

Stormwater Management Report

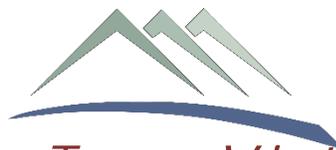
August 17, 2020

SmartCAP Airport Business Park Rough Grading/Access Road

Prepared for:

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Table of Contents

Stormwater Management Report	1
Project Overview.....	2
Site Location	2
Code Compliance	2
Executive Summary	3
Pervious/Impervious Areas	3
Onsite Pervious / Impervious Area	4
Soils.....	3
Minimum Stormwater Management Requirements	4
Overview of Minimum Requirements.....	5
1-Preparation of Stormwater Site Plans	6
2-Construction Stormwater Pollution Prevention Plan (SWPPP).....	6
3-Source Control of Pollution	6
4-Preservation of Natural Drainage Systems and Outfalls.....	6
5-Onsite Stormwater Management.....	7
6-Runoff Treatment.....	8
7-Flow Control.....	8
8-Wetland Protection.....	8
9-Operation and Maintenance	8

Appendix A – Stormwater Pollution Prevention Plan

Appendix B – Geotechnical Report(s)

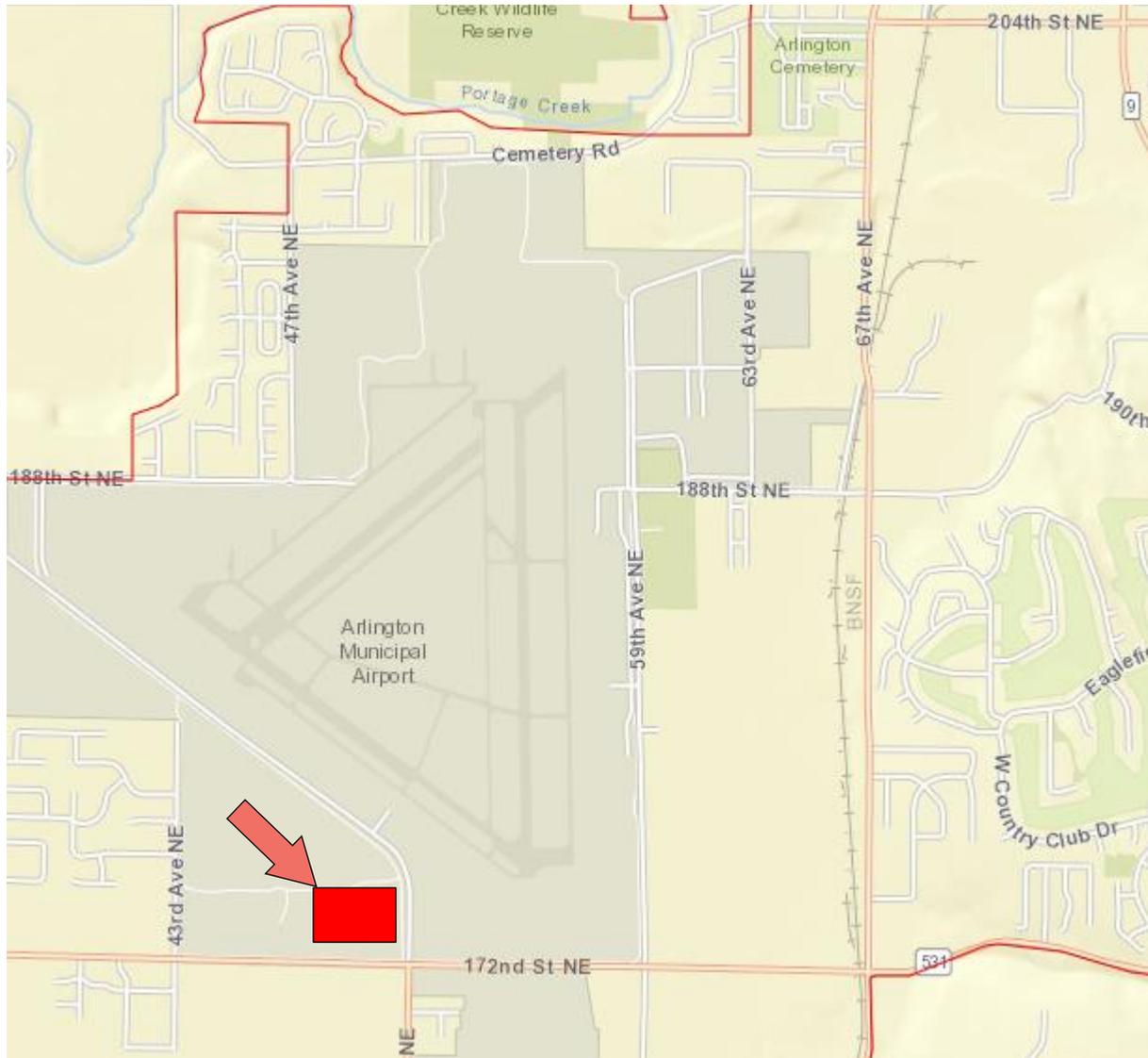
Appendix C – Operation and Maintenance

Appendix D –WWHM Infiltration Trench Drainage Calculations

Project Overview

Site Location

The project is located west of Airport Blvd in Arlington, Washington, on a 16.87 acre site.



