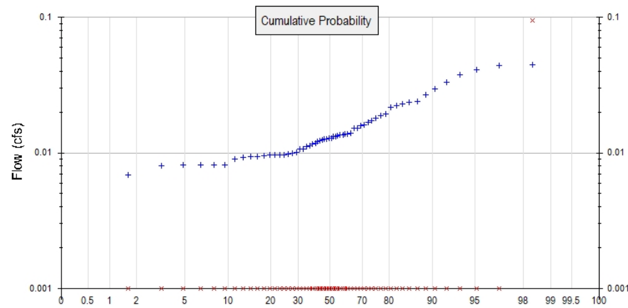
1.1556	0.002	0.001	0.000	0.027
1.2000	0.002	0.001	0.000	0.027
1.2444	0.002	0.001	0.000	0.027
1.2889	0.002	0.001	0.000	0.027
1.3333	0.002	0.001	0.000	0.027
1.3778	0.002	0.001	0.000	0.027
1.4222	0.002	0.001	0.000	0.027
1.4667	0.002	0.001	0.000	0.027
1.5111	0.002	0.001	0.000	0.027
1.5556	0.002	0.001	0.000	0.027
1.6000	0.002	0.001	0.000	0.027
1.6444	0.002	0.001	0.000	0.027
1.6889	0.002	0.001	0.000	0.027
1.7333	0.002	0.001	0.000	0.027
1.7778	0.002	0.001	0.000	0.027
1.8222	0.002	0.001	0.000	0.027
1.8667	0.002	0.001	0.000	0.027
1.9111	0.002	0.001	0.000	0.027
1.9556	0.002	0.001	0.000	0.027
2.0000	0.002	0.001	0.000	0.027
2.0444	0.002	0.002	0.000	0.027
2.0889	0.002	0.002	0.000	0.027
2.1333	0.002	0.002	0.000	0.027
2.1778	0.002	0.002	0.000	0.027
2.2222	0.002	0.002	0.000	0.027
2.2667	0.002	0.002	0.000	0.027
2.3111	0.002	0.002	0.000	0.027
2.3556	0.002	0.002	0.000	0.027
2.4000	0.002	0.002	0.000	0.027
2.4444	0.002	0.002	0.000	0.027
2.4889	0.002	0.002	0.000	0.027
2.5333	0.002	0.002	0.000	0.027
2.5778	0.002	0.002	0.000	0.027
2.6222	0.002	0.002	0.000	0.027
2.6667	0.002	0.002	0.000	0.027
2.7111	0.002	0.002	0.000	0.027
2.7556	0.002	0.002	0.000	0.027
2.8000	0.002	0.002	0.000	0.027
2.8444	0.002	0.002	0.000	0.027
2.8889	0.002	0.002	0.000	0.027
2.9333	0.002	0.002	0.000	0.027
2.9778	0.002	0.002	0.000	0.027
3.0222	0.002	0.003	0.023	0.027
3.0667	0.002	0.003	0.121	0.027
3.1111	0.002	0.003	0.255	0.027
3.1556	0.002	0.003	0.404	0.027
3.2000	0.002	0.003	0.547	0.027
3.2444	0.002	0.003	0.665	0.027
3.2889	0.002	0.003	0.747	0.027
3.3333	0.002	0.003	0.799	0.027
3.3778	0.002	0.004	0.860	0.027
3.4222	0.002	0.004	0.909	0.027
3.4667	0.002	0.004	0.956	0.027
3.5111	0.002	0.004	1.000	0.027
3.5556	0.002	0.004	1.043	0.027
3.6000	0.002	0.004	1.084	0.027
3.6444	0.002	0.004	1.123	0.027
3.6889	0.002	0.004	1.161	0.027

3.7333	0.002	0.005	1.198	0.027
3.7778	0.002	0.005	1.234	0.027
3.8222	0.002	0.005	1.269	0.027
3.8667	0.002	0.005	1.303	0.027
3.9111	0.002	0.005	1.336	0.027
3.9556	0.002	0.005	1.368	0.027
4.0000	0.002	0.005	1.399	0.027

Analysis Results

POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 0.4
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.15
Total Impervious Area: 0.52

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.01344
5 year	0.020618
10 year	0.026153
25 year	0.034073
50 year	0.040669
100 year	0.047882

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**
1949	0.013	0.000
1950	0.014	0.000
1951	0.012	0.000
1952	0.010	0.000
1953	0.008	0.000
1954	0.044	0.000
1955	0.017	0.000
1956	0.015	0.000
1957	0.019	0.000
1958	0.014	0.000

1959	0.014	0.000
1960	0.013	0.000
1961	0.024	0.094
1962	0.012	0.000
1963	0.019	0.000
1964	0.014	0.000
1965	0.012	0.000
1966	0.007	0.000
1967	0.014	0.000
1968	0.017	0.000
1969	0.041	0.000
1970	0.010	0.000
1971	0.015	0.000
1972	0.011	0.000
1973	0.011	0.000
1974	0.023	0.000
1975	0.009	0.000
1976	0.010	0.000
1977	0.008	0.000
1978	0.010	0.000
1979	0.027	0.000
1980	0.013	0.000
1981	0.010	0.000
1982	0.013	0.000
1983	0.022	0.000
1984	0.013	0.000
1985	0.016	0.000
1986	0.038	0.000
1987	0.018	0.000
1988	0.009	0.000
1989	0.009	0.000
1990	0.013	0.000
1991	0.013	0.000
1992	0.010	0.000
1993	0.008	0.000
1994	0.009	0.000
1995	0.013	0.000
1996	0.022	0.000
1997	0.045	0.000
1998	0.008	0.000
1999	0.011	0.000
2000	0.008	0.000
2001	0.003	0.000
2002	0.012	0.000
2003	0.010	0.000
2004	0.016	0.000
2005	0.011	0.000
2006	0.030	0.000
2007	0.024	0.000
2008	0.033	0.000
2009	0.010	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	**Predeveloped**	**Mitigated**
1	0.0445	0.0941
2	0.0439	0.0000
3	0.0410	0.0000

4	0.0375	0.0000
5	0.0331	0.0000
6	0.0298	0.0000
7	0.0269	0.0000
8	0.0239	0.0000
9	0.0236	0.0000
10	0.0230	0.0000
11	0.0224	0.0000
12	0.0218	0.0000
13	0.0194	0.0000
14	0.0189	0.0000
15	0.0179	0.0000
16	0.0173	0.0000
17	0.0168	0.0000
18	0.0161	0.0000
19	0.0160	0.0000
20	0.0153	0.0000
21	0.0153	0.0000
22	0.0140	0.0000
23	0.0139	0.0000
24	0.0137	0.0000
25	0.0137	0.0000
26	0.0136	0.0000
27	0.0134	0.0000
28	0.0132	0.0000
29	0.0131	0.0000
30	0.0129	0.0000
31	0.0128	0.0000
32	0.0126	0.0000
33	0.0126	0.0000
34	0.0125	0.0000
35	0.0123	0.0000
36	0.0122	0.0000
37	0.0118	0.0000
38	0.0117	0.0000
39	0.0113	0.0000
40	0.0112	0.0000
41	0.0107	0.0000
42	0.0106	0.0000
43	0.0101	0.0000
44	0.0099	0.0000
45	0.0098	0.0000
46	0.0097	0.0000
47	0.0097	0.0000
48	0.0097	0.0000
49	0.0096	0.0000
50	0.0096	0.0000
51	0.0094	0.0000
52	0.0094	0.0000
53	0.0093	0.0000
54	0.0090	0.0000
55	0.0082	0.0000
56	0.0081	0.0000
57	0.0081	0.0000
58	0.0081	0.0000
59	0.0080	0.0000
60	0.0068	0.0000
61	0.0032	0.0000

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0067	19590	3	0	Pass
0.0071	16991	3	0	Pass
0.0074	14668	3	0	Pass
0.0077	12726	3	0	Pass
0.0081	10925	3	0	Pass
0.0084	9437	2	0	Pass
0.0088	8166	2	0	Pass
0.0091	7075	2	0	Pass
0.0095	6126	2	0	Pass
0.0098	5311	2	0	Pass
0.0101	4671	2	0	Pass
0.0105	4068	2	0	Pass
0.0108	3557	2	0	Pass
0.0112	3140	2	0	Pass
0.0115	2759	2	0	Pass
0.0119	2449	2	0	Pass
0.0122	2154	2	0	Pass
0.0125	1896	2	0	Pass
0.0129	1657	2	0	Pass
0.0132	1509	2	0	Pass
0.0136	1374	2	0	Pass
0.0139	1250	2	0	Pass
0.0143	1154	2	0	Pass
0.0146	1071	2	0	Pass
0.0150	1009	2	0	Pass
0.0153	950	2	0	Pass
0.0156	889	2	0	Pass
0.0160	826	2	0	Pass
0.0163	777	2	0	Pass
0.0167	734	2	0	Pass
0.0170	687	2	0	Pass
0.0174	648	2	0	Pass
0.0177	622	2	0	Pass
0.0180	602	2	0	Pass
0.0184	583	2	0	Pass
0.0187	561	2	0	Pass
0.0191	538	2	0	Pass
0.0194	507	2	0	Pass
0.0198	487	2	0	Pass
0.0201	473	2	0	Pass
0.0204	457	2	0	Pass
0.0208	440	2	0	Pass
0.0211	424	2	0	Pass
0.0215	410	2	0	Pass
0.0218	394	2	0	Pass
0.0222	380	2	0	Pass
0.0225	368	2	0	Pass
0.0228	353	2	0	Pass
0.0232	341	2	0	Pass
0.0235	333	2	0	Pass
0.0239	322	2	0	Pass
0.0242	313	2	0	Pass
0.0246	302	2	0	Pass