Code Compliance

The project will comply with:

- [WSDOT] STANDARD SPECIFICATIONS for ROAD, BRIDGE and MUNICIPAL CONSTRUCTION, WSDOT, 2018 Edition with amendments
- [ADCS] Arlington Design and Construction Standards, dated July 2008
- [AMC] Arlington Municipal Code
- [SWMMWW] 2012/14 Stormwater Management Manual for Western Washington

Executive Summary

The proposed project involves rough grading for a 134,208 sf industrial facility scheduled to become operational in the summer of 2021. The facility will include loading docks and associated parking, constructed on a 16.87-acre site. The property is owned by Arlington Airport, and will be leased to SmartCAP. The project also includes the relocation of an existing access road.

Stormwater mitigation for the relocated access road will utilize an infiltration trench.

Existing Conditions

The subject property is rectangular-shaped and occupies 16.87 acres. The property is bordered to the west by Weston High School and the Stillaguamish Athletic Club, to the south by SR531, to the east by Airport Blvd, and to the north by undeveloped commercial/business park land. The site is level, with minimal elevation change over the extent of the property. The south end of the site is covered with grass. The north end of the site is covered by coniferous trees.

Soils

The existing soils predominantly consist of approximately 6 to 12 inches of topsoil over approximately 1.5 to 3.0 feet of medium dense weathered tan silty to poorly graded sand (weathered Marysville Sand). Underlying the weather Marysville Sand, to the maximum depth of each test pit exploration was a gray medium-dense to dense poorly graded sand containing trace silt and gravel. The geotechnical engineer, Geotest, interprets these soils to be of the Marysville Sand Member.

Geologic information for the project site was obtained from the geologic map entitled, Geologic map of the Arlington West 7.5-minute quadrangle, Snohomish County, Washington (Minard, 1985), published by the U.S. Geological Survey. According to Minard, the subject property is underlain by Marysville Sand Member Recessional Outwash (Qvrn) from the Fraser glaciation. This soil unit is referred to as Marysville Sand. This soil unit is generally comprised of well-drained, stratified to massive outwash sand, some gravel, and some areas of silt and clay.

Groundwater was observed at a depth of between 5.5 and 8 feet below existing site grades. Geotest roughly correlated groundwater elevations to be between 118 and 119 feet. Based on Pilot Infiltration Tests, Geotest recommends a long-term design infiltration rate of 6 inches per hour in areas with 3+ feet of separation from the groundwater table and 3 inches per hour in areas with less than 3 feet of separation.

Refer to soils report in Appendix B for additional information.

Proposed Conditions

The proposed project involves rough grading for a 134,208 sf industrial facility scheduled to become operational in the summer of 2021. The facility will include loading docks and associated parking, constructed on a 16.87-acre site. The property is owned by Arlington Airport, and will be leased to SmartCAP. The project also includes the relocation of an existing access road.

Stormwater mitigation for the relocated access road will utilize an infiltration trench.

Pervious/Impervious Areas

For use in determining stormwater mitigation fees the following areas represent the true pervious/impervious area for the entire site.

Onsite Pervious / Impervious Area

Total impervious surface.....	0.72 ac
Total pervious surface.....	16.15 ac
TOTAL ONSITE AREA.....	16.87 ac

Minimum Stormwater Management Requirements

Overview of Minimum Requirements

Minimum requirements 1-9 shall apply to the project.

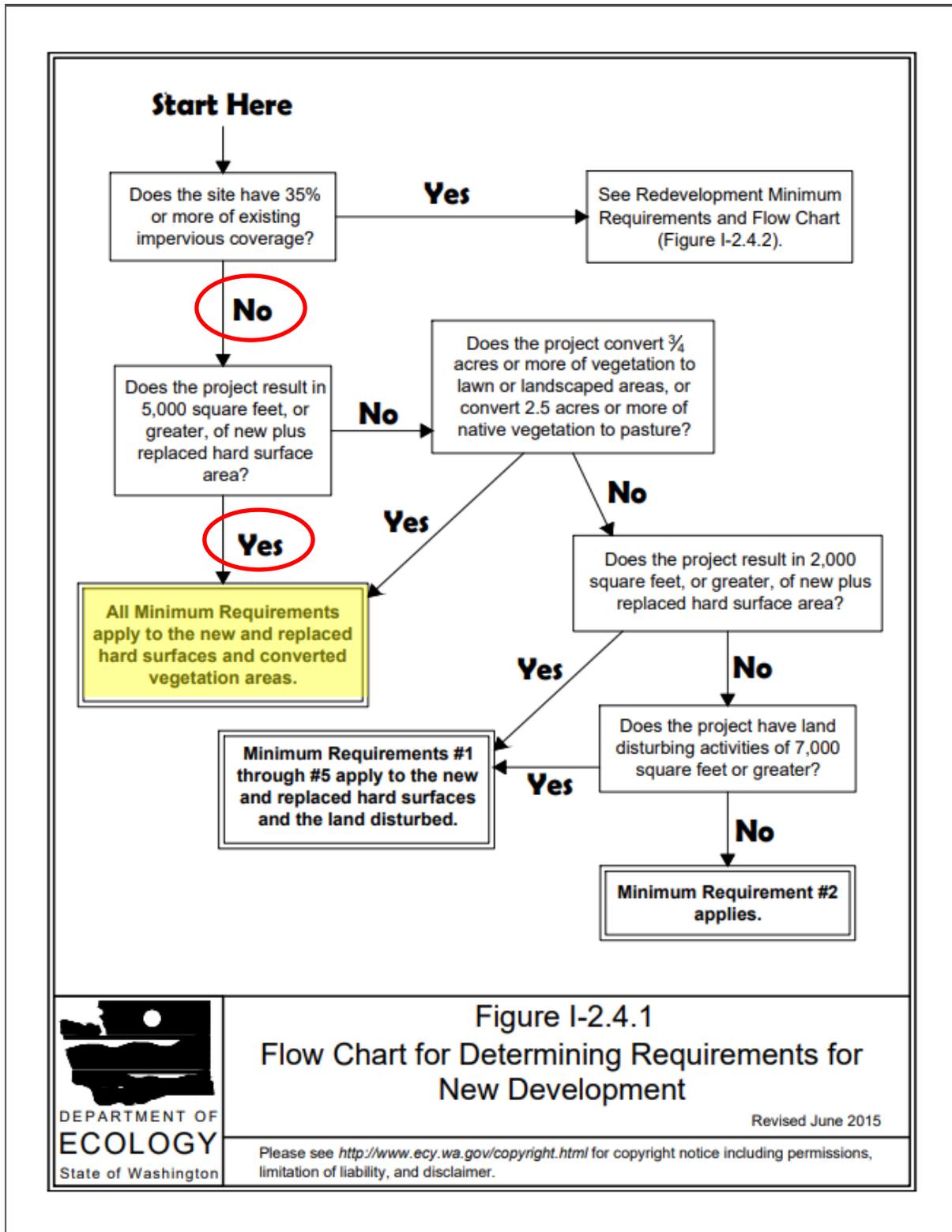
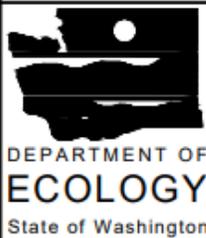


Figure I-2.4.1
Flow Chart for Determining Requirements for New Development



Revised June 2015

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1-Preparation of Stormwater Site Plans

Stormwater site plans are being prepared in accordance with Volume I, Chapter 3 of the SWMMWW.

2-Construction Stormwater Pollution Prevention Plan (SWPPP)

A SWPPP narrative has been prepared and is included in Appendix A and on the plan set. The erosion potential for the site is very low to non-existent. The onsite soils are highly infiltratable so no runoff during construction is anticipated.

3-Source Control of Pollution

The project will not pose any source of pollution for the site. The site is not considered a high use site. The SWPPP provided will address the source control of pollution during the construction phase.

4-Preservation of Natural Drainage Systems and Outfalls

Existing regional drainage infiltrates into the soils. The proposed drainage system will also infiltrate, therefore, preservation of natural drainage systems and outfall is being met.