0.0249	293	2	0	Pass
0.0252	284	2	0	Pass
0.0256	276	2	0	Pass
0.0259	265	2	0	Pass
0.0263	257	2	0	Pass
0.0266	242	2	0	Pass
0.0270	234	2	0	Pass
0.0273	226	2	0	Pass
0.0276	212	2	0	Pass
0.0280	205	2	0	Pass
0.0283	195	2	1	Pass
0.0287	187	2	1	Pass
0.0290	177	2	1	Pass
0.0294	166	2	1	Pass
0.0297	160	2	1	Pass
0.0300	150	2	1	Pass
0.0304	146	2	1	Pass
0.0307	135	2	1	Pass
0.0311	128	2	1	Pass
0.0314	120	2	1	Pass
0.0318	111	2	1	Pass
0.0321	99	2	2	Pass
0.0324	85	2	2	Pass
0.0328	75	2	2	Pass
0.0331	63	2	3	Pass
0.0335	59	2	3	Pass
0.0338	56	2	3	Pass
0.0342	50	2	4	Pass
0.0345	42	2	4	Pass
0.0348	40	2	5	Pass
0.0352	37	2	5	Pass
0.0355	36	2	5	Pass
0.0359	30	2	6	Pass
0.0362	28	2	7	Pass
0.0366	26	2	7	Pass
0.0369	20	2	10	Pass
0.0372	16	2	12	Pass
0.0376	13	2	15	Pass
0.0379	8	2	25	Pass
0.0383	6	2	33	Pass
0.0386	5	2	40	Pass
0.0390	4	2	50	Pass
0.0393	4	2	50	Pass
0.0396	3	2	66	Pass
0.0400	3	2	66	Pass
0.0403	3	2	66	Pass
0.0407	3	2	66	Pass

Water Quality

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

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Gravel Trench Bed 1 POC	☐	95.40			☐	100.00			
Gravel Trench Bed 2 POC	☐	10.30			☐	100.00			
Total Volume Infiltrated		105.70	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

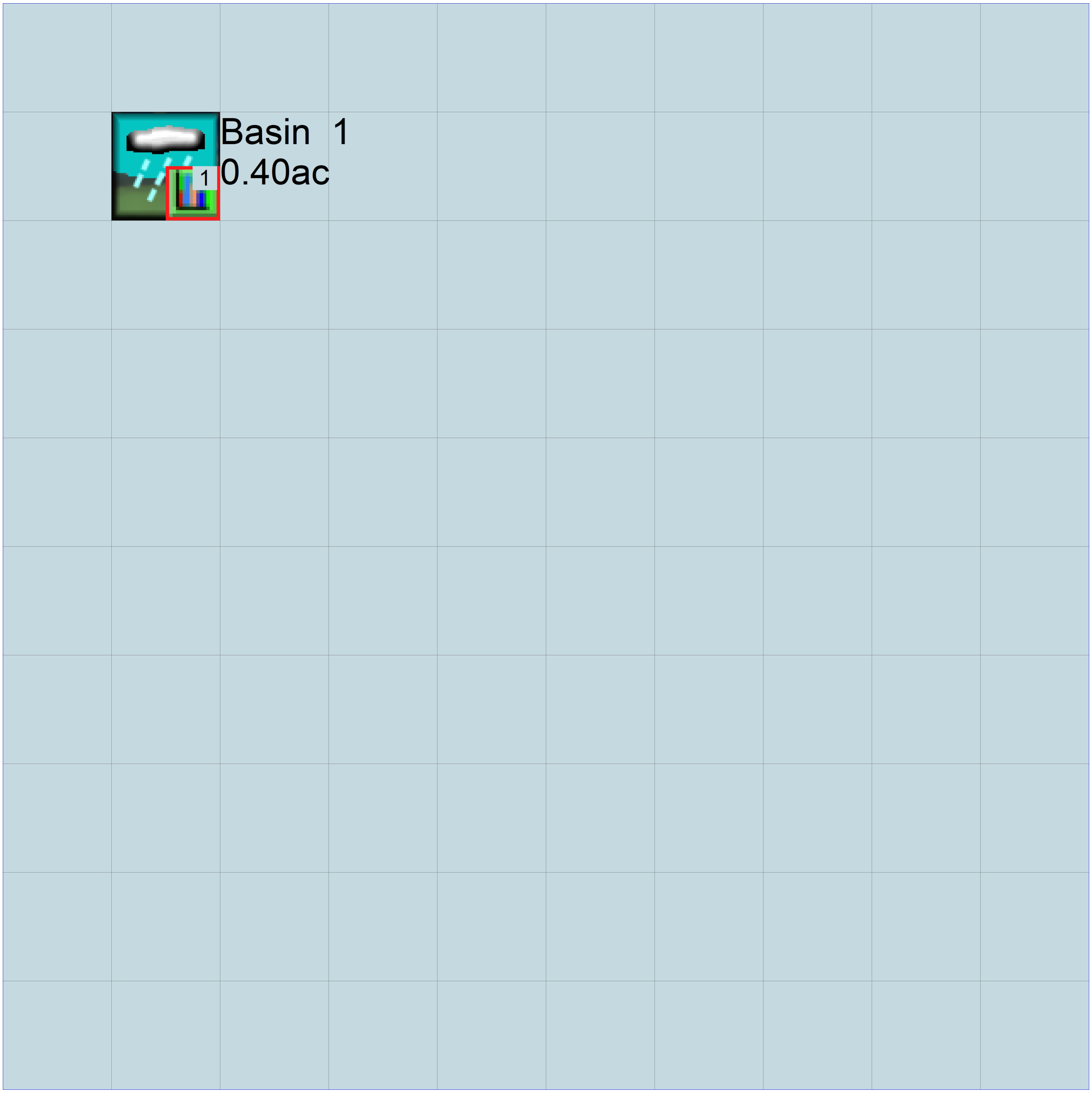
No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix

Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   Infiltration Sizing.wdm
MESSU      25   MitInfiltration Sizing.MES
           27   MitInfiltration Sizing.L61
           28   MitInfiltration Sizing.L62
           30   POCInfiltration Sizing1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND       1
      IMPLND       5
      IMPLND       8
      IMPLND       4
      RCHRES       1
      RCHRES       2
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Gravel Trench Bed 1         MAX                      1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                         User  t-series Engl Metr ***
                                         in  out           ***
   16      C, Lawn, Flat          1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   16         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   16         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   16              0       4.5      0.03       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   16              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                   ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16            0.1      0.25      0.25         6       0.5      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   16              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
    1      ROADS/FLAT             1    1    1   27    0
    5      DRIVEWAYS/FLAT         1    1    1   27    0
    8      SIDEWALKS/FLAT         1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    5         0    0    1    0    0    0
    8         0    0    1    0    0    0
    4         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    0    1    9
    5         0    0    4    0    0    0    1    9
    8         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
```

```
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
    5         0    0    0    0    0
    8         0    0    0    0    0
    4         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
    5            400      0.01       0.1       0.1
    8            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
    5              0         0
    8              0         0
    4              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    5              0         0
    8              0         0
    4              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
ROAD IMPROVEMENTS & D/Ws***
PERLND  16                        0.15     RCHRES   1      2
PERLND  16                        0.15     RCHRES   1      3
IMPLND   1                        0.33     RCHRES   1      5
IMPLND   5                        0.08     RCHRES   1      5
IMPLND   8                        0.05     RCHRES   1      5
ROOF EACH LOT***
IMPLND   4                        0.06     RCHRES   2      5

******Routing******
PERLND  16                        0.15     COPY     1     12
IMPLND   1                        0.33     COPY     1     15
IMPLND   5                        0.08     COPY     1     15
IMPLND   8                        0.05     COPY     1     15
PERLND  16                        0.15     COPY     1     13
IMPLND   4                        0.06     COPY     1     15
RCHRES   1                           1     COPY   501     17
RCHRES   2                           1     COPY   501     17
END SCHEMATIC