5-Onsite Stormwater Management

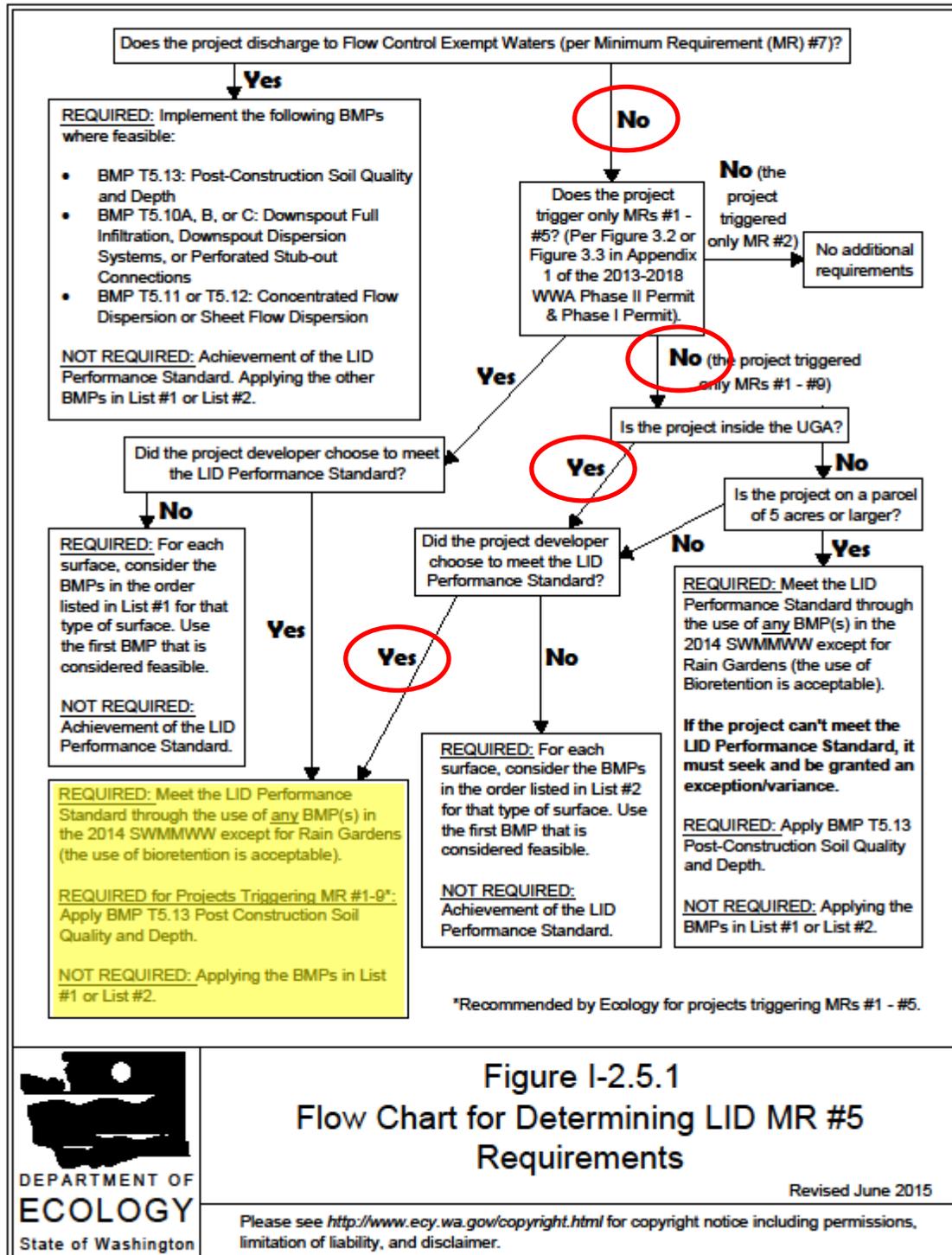


Figure I-2.5.1
Flow Chart for Determining LID MR #5
Requirements



Revised June 2015

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The drainage system will be designed to infiltrate 100% of the stormwater therefore meeting and exceeding the LID stormwater requirements including other minimum requirements. Detailed WWHM drainage calculations for offsite facilities are provided in Appendix D.

[SSC-4](#) of the SWMMWW requires that infiltration facilities that are utilized for treatment purposes must document that the water quality design storm volume (indicated by WWHM or MGS Flood, or runoff from a 6-month, 24-hour rain event) can infiltrate through the infiltration basin surface within 48 hours. The infiltration facilities are designed to infiltrate 100% of the stormwater within the 2.0' depth of the storage layer. The water quality storm, which is less than the all storms contained within the model, will also be contained within the 2.0' storage layer of the infiltration trenches. SSC-4 is therefore met.

Upstream Analysis

The surrounding area has flat topography with high infiltration soils. No stormwater from offsite areas are anticipated to flow onto the project site.

Downstream Analysis

The proposed storm drain mitigation for the project site will infiltrate 100% of the stormwater. Therefore, no impacts to the downstream system are anticipated.

In the event that onsite drainage systems are overwhelmed by excessive rainfall, the stormwater will continue to stay onsite due to the topography of the site. Stormwater will not leave the site.

BMP T5.13: Post-Construction Soil Quality and Depth

BMP T5.13 is required as part of Minimum Requirement #5. Although the Contractor has the option of stockpiling existing topsoil material, it is anticipated that the Contractor will import topsoil material to meet the requirements of BMP T5.13.

6-Runoff Treatment

The site will meet the basic level of treatment, as the project does not meet the thresholds for enhanced treatment, phosphorous removal, or oil treatment as described in [Section V-3](#) of the SWMMWW.

Pollutant generating impervious areas (PGIS) will drain to a series of infiltration trenches that utilize an 18" layer of sand for filtration, as the existing soils do not meet the site suitability requirements of SSC-6. The sand layer will be below the gravel infiltration trench. The system is similar to that used by permeable pavements for treatment, as part of BMP T5.15, whereby stormwater passes through a gravel storage layer, followed by a sand layer, and then final infiltration into the native soil.

7-Flow Control

This is being met with 100% infiltration of the stormwater onsite.

8-Wetland Protection

No wetlands are present on the site or within the adjacent downstream area.

9-Operation and Maintenance

Operation and maintenance procedures are included in Appendix C.

Appendix A

Construction Stormwater Pollution Prevent Plan (SWPPP)

Construction Stormwater General Permit (CSWGP)
 Stormwater Pollution Prevention Plan (SWPPP)
 for
 SmartCAP Airport Business Park Rough Grading & Access Road Relocation

Prepared for:
 Department of Ecology
 Northwest Region

Permittee / Owner	Developer	Operator / Contractor
SMARTCAP Opportunity Zone Fund, LLC	Robert Shipley	Tyson Goodwin

[Insert Project Site Location]

Update as necessary.

Certified Erosion and Sediment Control Lead (CESCL)

Name	Organization	Contact Phone Number
Matt Terlau	SmartCAP	937-974-0648

SWPPP Prepared By

Name	Organization	Contact Phone Number
Eric Scott	TerraVista NW	425-422-0840

SWPPP Preparation Date

Month / Day / Year

Project Construction Dates

Activity / Phase	Start Date	End Date
Construction	Aug 2020	Aug 2021

GENERAL INSTRUCTIONS AND CAVEATS

This template presents the recommended structure and content for preparation of a Construction Stormwater General Permit (CSWGP) Stormwater Pollution Prevention Plan (SWPPP).

The Department of Ecology's (Ecology) CSWGP requirements inform the structure and content of this SWPPP template; however, **you must customize this template to reflect the conditions of your site.**

A Construction Stormwater Site Inspection Form can be found on Ecology's website.

<https://www.ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Construction-stormwater-permit>

Using the SWPPP Template

Each section will include instructions and space for information specific to your project. Please read the instructions for each section and provide the necessary information when prompted. This Word template can be modified electronically. You may add/delete text, copy and paste, edit tables, etc. Some sections may be completed with brief answers while others may require several pages of explanation.

INSTRUCTIONS

Instructions are identified by gray shading, and should **be deleted upon SWPPP completion.** Delete this entire section upon SWPPP completion.

Follow this link to a copy of the Construction Stormwater General Permit:

<https://www.ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Construction-stormwater-permit>

Table of Contents

List of Tables

List of Appendices

List of Acronyms and Abbreviations

Acronym / Abbreviation	Explanation
303(d)	Section of the Clean Water Act pertaining to Impaired Waterbodies
BFO	Bellingham Field Office of the Department of Ecology
BMP(s)	Best Management Practice(s)
CESCL	Certified Erosion and Sediment Control Lead
CO ₂	Carbon Dioxide
CRO	Central Regional Office of the Department of Ecology
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERO	Eastern Regional Office of the Department of Ecology
ERTS	Environmental Report Tracking System
ESC	Erosion and Sediment Control
GULD	General Use Level Designation
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
NWRO	Northwest Regional Office of the Department of Ecology
pH	Power of Hydrogen
RCW	Revised Code of Washington
SPCC	Spill Prevention, Control, and Countermeasure
su	Standard Units
SWMMEW	Stormwater Management Manual for Eastern Washington
SWMMWW	Stormwater Management Manual for Western Washington
SWPPP	Stormwater Pollution Prevention Plan
TESC	Temporary Erosion and Sediment Control
SWRO	Southwest Regional Office of the Department of Ecology
TMDL	Total Maximum Daily Load
VFO	Vancouver Field Office of the Department of Ecology
WAC	Washington Administrative Code
WSDOT	Washington Department of Transportation
WWHM	Western Washington Hydrology Model

Project Information (1.0)

Project/Site Name: SmartCAP Airport Business Park

Street/Location: 188th St

City: Arlington State: WA Zip code: 98223

Subdivision:

Receiving waterbody: Groundwater

Existing Conditions (1.1)

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

Total acreage: 16.87 acres

Disturbed acreage: 16.87 acres

Existing structures: None

Landscape topography: Flat

Drainage patterns: Infiltration

Existing Vegetation: Grasses

Critical Areas (wetlands, streams, high erosion risk, steep or difficult to stabilize slopes):
None

List of known impairments for 303(d) listed or Total Maximum Daily Load (TMDL) for the receiving waterbody: None

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

List all known or suspected contaminants associated with this site in Table 1. Include contaminants previously remediated.

Table 1 – Summary of Site Pollutant Constituents

Constituent (Pollutant)	Location	Depth	Concentration
None	[Insert Text]	[Insert Text]	[Insert Text]

Proposed Construction Activities (1.2)

Description of site development (example: subdivision):

Commercial / Industrial Development

Description of construction activities (example: site preparation, demolition, excavation):

Site preparation, demolition, excavation and fill, paving, and building construction

Description of site drainage including flow from and onto adjacent properties. Must be consistent with Site Map in Appendix A:

Stormwater drainage will utilize biofiltration and infiltration trenches to infiltrate 100% of the stormwater.

Description of final stabilization (example: extent of revegetation, paving, landscaping):

Site will be paved as well as seeded with grasses within landscape areas.