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



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

```
RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                     ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG               ***
                                           in  out                              ***
    1     Gravel Trench Be-005    2    1    1    1   28    0    1
    2     Gravel Trench Be-007    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
    2         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR   *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                          ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *          ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
    2        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50           ***
  <------><--------><--------><--------><--------><--------><-------->           ***
    1             1      0.02       0.0       0.0       0.5       0.0
    2             2      0.01       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                             ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1           0          4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2           0          4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   92    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.020661  0.000000  0.000000  0.000000
  0.050000  0.020661  0.000362  0.000000  0.208333
  0.100000  0.020661  0.000723  0.000000  0.208333
  0.150000  0.020661  0.001085  0.000000  0.208333
  0.200000  0.020661  0.001446  0.000000  0.208333
  0.250000  0.020661  0.001808  0.000000  0.208333
  0.300000  0.020661  0.002169  0.000000  0.208333
  0.350000  0.020661  0.002531  0.000000  0.208333
  0.400000  0.020661  0.002893  0.000000  0.208333
  0.450000  0.020661  0.003254  0.000000  0.208333
  0.500000  0.020661  0.003616  0.000000  0.208333
  0.550000  0.020661  0.003977  0.000000  0.208333
  0.600000  0.020661  0.004339  0.000000  0.208333
```

0.650000	0.020661	0.004700	0.000000	0.208333
0.700000	0.020661	0.005062	0.000000	0.208333
0.750000	0.020661	0.005424	0.000000	0.208333
0.800000	0.020661	0.005785	0.000000	0.208333
0.850000	0.020661	0.006147	0.000000	0.208333
0.900000	0.020661	0.006508	0.000000	0.208333
0.950000	0.020661	0.006870	0.000000	0.208333
1.000000	0.020661	0.007231	0.000000	0.208333
1.050000	0.020661	0.007593	0.000000	0.208333
1.100000	0.020661	0.007955	0.000000	0.208333
1.150000	0.020661	0.008316	0.000000	0.208333
1.200000	0.020661	0.008678	0.000000	0.208333
1.250000	0.020661	0.009039	0.000000	0.208333
1.300000	0.020661	0.009401	0.000000	0.208333
1.350000	0.020661	0.009762	0.000000	0.208333
1.400000	0.020661	0.010124	0.000000	0.208333
1.450000	0.020661	0.010486	0.000000	0.208333
1.500000	0.020661	0.010847	0.000000	0.208333
1.550000	0.020661	0.011209	0.000000	0.208333
1.600000	0.020661	0.011570	0.000000	0.208333
1.650000	0.020661	0.011932	0.000000	0.208333
1.700000	0.020661	0.012293	0.000000	0.208333
1.750000	0.020661	0.012655	0.000000	0.208333
1.800000	0.020661	0.013017	0.000000	0.208333
1.850000	0.020661	0.013378	0.000000	0.208333
1.900000	0.020661	0.013740	0.000000	0.208333
1.950000	0.020661	0.014101	0.000000	0.208333
2.000000	0.020661	0.014463	0.000000	0.208333
2.050000	0.020661	0.014824	0.000000	0.208333
2.100000	0.020661	0.015186	0.000000	0.208333
2.150000	0.020661	0.015548	0.000000	0.208333
2.200000	0.020661	0.015909	0.000000	0.208333
2.250000	0.020661	0.016271	0.000000	0.208333
2.300000	0.020661	0.016632	0.000000	0.208333
2.350000	0.020661	0.016994	0.000000	0.208333
2.400000	0.020661	0.017355	0.000000	0.208333
2.450000	0.020661	0.017717	0.000000	0.208333
2.500000	0.020661	0.018079	0.000000	0.208333
2.550000	0.020661	0.018440	0.000000	0.208333
2.600000	0.020661	0.018802	0.000000	0.208333
2.650000	0.020661	0.019163	0.000000	0.208333
2.700000	0.020661	0.019525	0.000000	0.208333
2.750000	0.020661	0.019886	0.000000	0.208333
2.800000	0.020661	0.020248	0.000000	0.208333
2.850000	0.020661	0.020610	0.000000	0.208333
2.900000	0.020661	0.020971	0.000000	0.208333
2.950000	0.020661	0.021333	0.000000	0.208333
3.000000	0.020661	0.021694	0.000000	0.208333
3.050000	0.020661	0.022056	0.000000	0.208333
3.100000	0.020661	0.022417	0.000000	0.208333
3.150000	0.020661	0.022779	0.000000	0.208333
3.200000	0.020661	0.023140	0.000000	0.208333
3.250000	0.020661	0.023502	0.000000	0.208333
3.300000	0.020661	0.023864	0.000000	0.208333
3.350000	0.020661	0.024225	0.000000	0.208333
3.400000	0.020661	0.024587	0.000000	0.208333
3.450000	0.020661	0.024948	0.000000	0.208333
3.500000	0.020661	0.025310	0.000000	0.208333
3.550000	0.020661	0.026343	0.078856	0.208333
3.600000	0.020661	0.027376	0.219469	0.208333
3.650000	0.020661	0.028409	0.385862	0.208333
3.700000	0.020661	0.029442	0.547841	0.208333
3.750000	0.020661	0.030475	0.678003	0.208333
3.800000	0.020661	0.031508	0.762603	0.208333
3.850000	0.020661	0.032541	0.828154	0.208333
3.900000	0.020661	0.033574	0.885334	0.208333
3.950000	0.020661	0.034607	0.939038	0.208333
4.000000	0.020661	0.035640	0.989833	0.208333
4.050000	0.020661	0.036674	1.038146	0.208333
4.100000	0.020661	0.037707	1.084308	0.208333

```
  4.150000  0.020661  0.038740  1.128584  0.208333
  4.200000  0.020661  0.039773  1.171186  0.208333
  4.250000  0.020661  0.040806  1.212293  0.208333
  4.300000  0.020661  0.041839  1.252051  0.208333
  4.350000  0.020661  0.042872  1.290585  0.208333
  4.400000  0.020661  0.043905  1.328001  0.208333
  4.450000  0.020661  0.044938  1.364391  0.208333
  4.500000  0.020661  0.045971  1.399836  0.208333
  4.550000  0.020661  0.047004  1.434405  0.208333
  END FTABLE  1
  FTABLE      2
   92    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)    (cfs)     (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.002755  0.000000  0.000000  0.000000
  0.044444  0.002755  0.000043  0.000000  0.027778
  0.088889  0.002755  0.000086  0.000000  0.027778
  0.133333  0.002755  0.000129  0.000000  0.027778
  0.177778  0.002755  0.000171  0.000000  0.027778
  0.222222  0.002755  0.000214  0.000000  0.027778
  0.266667  0.002755  0.000257  0.000000  0.027778
  0.311111  0.002755  0.000300  0.000000  0.027778
  0.355556  0.002755  0.000343  0.000000  0.027778
  0.400000  0.002755  0.000386  0.000000  0.027778
  0.444444  0.002755  0.000429  0.000000  0.027778
  0.488889  0.002755  0.000471  0.000000  0.027778
  0.533333  0.002755  0.000514  0.000000  0.027778
  0.577778  0.002755  0.000557  0.000000  0.027778
  0.622222  0.002755  0.000600  0.000000  0.027778
  0.666667  0.002755  0.000643  0.000000  0.027778
  0.711111  0.002755  0.000686  0.000000  0.027778
  0.755556  0.002755  0.000728  0.000000  0.027778
  0.800000  0.002755  0.000771  0.000000  0.027778
  0.844444  0.002755  0.000814  0.000000  0.027778
  0.888889  0.002755  0.000857  0.000000  0.027778
  0.933333  0.002755  0.000900  0.000000  0.027778
  0.977778  0.002755  0.000943  0.000000  0.027778
  1.022222  0.002755  0.000986  0.000000  0.027778
  1.066667  0.002755  0.001028  0.000000  0.027778
  1.111111  0.002755  0.001071  0.000000  0.027778
  1.155556  0.002755  0.001114  0.000000  0.027778
  1.200000  0.002755  0.001157  0.000000  0.027778
  1.244444  0.002755  0.001200  0.000000  0.027778
  1.288889  0.002755  0.001243  0.000000  0.027778
  1.333333  0.002755  0.001286  0.000000  0.027778
  1.377778  0.002755  0.001328  0.000000  0.027778
  1.422222  0.002755  0.001371  0.000000  0.027778
  1.466667  0.002755  0.001414  0.000000  0.027778
  1.511111  0.002755  0.001457  0.000000  0.027778
  1.555556  0.002755  0.001500  0.000000  0.027778
  1.600000  0.002755  0.001543  0.000000  0.027778
  1.644444  0.002755  0.001586  0.000000  0.027778
  1.688889  0.002755  0.001628  0.000000  0.027778
  1.733333  0.002755  0.001671  0.000000  0.027778
  1.777778  0.002755  0.001714  0.000000  0.027778
  1.822222  0.002755  0.001757  0.000000  0.027778
  1.866667  0.002755  0.001800  0.000000  0.027778
  1.911111  0.002755  0.001843  0.000000  0.027778
  1.955556  0.002755  0.001886  0.000000  0.027778
  2.000000  0.002755  0.001928  0.000000  0.027778
  2.044444  0.002755  0.001971  0.000000  0.027778
  2.088889  0.002755  0.002014  0.000000  0.027778
  2.133333  0.002755  0.002057  0.000000  0.027778
  2.177778  0.002755  0.002100  0.000000  0.027778
  2.222222  0.002755  0.002143  0.000000  0.027778
  2.266667  0.002755  0.002185  0.000000  0.027778
  2.311111  0.002755  0.002228  0.000000  0.027778