Contaminated Site Information:

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

NA

Construction Stormwater Best Management Practices (BMPs) (2.0)

Describe the BMPs identified to control pollutants in stormwater discharges. Depending on the site, multiple BMPs for each element may be necessary. For each element identified:

- Clearly describe the control measure(s).
- Describe the implementation sequence.
- Describe the inspection and maintenance procedures for that specific BMP.
- Identify the responsible party for maintaining BMPs (if your SWPPP is shared by multiple operators, indicate the operator responsible for each BMP).

Categorize each BMP under one of the following elements as listed below:

1. Preserve Vegetation / Mark Clearing Limits
2. Establish Construction Access
3. Control Flow Rates
4. Install Sediment Controls
5. Stabilize Soils
6. Protect Slopes
7. Protect Drain Inlets
8. Stabilize Channels and Outfalls
9. Control Pollutants
10. Control Dewatering
11. Maintain BMPs
12. Manage the Project
13. Protect Low Impact Development

- BMPs must be consistent with the most current approved edition of the Stormwater Management Manual for Western Washington (SWMMWW) at sites west of the crest of the Cascade Mountains; the Stormwater Management Manual for Eastern Washington (SWMMEW) for sites east of the crest of the Cascade Mountains at the time the general permit was issued; or other Ecology-approved manual.
- Note the location of each BMP on your Site Map in Appendix A.
- Include the corresponding Ecology source control BMPs and runoff conveyance and treatment BMPs in Appendix B.
 - SWMMWW Volume II Chapter 4 Sections 4.1 and 4.2 – <https://fortress.wa.gov/ecy/publications/SummaryPages/1410055.html> or
 - SWMMEW Chapter 7 Section 7.3.1 and 7.3.2 – <https://fortress.wa.gov/ecy/publications/summarypages/0410076.html>
 - If it can be justified that a particular element does not apply to the project site, include a written justification in lieu of the BMP description in the text for the appropriate element.

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

The 12 Elements (2.1)

Element 1: Preserve Vegetation / Mark Clearing Limits (2.1.1)

Describe the methods (signs, fences, etc.) you will use to protect those areas that should not be disturbed.

Describe natural features identified and how each will be protected during construction. Trees that are to be preserved, as well as all sensitive areas and their buffers, shall be clearly delineated, both in the field and on the plans.

Describe how natural vegetation and native topsoil will be preserved.

List and describe BMPs: BMP C103 – High Visibility Fence, BMP C233-Silt Fence
Installation Schedules: Installed prior to ground breaking
Inspection and Maintenance plan: Inspected weekly and after major precipitation event
Responsible Staff: CESCL

Element 2: Establish Construction Access (2.1.2)

Describe how you will minimize dust generation and vehicles tracking sediment off-site.

Limit vehicle access to one route, if possible.

Recycled concrete used to establish construction ingress or egress may be a stormwater pollutant source that requires treatment prior to discharge.

Street sweeping, street cleaning, or wheel wash/tire baths may be necessary if the stabilized construction access is not effective. All wheel wash wastewater shall be controlled on-site and CANNOT be discharged into waters of the State.

Install site ingress/egress stabilization BMPs according to BMP C105.

Describe how you will clean the affected roadway(s) from sediment which is tracked off-site.

List and describe BMPs: **BMP C105-Stabilized Construction Entrance**

Installation Schedules: **installed at the start of construction**

Inspection and Maintenance plan: **Inspected and maintained weekly or after significant rainfall event**

Responsible Staff: **CESCL**

Element 3: Control Flow Rates (2.1.3)

Describe how you will protect properties and waterways downstream of the project from increased speed and volume of stormwater discharges due to construction activity.

Construction of stormwater retention and/or detention facilities must be done as one of the first steps in grading.

Assure that detention facilities are functioning properly before constructing site improvements (i.e. impervious surfaces).

If applicable, describe how you will protect areas designed for infiltration from siltation during the construction phase.

Will you construct stormwater retention and/or detention facilities?

Yes

No

Will you use permanent infiltration ponds or other low impact development (example: rain gardens, bio-retention, porous pavement) to control flow during construction?

Yes

No

List and describe BMPs: None

Installation Schedules: [Insert text here]

Inspection and Maintenance plan: [Insert text here]

Responsible Staff: [Insert text here]

Element 4: Install Sediment Controls (2.1.4)

Describe how you will minimize sediment discharges from the site. Construct sediment control BMPs as one of the first steps of grading. These BMPs must be functional before other land disturbing activities – especially grading and filling – take place.

Describe the BMPs identified to filter sediment prior to it being discharged to an infiltration system or leaving the construction site.

Describe how you will direct stormwater for maximum infiltration where feasible.

Describe how you will not interfere with the movement of juvenile Salmonids attempting to enter off-channel areas or drainages.

Describe how you will respond if sediment controls are ineffective and turbid water is observed discharging from the site.