  2.355556  0.002755  0.002271  0.000000  0.027778
  2.400000  0.002755  0.002314  0.000000  0.027778
  2.444444  0.002755  0.002357  0.000000  0.027778
```

```
  2.488889  0.002755  0.002400  0.000000  0.027778
  2.533333  0.002755  0.002443  0.000000  0.027778
  2.577778  0.002755  0.002485  0.000000  0.027778
  2.622222  0.002755  0.002528  0.000000  0.027778
  2.666667  0.002755  0.002571  0.000000  0.027778
  2.711111  0.002755  0.002614  0.000000  0.027778
  2.755556  0.002755  0.002657  0.000000  0.027778
  2.800000  0.002755  0.002700  0.000000  0.027778
  2.844444  0.002755  0.002743  0.000000  0.027778
  2.888889  0.002755  0.002785  0.000000  0.027778
  2.933333  0.002755  0.002828  0.000000  0.027778
  2.977778  0.002755  0.002871  0.000000  0.027778
  3.022222  0.002755  0.002994  0.023421  0.027778
  3.066667  0.002755  0.003116  0.121030  0.027778
  3.111111  0.002755  0.003238  0.255267  0.027778
  3.155556  0.002755  0.003361  0.404632  0.027778
  3.200000  0.002755  0.003483  0.547841  0.027778
  3.244444  0.002755  0.003606  0.665728  0.027778
  3.288889  0.002755  0.003728  0.747561  0.027778
  3.333333  0.002755  0.003851  0.799562  0.027778
  3.377778  0.002755  0.003973  0.860390  0.027778
  3.422222  0.002755  0.004096  0.909594  0.027778
  3.466667  0.002755  0.004218  0.956270  0.027778
  3.511111  0.002755  0.004340  1.000771  0.027778
  3.555556  0.002755  0.004463  1.043376  0.027778
  3.600000  0.002755  0.004585  1.084308  0.027778
  3.644444  0.002755  0.004708  1.123750  0.027778
  3.688889  0.002755  0.004830  1.161854  0.027778
  3.733333  0.002755  0.004953  1.198748  0.027778
  3.777778  0.002755  0.005075  1.234539  0.027778
  3.822222  0.002755  0.005197  1.269321  0.027778
  3.866667  0.002755  0.005320  1.303176  0.027778
  3.911111  0.002755  0.005442  1.336173  0.027778
  3.955556  0.002755  0.005565  1.368375  0.027778
  4.000000  0.002755  0.005687  1.399836  0.027778
  4.044444  0.002755  0.005810  1.430605  0.027778
  END FTABLE  2
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.2            PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.2            IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1       1       WDM   1000 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      1 1       1       WDM   1001 FLOW     ENGL      REPL
RCHRES   1 HYDR   O      2 1       1       WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1       1       WDM   1003 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1    48.4       WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1    48.4       WDM    801 FLOW     ENGL      REPL
RCHRES   2 HYDR   RO     1 1       1       WDM   1004 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      1 1       1       WDM   1005 FLOW     ENGL      REPL
RCHRES   2 HYDR   O      2 1       1       WDM   1006 FLOW     ENGL      REPL
RCHRES   2 HYDR   STAGE  1 1       1       WDM   1007 STAG     ENGL      REPL
END EXT TARGETS

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

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

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

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

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

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

  MASS-LINK       17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK   17

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

Clear Creek Solutions, Inc.
6200 Capitol Blvd. Ste F
Olympia, WA. 98501
Toll Free 1(866)943-0304
Local (360)943-0304

www.clearcreeksolutions.com

APPENDIX B

GEOTECHNICAL REPORT

NELSON GEOTECHNICAL ASSOCIATES. INC.

17311-135th Ave. N.E. Suite A-500
Woodinville, WA 98072
(425) 486-1669
www.nelsongeotech.com

October 31, 2022

Kimo Funston
c/o Samuel Luthi
Land Resolutions, Inc.
Via Email: jen@orcalsi.com

Geotechnical Engineering Evaluation
Funston Short Plat Development and Infiltration
12527 – 51st Avenue NE
Marysville, Washington
NGA File No. 1383722

Dear Kimo:

We are pleased to submit the attached report titled ***"Geotechnical Engineering Evaluation – Funston Short Plat Development and Infiltration – 12527 – 51st Avenue NE – Marysville, Washington."*** This report summarizes our observations of the existing surface and subsurface conditions within the property and provides general recommendations for the proposed site development. Our services were completed in general accordance with the proposal signed by you on September 20, 2022.

The property is rectangular in shape and covers 1.24 acres in area. It is currently occupied by a single-family residence and a detached garage. The property is bordered by 51st Avenue NE to the west and by neighboring residential properties to all other sides. Topographically, the site is relatively level. We understand the plans for development include demolition of existing site structures, short platting the site into 5 lots, and construction of new single-family residences on each lot.

We explored the site subsurface soil conditions with five trackhoe excavated test pits one of which was utilized for infiltration testing, we also installed two piezometer monitoring wells in Test Pit 2 and 4. The test pit explorations extended to depths in the range of 5.0 to 10.0 feet below the existing ground surface. Our explorations indicated that the site contains a surficial layer of undocumented fill and/or topsoil underlain by competent, native Marysville sand soils in the range of 2.5 to 4.0 feet below the existing ground surface.

It is our opinion that the proposed site development is feasible from a geotechnical engineering standpoint, provided that our recommendations for site development are incorporated into project plans. We recommend that the new residence structure be founded on medium dense or better native bearing glacial soils for bearing capacity and settlement considerations. These soils should generally be encountered approximately 2.5 to 4.0 feet below the existing ground surface based on our explorations. However, deeper areas of loose soil and/or undocumented fill could exist within other unexplored areas of the site. If undocumented fill is encountered in unexplored areas of the site, it should be removed and replaced with structural fill for foundation and pavement support.

We also performed on-site infiltration testing in accordance with the 2019 Stormwater Management Manual for Western Washington (2019 SWMMWW) that is utilized by the city of Marysville to determine the design infiltration rate and overall system sizing. Our on-site testing consisted of performing one small-scale Pilot Infiltration Test (PIT) within the central western portion of the site. The subsurface soils generally consisted of gray, fine to coarse sand with trace gravel in a medium dense or better condition, that we interpreted as native Marysville sand. Based on our observations, testing in the field, and the lack of silt in the native Marysville sand, it is our opinion that native on-site material is conductive for traditional stormwater infiltration systems.

In the attached report, we have provided general recommendations for erosion control, site grading, temporary and permanent slopes, foundations support, structural fill, slabs-on-grade, and site drainage. We should be retained to review and comment on final development plans and observe the earthwork phase of construction. We recommend that Nelson Geotechnical Associates (NGA) be retained to review the geotechnical aspects of the project plans prior to construction. We also recommend that NGA be retained to provide monitoring and consultation services 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 construction differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications.

It has been a pleasure to provide service to you on this project. Please contact us if you have any questions regarding this report or require further information.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Khaled M. Shawish, PE
Principal

TABLE OF CONTENTS

LIST OF FIGURES

Geotechnical Engineering Evaluation
Funston Short Plat Development and Infiltration
12527 – 51st Avenue NE
Marysville, Washington

INTRODUCTION

This report presents the results of our geotechnical engineering investigation and evaluation of the planned Funston Short Plat Development and Infiltration project. The project site is located at the address of 12527 – 51St Avenue NE in Marysville, Washington as shown on the Vicinity Map in Figure 1. The purpose of this study is to explore and characterize the site's surface and subsurface conditions and to provide geotechnical recommendations for the planned site development.

The property is currently occupied by a single-family residence and a detached garage. Topographically, the site is relatively level. The property is bordered by 51st Avenue NE to the west and by neighboring residential properties to all other sides. The existing site layout is shown on the Schematic Site Plan in Figure 2.

SCOPE

The purpose of this study is to explore and characterize the site surface and subsurface conditions and provide general recommendations for site development. Specifically, our scope of services included the following:

1. Reviewing available soil and geologic maps of the area as well as other relevant geotechnical information, as provided.
2. Exploring the subsurface soil and groundwater conditions within the site using trackhoe-excavated test pits. Excavation services were subcontracted by NGA.
3. Providing long-term design infiltration rates based on on-site Small Pilot Infiltration Testing (PIT) per the 2019 SWMMWW.
4. Performing laboratory grain-size sieve analysis on soil samples, as necessary.
5. Providing recommendations for earthwork and foundation support.
6. Providing recommendations for temporary and permanent slopes.
7. Providing recommendations for subsurface utilities and pavement subgrade preparation.
8. Providing our opinion on stormwater infiltration feasibility.

9. Providing recommendations for infiltration/bioretention system installation.
10. Providing general recommendations for site drainage and erosion control.
11. Documenting the results of our findings, conclusions, and recommendations in a written geotechnical report.

SITE CONDITIONS

Surface Conditions

The site consists of a roughly rectangular-shaped property covering approximately 1.24 acres. The property is currently occupied by a single-family residence and a detached garage. Topographically, the site is relatively level. The site is generally vegetated with grass pasture areas, underbrush and scattered young to mature trees. The property is bordered by 51st Avenue NE to the west and by neighboring residential properties to all other sides. We did not observe any surface water during our explorations on September 27, 2022.

Subsurface Conditions

Geology: The geologic units for this site are shown on The Geologic Map of the Marysville Quadrangle, Snohomish County, Washington, by Minard, J.P. (USGS, 1985). The site is mapped as Marysville sand (Qvrm). The Marysville sand is described as consisting mostly of well-drained, stratified to massive outwash sand, a little fine gravel, and some beds of silt and clay. The soils generally encountered in our explorations consisted of surficial fill soil and topsoil underlain by fine to coarse sand with trace gravel consistent with the description of the native Marysville sand deposits at depth.

Explorations: The subsurface conditions within the site were explored on September 27, 2022 with five trackhoe excavated test pits extending to depths in the range of 5.0 to 10.0 feet below the existing ground surface. The approximate locations of our explorations are shown on the Schematic Site Plan in Figure 2.

A geologist from NGA was present during the explorations, examined the soils and geologic conditions encountered, obtained samples of the different soil types, and maintained logs of the explorations. The soils were visually classified in general accordance with the Unified Soil Classification System, presented in Figure 3. The logs of our explorations are attached to this report and are presented as Figures 4 and 5. We present a brief summary of the subsurface conditions in the following paragraph. For a detailed description of the subsurface conditions, the exploration logs should be reviewed.

At the surface of all of our test pits, we encountered approximately 0.5 to 1.0 feet of brown to light brown, silty, fine to medium sand with roots, which we interpreted as surficial topsoil soils. Underlying the layer of surficial topsoil, we encountered brown, fine to coarse sand with trace gravel and silt, which we interpreted to be undocumented fill extending to depths between 2.5 and 4.0 feet below the existing ground surface. Underlying the undocumented fill, we encountered gray, fine to coarse sand with trace gravel, which we interpreted to be native Marysville sand deposits. All of our explorations were terminated within native soils at depths in the range of 5.0 to 10.0 feet below the existing ground surface.

Hydrogeologic Conditions

We did not encounter groundwater within our explorations throughout the site. If shallow groundwater seepage is encountered during construction, we anticipate this would likely be a perched groundwater condition. Perched water occurs when surface water infiltrates through less dense, more permeable soils and accumulates on top of a relatively low permeability material. Perched water does not represent a regional groundwater "table" within the upper soil horizons. Perched water tends to vary spatially and is dependent upon the amount of rainfall. We would expect the amount of perched groundwater to decrease during drier times of the year and increase during wetter periods.

A shallow groundwater table may also be present within the site. During our site visit we installed two piezometers within our explorations in Test Pits 2 and 4, respectfully. We will return to the site to monitor ground water conditions throughout the wet season.

SENSITIVE AREA EVALUATION

Seismic Hazard

We reviewed the 2018 International Building Code (IBC) for seismic site classification for this project. Since competent glacial soils are inferred to underlie the site at depth, the site conditions best fit the IBC description for Site Class D. Table 1 below provides seismic design parameters for the site that are in conformance with the 2018 IBC, which specifies a design earthquake having a two percent probability of occurrence in 50 years (return interval of 2,475 years), and the 2008 USGS seismic hazard maps.

Table 1 – ASCE 7-16 Seismic Design Parameters

Site Class	Spectral Acceleration at 0.2 sec. (g) S_s	Spectral Acceleration at 1.0 sec. (g) S_1	Site Coefficients		Design Spectral Response Parameters	
			F_a	F_v	S_{DS}	S_{D1}
D	1.079	0.385	1.068	Null	0.769	Null

The spectral response accelerations were obtained from the USGS Earthquake Hazards Program Interpolated Probabilistic Ground Motion website (2008 data) for the project latitude and longitude.

Hazards associated with seismic activity include liquefaction potential and amplification of ground motion. Liquefaction is caused by a rise in pore pressures in a loose, fine sand deposit beneath the groundwater table. It is our opinion that the medium dense or better glacial deposits interpreted to underlie the site have a low to moderate potential for liquefaction or amplification of ground motion.

Erosion Hazard

The criteria used for determination of the erosion hazard for affected areas include soil type, slope gradient, vegetation cover, and groundwater conditions. The erosion sensitivity is related to vegetative cover and the specific surface soil types, which are related to the underlying geologic soil units. The Soil Survey of Snohomish County Area, Washington, by the Soil Conservation Service (SCS), was reviewed to determine the erosion hazard of the native on-site soils. The site soils are mapped as Ragnar fine sandy loam, 0 to 8 percent slopes. The erosion hazard for these soils is listed as moderate. Based on our observations and the material encountered, we would interpret this site as having a low to moderate erosion hazard where the surficial soils are exposed. It is our opinion that the erosion hazard for site soils should be low in areas where the site is not disturbed.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion that the planned development within the site is generally feasible from a geotechnical standpoint. Our explorations indicated that the site was generally underlain by competent native Marysville sand soils. The Marysville sand soils encountered at depth should provide adequate support for foundation, slab, and pavement loads. We recommend that the new residence structures be founded on medium dense or better native bearing glacial soils for bearing capacity and settlement considerations. These soils should generally be encountered approximately 2.5 to 4.0 feet below the existing ground surface based on our explorations. However, deeper areas of loose soil and/or undocumented fill could also exist within unexplored areas of the site. If undocumented fill is encountered in unexplored areas of the site, it should be removed and replaced with structural fill for foundation and pavement support. We recommend that NGA be retained to review proposed grading plans once they are developed and allowed to provide alternative foundation support recommendations as needed.