Consider the amount, frequency, intensity and duration of precipitation, soil characteristics, and site characteristics when selecting sediment control BMPs.

List and describe BMPs: **BMP C233-Silt Fence**

Installation Schedules: **Installed at start of construction**

Inspection and Maintenance plan: **Inspect weekly or after rainfall event**

Responsible Staff: **CESCL**

Element 5: Stabilize Soils (2.1.5)

Describe how you will stabilize exposed and unworked soils throughout the life of the project (i.e. temporary and permanent seeding, mulching, erosion control fabrics, etc.).

Describe how you will stabilize soil stockpiles.

Describe how you will minimize the amount of soil exposed throughout the life of the project.

Describe how you will minimize the disturbance of steep slopes.

Describe how you will minimize soil compaction.

Describe how you will stabilize contaminated soil and contaminated soil stockpiles if applicable.

Exposed and unworked soils will be stabilized according to the time period set forth for dry and wet seasons, on the west or east sides of the crest of the Cascade Mountains.

Select your region's table and delete the others.

West of the Cascade Mountains Crest

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

East of the Cascade Mountains Crest, except the Central Basin*

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	July 1 – September 30	10 days
During the Wet Season	October 1 – June 30	5 days

The Central Basin*, East of the Cascade Mountain Crest

Season	Dates	Number of Days Soils Can be Left Exposed
During the Dry Season	July 1 – September 30	30 days
During the Wet Season	October 1 – June 30	15 days

*Note: The Central Basin is defined as the portions of Eastern Washington with mean annual precipitation of less than 12 inches.

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

Anticipated project dates:

Start date: Aug 2020

End date: Aug 2021

Will you construct during the wet season?

Yes

No

List and describe BMPs: BMP C120-Temp / Permanent Seeding, BMP C123-Plastic Covering, BMP C140-Dust Control

Installation Schedules: Dust control will be used from beginning of construction to final stabilization of soil. Plastic covering will be used during the wet season, permanent seeding will be done in the fall.

Inspection and Maintenance plan: Inspect weekly or after rain event

Responsible Staff: CESCL

Element 6: Protect Slopes (2.1.6)

West of the Cascade Mountains Crest

Describe how slopes will be designed, constructed, and protected to minimize erosion.

Temporary pipe slope drains must handle the peak 10-minute flow rate from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used.

The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits.

For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates.

If using the Western Washington Hydrology Model (WWHM) to predict flows, bare soil areas should be modeled as "landscaped area".

Describe how you will reduce scouring within constructed channels that are cut down a slope.

East of the Cascade Mountain Crest

Describe how slopes will be designed, constructed, and protected to minimize erosion.

Temporary pipe slope drains must handle the expected peak flow velocity from a 6-month, 3-hour storm for the developed condition, referred to as the short duration storm.

Describe how you will reduce scouring within constructed channels that are cut down a slope.

Will steep slopes be present at the site during construction?

Yes

No

List and describe BMPs: BMP C120-Temp/Permanent Seeding

Installation Schedules: Installed in the fall

Inspection and Maintenance plan: Inspected weekly to insure germination of seed

Responsible Staff: CESCL

Element 7: Protect Drain Inlets (2.1.7)

Describe how you will protect all operable storm drain inlets so that stormwater runoff does not enter the stormwater conveyance system.

Describe how you will remove sediment that enters the stormwater conveyance system (i.e. filtration, treatment, etc.).

Keep in mind inlet protection may function well for coarse sediment but is less effective in filtering finer particles and dissolved constituents. Inlet protection is the last component of a treatment train and protection of drain inlets include additional sediment and erosion control measures. Inlet protection devices will be cleaned (or removed and replaced), when sediment has filled the device by one third (1/3) or as specified by the manufacturer.

Inlets will be inspected weekly at a minimum and daily during storm events.

List and describe BMPs: **BMP C220-Storm Drain Inlet Protection**
Installation Schedules: **Installed prior to construction**
Inspection and Maintenance plan: **Inspected weekly or after rain event**
Responsible Staff: **CESCL**

Element 8: Stabilize Channels and Outlets (2.1.8)

Describe how you will prevent downstream erosion where site runoff is to be conveyed in channels, discharged to a stream or, discharged to a natural drainage point.

West of the Cascade Mountains Crest

On-site conveyance channels must handle the peak 10-minute flow rate from a Type 1A, 10-year, 24-hour frequency storm for the developed condition. Alternatively, the 10-year, 1-hour flow rate predicted by an approved continuous runoff model, increased by a factor of 1.6, may be used.

The hydrologic analysis must use the existing land cover condition for predicting flow rates from tributary areas outside the project limits.

For tributary areas on the project site, the analysis must use the temporary or permanent project land cover condition, whichever will produce the highest flow rates.

If using the WWHM to predict flows, bare soil areas should be modeled as "landscaped area".