We also performed on-site infiltration testing based on the 2019 Stormwater Management Manual for Western Washington (2019 SWMMWW) that is utilized by the city of Marysville to determine the design infiltration rate and overall system sizing. Our explorations throughout the site generally encountered topsoil and/or undocumented fill soils underlain by competent native Marysville sand at relatively shallow depths. One small pilot infiltration test (small PIT) was conducted within the central western portion of the site. Based on our observations, results of the Small PIT, and the lack of silt in the native soils encountered at depth, it is our opinion that the native soils are conductive for traditional stormwater infiltration systems. Specifics about the long-term design infiltration are outlined in the **Site Drainage** subsection of this report.

Erosion Control

The erosion hazard for the on-site soils are considered to be low to moderate but the actual hazard will be dependent on how the site is graded and how water is allowed to concentrate. Best Management Practices (BMPs) should be used to control erosion. Areas disturbed during construction should be protected from erosion. Erosion control measures may include diverting surface water away from the stripped or disturbed areas. Silt fences and/or straw bales should be erected to prevent muddy water from leaving the site. Disturbed areas should be planted as soon as practical and the vegetation should be maintained until it is established. The erosion potential of areas not stripped of vegetation should be low.

The soils encountered on this site are considered moisture-sensitive and will disturb easily when wet. To reduce cost overruns and delays, we recommend that construction take place during the drier summer months. If construction takes place during the rainy months, additional expenses and delays should be expected. Additional expenses could include the need for placing erosion control and temporary drainage measures, the need for placing a blanket of rock spalls on exposed subgrades, and construction traffic areas prior to placing structural fill, and the need for importing all-weather material for structural fill.

Site Preparation and Grading

After erosion control measures are implemented, site preparation should consist of stripping the topsoil, undocumented fill and/or loose soils from foundation, slab, pavement areas, and other structural areas, to expose medium dense or better native bearing soils. The stripped soil should be removed from the site or stockpiled for later use as a landscaping fill. Based on our observations, we anticipate stripping depths of approximately 2.5 to 4.0 feet, depending on the specific locations. Additional stripping may be required if areas of deeper undocumented fill and/or loose soil are encountered in unexplored areas of the site.

After site stripping, if the exposed subgrade is deemed loose, it should be compacted to a non-yielding condition and then proof-rolled with a heavy rubber-tired piece of equipment. Areas observed to pump or weave during the proof-roll test should be reworked to structural fill specifications or over-excavated and replaced with properly compacted structural fill or rock spalls. If loose soils are encountered in the pavement areas, the loose soils should be removed and replaced with rock spalls or granular structural fill. If significant surface water flow is encountered during construction, this flow should be diverted around areas to be developed, and the exposed subgrades should be maintained in a semi-dry condition.

If wet conditions are encountered, alternative site stripping and grading techniques might be necessary. These could include using large excavators equipped with wide tracks and a smooth bucket to complete site grading and covering exposed subgrade with a layer of crushed rock for protection. If wet conditions are encountered or construction is attempted in wet weather, the subgrade should not be compacted as this could cause further subgrade disturbance. In wet conditions, it may be necessary to cover the exposed subgrade with a layer of crushed rock as soon as it is exposed to protect the moisture sensitive soils from disturbance by machine or foot traffic during construction. The prepared subgrade should be protected from construction traffic and surface water should be diverted around areas of prepared subgrade.

The site soils are considered to be moisture-sensitive and will disturb easily when wet. We recommend that construction take place during the drier summer months if possible. However, if construction takes place during the wet season, additional expenses and delays should be expected due to the wet conditions. Additional expenses could include the need for placing a blanket of rock spalls on exposed subgrades, construction traffic areas, and paved areas prior to placing structural fill. Wet weather grading will also require additional erosion control and site drainage measures. Some of the on-site soils may be suitable for use as structural fill, depending on the moisture content of the soil at the time of construction. NGA should be retained to evaluate the suitability of all on-site and imported structural fill material during construction.

Temporary and Permanent Slopes

Temporary cut slope stability is a function of many factors, including the type and consistency of soils, depth of the cut, surcharge loads adjacent to the excavation, length of time a cut remains open, and the presence of surface or groundwater. It is exceedingly difficult under these variable conditions to estimate a stable, temporary, cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe slope configurations at all times as indicated in OSHA guidelines for cut slopes.

The following information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Nelson Geotechnical Associates, Inc. assumes responsibility for job site safety. Job site safety is the sole responsibility of the project contractor.

For planning purposes, we recommend that temporary cuts in the upper undocumented fill soils be no steeper than 2 Horizontal to 1 Vertical (2H:1V). Temporary cuts in the competent unweathered glacial soils at depth should be no steeper than 1H:1V. If significant groundwater seepage or surface water flow were encountered, we would expect that flatter inclinations would be necessary. We recommend that cut slopes be protected from erosion. The slope protection measures may include covering cut slopes with plastic sheeting and diverting surface runoff away from the top of cut slopes. We do not recommend vertical slopes for cuts deeper than four feet if worker access is necessary. We recommend that cut slope heights and inclinations conform to appropriate OSHA/WISHA regulations.

Permanent cut and fill slopes should be no steeper than 2H:1V. However, flatter inclinations may be required in areas where loose soils are encountered. Permanent slopes should be vegetated, and the vegetative cover maintained until established.

Foundation Support

Conventional shallow spread foundations should be placed on medium dense or better native bearing glacial soils or be supported on structural fill or rock spalls extending to those soils. Medium dense or better bearing soils should be encountered approximately 2.5 to 4.0 feet below ground surface based on our explorations. Where undocumented fill or less dense soils are encountered at footing bearing elevation, the subgrade should be over-excavated to expose suitable bearing soil. The over-excavation may be filled with structural fill, or the footing may be extended down to the competent native soils. If footings are supported on structural fill, the fill zone should extend outside the edges of the footing a distance equal to one half of the depth of the over-excavation below the bottom of the footing.

Footings should extend at least 18 inches below the lowest adjacent finished ground surface for frost protection and bearing capacity considerations. Foundations should be designed in accordance with the 2018 IBC. Footing widths should be based on the anticipated loads and allowable soil bearing pressure. Water should not be allowed to accumulate in footing trenches. All loose or disturbed soil should be removed from the foundation excavation prior to placing concrete.

For foundations constructed as outlined above, we recommend an allowable bearing pressure of not more than 2,000 pounds per square foot (psf) be used for the design of footings founded on the medium dense or better native bearing soils or structural fill extending to the competent native bearing material. The foundation bearing soil should be evaluated by a representative of NGA. We should be consulted if higher bearing pressures are needed. Current IBC guidelines should be used when considering increased allowable bearing pressure for short-term transitory wind or seismic loads. Potential foundation settlement using the recommended allowable bearing pressure is estimated to be less than 1-inch total and ½-inch differential between adjacent footings or across a distance of about 20 feet, based on our experience with similar projects.

Lateral loads may be resisted by friction on the base of the footing and passive resistance against the subsurface portions of the foundation. A coefficient of friction of 0.35 may be used to calculate the base friction and should be applied to the vertical dead load only. Passive resistance may be calculated as a triangular equivalent fluid pressure distribution. An equivalent fluid density of 200 pounds per cubic foot (pcf) should be used for passive resistance design for a level ground surface adjacent to the footing. This level surface should extend a distance equal to at least three times the footing depth. These recommended values incorporate safety factors of 1.5 and 2.0 applied to the estimated ultimate values for frictional and passive resistance, respectively. To achieve this value of passive resistance, the foundations should be poured "neat" against the native medium dense soils or compacted fill should be used as backfill against the front of the footing. We recommend that the upper one foot of soil be neglected when calculating the passive resistance.

Structural Fill

General: Fill placed beneath foundations, pavement, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction. The area to receive the fill should be suitably prepared as described in the **Site Preparation and Grading** subsection prior to beginning fill placement.

Materials: Structural fill should consist of good quality, granular soil, free of organics and other deleterious material, and be well graded to a maximum size of about three inches. All-weather fill should contain no more than five-percent fines (soil finer than U.S. No. 200 sieve, based on that fraction passing the U.S. 3/4-inch sieve). Some of the more granular on-site soils may be suitable for use as structural fill, but this will be highly dependent on the moisture content of these soils at the time of construction. We should be retained to evaluate all proposed structural fill material prior to placement.

Fill Placement: Following subgrade preparation, placement of structural fill may proceed. All filling should be accomplished in uniform lifts up to eight inches thick. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts. All structural fill underlying building areas and pavement subgrade should be compacted to a minimum of 95 percent of its maximum dry density. Maximum dry density, in this report, refers to that density as determined by the ASTM D-1557 Compaction Test procedure. The moisture content of the soils to be compacted should be within about two percent of optimum so that a readily compactable condition exists. It may be necessary to over-excavate and remove wet soils in cases where drying to a compactable condition is not feasible. All compaction should be accomplished by equipment of a type and size sufficient to attain the desired degree of compaction and should be tested.

Slab-on-Grade

Slabs-on-grade should be supported on subgrade soils prepared as described in the **Site Preparation and Grading** subsection of this report. We recommend that all floor slabs be underlain by at least six inches of free-draining gravel with less than three percent by weight of the material passing Sieve #200 for use as a capillary break. A suitable vapor barrier, such as heavy plastic sheeting (6-mil, minimum), should be placed over the capillary break material. An additional 2-inch-thick moist sand layer may be used to cover the vapor barrier. This sand layer may be used to protect the vapor barrier membrane and to aid in curing the concrete.

Pavements

Pavement subgrade preparation and structural filling where required, should be completed as recommended in the **Site Preparation and Grading** and **Structural Fill** subsections of this report. The pavement subgrade should be proof-rolled with a heavy, rubber-tired piece of equipment, to identify soft or yielding areas that require repair. The pavement section should be underlain by a stable subgrade. We should be retained to observe the proof-rolling and recommend repairs prior to placement of the asphalt or hard surfaces.

Utilities

We recommend that underground utilities be bedded with a minimum six inches of pea gravel prior to backfilling the trench with on-site or imported material. Trenches within settlement sensitive areas should be compacted to 95% of the modified proctor as described in the **Structural Fill** subsection of this report. Trenches located in non-structural areas should be compacted to a minimum 90% of the maximum dry density. The trench backfill compaction should be tested.

Site Drainage

Infiltration: In accordance with the 2019 SWMMWW, we conducted one Small PIT within Infiltration Pit 1, as shown on the Schematic Site Plan in Figure 2. Infiltration Pit 1 measured 5.0-feet long by 3.5-feet wide by 5.0-feet deep. The hole was filled with approximately 12-inches of water at the beginning of the day for the pre-soak period of the test. During the pre-soak period of the test, additional water was consistently added to the hole to maintain the water level.

After the pre-soak period was completed, the water flow rate into the hole was monitored with a Great Plains Industries (GPI) TM 075 flow meter for one hour for the steady-state period of the test. The flow rate for Infiltration Pit 1 averaged out to be 5.88 gallons per minute (352.8 gallons per hour), which equates to an approximate infiltration rate of 32.34 inches per hour. The water was shut off after the steady-state period and the water level within the pit was monitored. After 20 minutes, the water level within the pit had completely dissipated, resulting in an infiltration rate of 36.0 inches per hour.

It is our opinion that the relatively clean Marysville sand soils encountered at depth within the site are suitable for traditional stormwater infiltration. The granular Marysville sand soils were generally encountered at depths in the range of 2.5 to 4.0 feet below the existing ground surface. We have selected an overall field rate of 32.34 inches per hour obtained from the steady-state portion of the test within Infiltration Pit 1 to be utilized in determining the long-term design infiltration rate for the infiltration systems within the site. We referenced the equation in Chapter 5 (Page 736) of the 2019 SWMMWW that applies the correction factors to the field measured infiltration rate to generate a long-term design infiltration rate. Correction factors of 0.50, 0.80, and 0.90 were utilized in this equation for $F_{testing}$, $F_{geometry}$, $F_{plugging}$, respectively. Using these correction factors, we calculated a long-term design infiltration rate of 11.64 inches per hour; however, in accordance with the 2019 SWMMWW we recommend a long-term design infiltration rate of no more than 10.0 inches per hour be utilized within this site. Minimum separation between any infiltration systems and the high groundwater table is required by the design manual. The groundwater levels should be monitored through the wet season and system configured accordingly.

Surface Drainage: Final site grades should allow for drainage away from the planned residence areas. We suggest that the finished ground be sloped at a minimum gradient of three percent for a distance of at least 10 feet away from the proposed structures. Runoff generated on this site should be collected and routed into a permanent discharge system. This should include all downspouts and runoff generated on all hard surfaces and yards areas. Under no circumstances should water be allowed to flow uncontrolled over the site slopes. Water should not be allowed to collect in any area where footings or slabs are to be constructed.

Subsurface Drainage: If groundwater is encountered during construction, we recommend that the contractor slope the bottom of the excavation and collect the water into ditches and small sump pits where the water can be pumped out of the excavation and routed into an approved outlet. We recommend that the residence down spouts and footing drains be tight-lined to an approved discharge location.

We recommend the use of footing drains around structures. Footing drains should be installed at least one foot below planned finished floor elevation. The drains should consist of a minimum 4-inch-diameter, rigid, slotted or perforated, PVC pipe surrounded by free-draining material wrapped in a filter fabric. We recommend that the free-draining material consist of an 18-inch-wide zone of clean (less than three-percent fines), granular material placed along the back of walls. Washed rock is an acceptable drain material, or drainage composite may be used instead. The free-draining material should extend up the wall to one foot below the finished surface. The top foot of soil should consist of low permeability soil placed over plastic sheeting or building paper to minimize the migration of surface water or silt into the footing drain. Footing drains should discharge into tight-lines leading to an approved collection and discharge point with convenient cleanouts to prolong the useful life of the drains. Roof drains should not be connected to wall or footing drains.

CONSTRUCTION MONITORING

We recommend that we be retained to provide construction monitoring services to evaluate conditions encountered in the field with respect to anticipated conditions, to provide recommendations for design changes should the conditions differ from anticipated, and to evaluate whether construction activities comply with contract plans and specifications.

USE OF THIS REPORT

NGA has prepared this report for **Kimo Funston** and their agents, for use in the planning and design of the development on this site only. The scope of our work does not include services related to construction safety precautions and our recommendations are not intended to direct the contractors' methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. There are possible variations in subsurface conditions between the explorations and also with time. Our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions. A contingency for unanticipated conditions should be included in the budget and schedule. We recommend that we be retained to review the project plans after they have been developed to determine that recommendations in the report were incorporated into project plans.

We recommend that NGA be retained to review final plans prior to construction. We also recommend that NGA be retained to provide monitoring and consultation services 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 differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications. We should be contacted a minimum of one week prior to construction activities and could attend pre-construction meetings if requested.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this report was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

o-o-o

It has been a pleasure to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Sarah L. Dunn
Staff Geologist II

10/31/2022

Khaled M. Shawish, PE
Principal

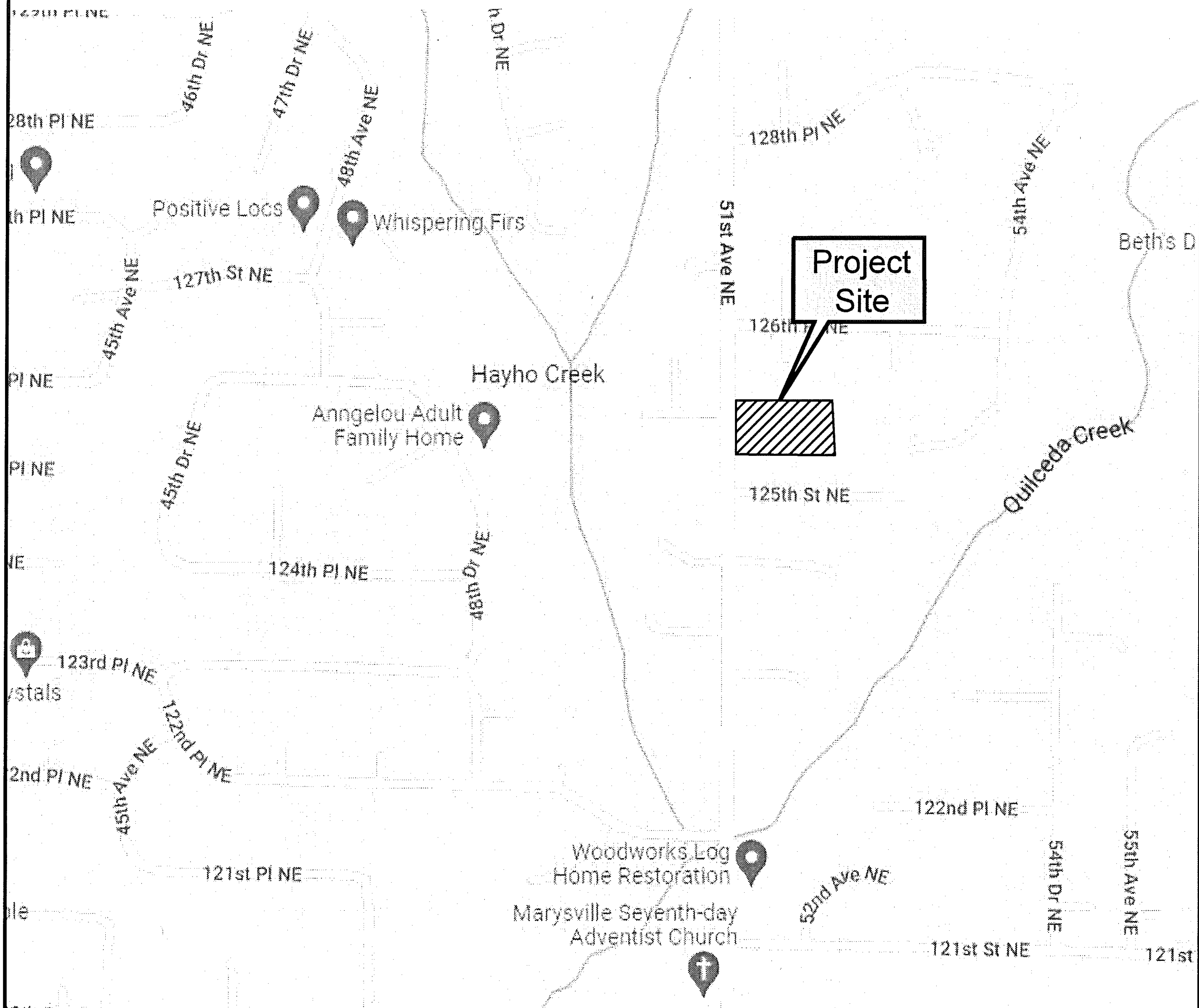
FKS:SLD:KMS:sg

Five Figures Attached

VICINITY MAP

Not to Scale

N

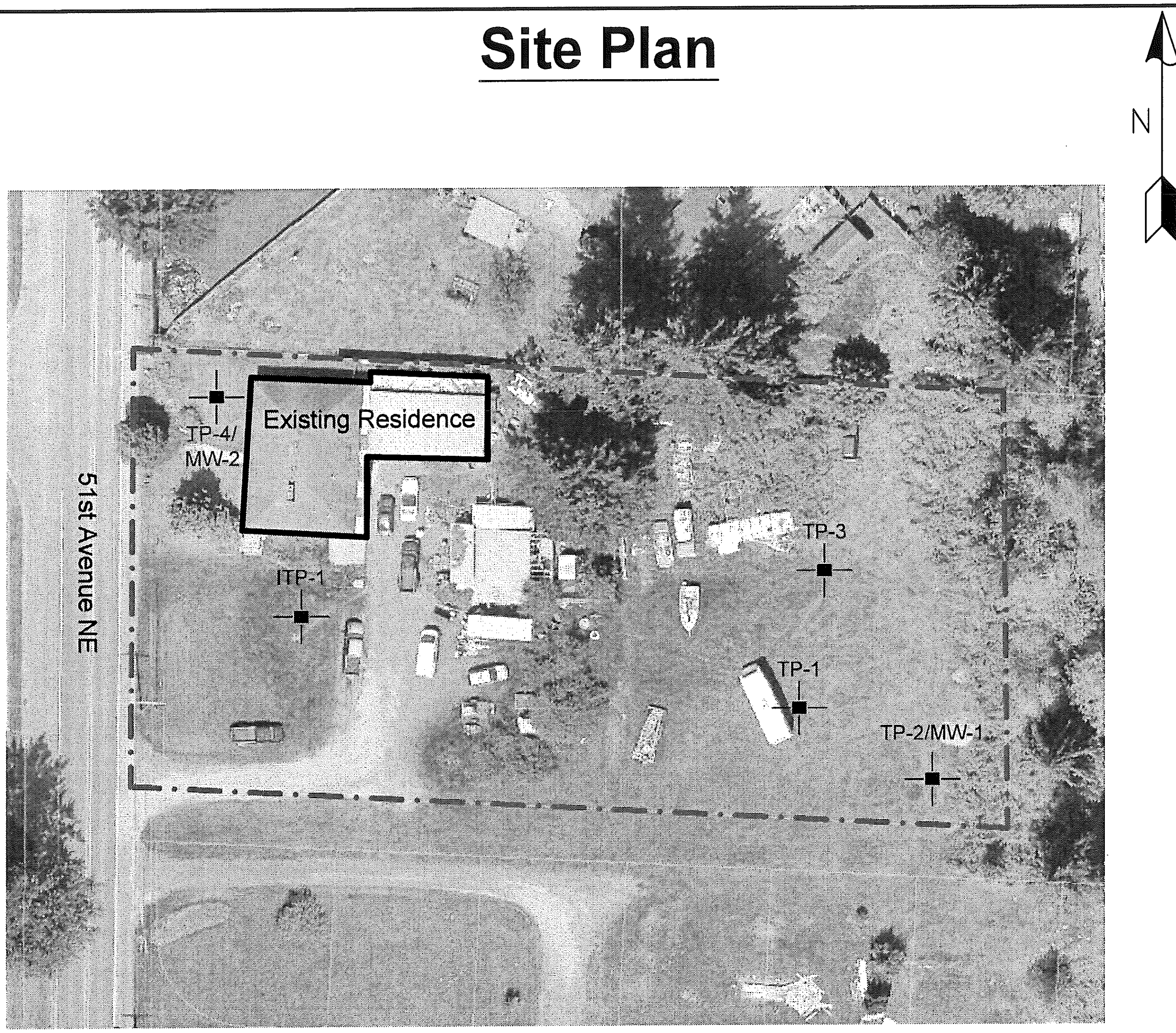


Marysville, WA

Project Number 1383722	Funston Short Plat Vicinity Map	NELSON GEOTECHNICAL ASSOCIATES, INC	No.	Date	Revision	By	CK
Figure 1		Woodinville Office 17311-135th Ave. NE, A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510; Wenatchee Office 105 Palouse St. Wenatchee, WA 98801 (509) 665-7696 / Fax: 665-7692; www.nelsongeotech.com	1	10/6/22	Original	FKS	SLD

C:\Users\DannyNelson\Nelson Geotechnical Associates, Inc\Nelson Geotechnical Associates, Inc - Company\2022 NGA Project\13837-22 Funston Short Plat Marysville\Drafting\VM.dwg

Site Plan



LEGEND

Property line

TP-1 — Number and approximate location of test pit

TP-1 — Number and approximate location of infiltration test pit

MW-1 — Number and approximate location of monitoring well

0 60 120

Scale: 1 inch = 60 feet

Reference: Site Plan based on field measurements, observations, and aerial parcel map review.

Project Number 1383722	Funston Short Plat Site Plan	NELSON GEOTECHNICAL ASSOCIATES, INC	No.	Date	Revision	By	CK
Figure 2		Woodinville Office 17311-135th Ave. NE, A-500 Woodinville, WA 98072 (425) 486-1669 / Fax: 481-2510; Wenatchee Office 105 Palouse St. Wenatchee, WA 98801 (509) 665-7696 / Fax: 665-7692; www.nelsongeotech.com	1	10/6/22	Original	FKS	SLD

C:\Users\DannyNelson\Nelson Geotechnical Associates, Inc\Nelson Geotechnical Associates, Inc - Company\2022 NGA Project\13837-22 Funston Short Plat Marysville\Drafting\Site Plan.dwg

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE - GRAINED SOILS MORE THAN 50 % RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE - GRAINED SOILS MORE THAN 50 % PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50 %	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 % OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.

2) Soil classification using laboratory tests is based on ASTM D 2488-93.

3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water.

Wet - Visible free water or saturated, usually soil is obtained from below water table

Project Number	Funston Short Plat Soil Classification Chart	NELSON GEOTECHNICAL ASSOCIATES, INC	No.	Date	Revision	By	CK
1383722			1	10/6/22	Original	FKS	SLD
Figure 3							

Woodinville Office
17311-135th Ave. NE, A-500
Woodinville, WA 98072
(425) 486-1669 / Fax: 481-2510

Wenatchee Office
105 Palouse St.
Wenatchee, WA 98801
(509) 665-7696 / Fax: 665-7692

www.nelsongeotech.com

LOG OF EXPLORATION

DEPTH (FEET)	USCS	SOIL DESCRIPTION
INFILTRATION TEST PIT ONE		
0.0 – 1.0		BROWN TO LIGHT BROWN, SILTY, FINE TO MEDIUM SAND WITH ROOTS (**TOPSOIL / FILL**) (LOOSE, DRY)
1.0 – 2.5		LIGHT BROWN, FINE TO COARSE SAND WITH TRACE GRAVEL AND SILT (LOOSE, DRY) (**FILL**)
2.5 – 5.0	SP	GRAY TO LIGHT GRAY, FINE TO COARSE SAND WITH TRACE GRAVEL (LOOSE TO MEDIUM DENSE, DRY TO MOIST)
		SAMPLES WERE NOT COLLECTED GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 5.0 FEET ON 9/27/2022
TEST PIT ONE		
0.0 – 0.5		BROWN TO LIGHT BROWN, SILTY, FINE TO MEDIUM SAND WITH ROOTS (**TOPSOIL / FILL**) (LOOSE, DRY)
0.5 – 3.0		BROWN, FINE TO COARSE SAND WITH TRACE GRAVEL AND SILT (LOOSE, DRY) (**FILL**)
3.0 – 9.5	SP	GRAY, FINE TO COARSE SAND WITH TRACE GRAVEL (LOOSE TO MEDIUM DENSE, DRY TO MOIST)
		SAMPLES WERE COLLECTED AT 4.75 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 9.5 FEET ON 9/27/2022
TEST PIT TWO		
0.0 – 0.5		BROWN TO LIGHT BROWN, SILTY, FINE TO MEDIUM SAND WITH ROOTS (**TOPSOIL / FILL**) (LOOSE, DRY)
0.5 – 3.5		BROWN, FINE TO COARSE SAND WITH TRACE GRAVEL AND SILT (LOOSE, DRY) (**FILL**)
3.5 – 8.5	SP	GRAY, FINE TO COARSE SAND WITH TRACE GRAVEL (LOOSE TO MEDIUM DENSE, DRY TO MOIST)
		SAMPLES WERE COLLECTED AT 6.0 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 8.5 FEET ON 9/27/2022
TEST PIT THREE		
0.0 – 1.0		BROWN TO LIGHT BROWN, SILTY, FINE TO MEDIUM SAND WITH ROOTS (**TOPSOIL / FILL**) (LOOSE, DRY)
1.0 – 4.0		BROWN, FINE TO COARSE SAND WITH TRACE GRAVEL AND SILT (LOOSE, DRY) (**FILL**)
4.0 – 10.0	SP	GRAY, FINE TO COARSE SAND WITH TRACE GRAVEL (LOOSE TO MEDIUM DENSE, DRY TO MOIST)
		SAMPLES WERE COLLECTED AT 8.5 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 10.0 FEET ON 9/27/2022

LOG OF EXPLORATION

DEPTH (FEET)	USCS	SOIL DESCRIPTION
TEST PIT FOUR		
0.0 – 0.5		BROWN TO LIGHT BROWN, SILTY, FINE TO MEDIUM SAND WITH ROOTS (**TOPSOIL / FILL**) (LOOSE, DRY)
0.5 – 4.0		BROWN, FINE TO COARSE SAND WITH TRACE GRAVEL AND SILT (LOOSE, DRY) (**FILL**)
4.0 – 9.0	SP	GRAY, FINE TO COARSE SAND WITH TRACE GRAVEL (LOOSE TO MEDIUM DENSE, DRY TO MOIST)

SAMPLES WERE COLLECTED AT 8.5 FEET
GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED
TEST PIT CAVING WAS NOT ENCOUNTERED
TEST PIT WAS COMPLETED AT 9.0 FEET ON 9/27/2022