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

List and describe BMPs: None
Installation Schedules: NA
Inspection and Maintenance plan: NA
Responsible Staff: NA

Element 9: Control Pollutants (2.1.9)

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

Table 2 – Pollutants

Pollutant (and source, if applicable)
None

Describe how you will handle and dispose of all pollutants, including waste materials and demolition debris, in a manner that does not cause contamination of stormwater.

Describe how you will cover, contain, and protect from vandalism all chemicals, liquid products, petroleum products, and other polluting materials.

Describe how you will manage known contaminants to prevent their discharge with stormwater to waters of the State (i.e. treatment system, off-site disposal).

Will maintenance, fueling, and/or repair of heavy equipment and vehicles occur on-site?

Yes No Provisions of spill prevention plan will be used

If yes, describe spill prevention and control measures in place while conducting maintenance, fueling, and repair of heavy equipment and vehicles.

If yes, also provide the total volume of fuel on-site and capacity of the secondary containment for each fuel tank. Secondary containment structures shall be impervious.

Will wheel wash or tire bath system BMPs be used during construction?

Yes No

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

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

Will pH-modifying sources be present on-site?

Yes No If yes, check the source(s).

Table 3 – pH-Modifying Sources

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

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

List and describe BMPs: **BMP C151-Concrete Handling, BMP C152-Sawcutting, BMP C154-Concrete Washout**

Installation Schedules: **Installed prior to concrete work being performed**

Inspection and Maintenance plan: **Inspected weekly**

Responsible Staff: **CESCL**

Adjust pH of stormwater if outside the range of 6.5 to 8.5 su.

Obtain written approval from Ecology before using chemical treatment with the exception of CO₂ or dry ice to modify pH.

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

Element 10: Control Dewatering (2.1.10)

Describe where dewatering will occur, including source of the water to be removed. State clearly if dewatering water is contaminated or has the potential to be contaminated.

Water from foundations, vaults, and trenches with characteristics similar to stormwater runoff shall be discharged into a controlled conveyance system before discharging to a sediment trap or sediment pond. Clean dewatering water will not be routed through stormwater sediment ponds.

Only clean, non-turbid dewatering water (such as well-point groundwater) may be discharged to systems tributary to, or directly into, surface waters of the State, provided the dewatering flow does not cause erosion or flooding of receiving waters.

Describe how you will manage dewatering water to prevent the discharge of contaminants to waters of the State, including dewatering water that has comeingled with stormwater (i.e. treatment system, off-site disposal).

Dewatering will not be used onsite

Check treatment or disposal option for dewatering water, if applicable:

Table 4 – Dewatering BMPs

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

List and describe BMPs: NA
Installation Schedules: NA
Inspection and Maintenance plan: NA
Responsible Staff: NA

Element 11: Maintain BMPs (2.1.11)

This section is a list of permit requirements and does not have to be filled out.

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

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

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

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

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

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

Element 12: Manage the Project (2.1.12)

The project will be managed based on the following principles:

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

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

Check all the management BMPs that apply at your site:

Table 5 – Management

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

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

Describe LIDs.

Permittees must protect all Bioretention and Rain Garden facilities from sedimentation through installation and maintenance of erosion and sediment control BMPs on portions of the site that drain into the Bioretention and/or Rain Garden facilities. Restore the facilities to their fully functioning condition if they accumulate sediment during construction. Restoring the facility must include removal of sediment and any sediment-laden Bioretention/Rain Garden soils, and replacing the removed soils with soils meeting the design specification.

Permittees must maintain the infiltration capabilities of Bioretention and Rain Garden facilities by protecting against compaction by construction equipment and foot traffic. Protect completed lawn and landscaped areas from compaction due to construction equipment.

Permittees must control erosion and avoid introducing sediment from surrounding land uses onto permeable pavements. Do not allow muddy construction equipment on the base material or pavement. Do not allow sediment-laden runoff onto permeable pavements.

Permittees must clean permeable pavements fouled with sediments or no longer passing an initial infiltration test using local stormwater manual methodology or the manufacturer's procedures.

Permittees must keep all heavy equipment off existing soils under LID facilities that have been excavated to final grade to retain the infiltration rate of the soils.

Describe how you will protect LID facilities from sedimentation, protect soils from compaction, and maintain the infiltration capabilities.

Describe how you will clean permeable pavements fouled with sediments.

N/A as there are no biofiltration facilities onsite.

Pollution Prevention Team (3.0)

Table 7 – Team Information

Title	Name(s)	Phone Number
Certified Erosion and Sediment Control Lead (CESCL)	Steve Rushton - Coast	425-315-4799
Resident Engineer	TBD	
Emergency Ecology Contact	TBD	425-649-7000
Emergency Permittee/ Owner Contact	Tim Shoultz-SmartCAP	425-896-8561
Non-Emergency Owner Contact	Same	
Monitoring Personnel		
Ecology Regional Office	[Insert Regional Office]	[Insert General Number]

Monitoring and Sampling Requirements (4.0)

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

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

Create your own Site Inspection Form or use the Construction Stormwater Site Inspection Form found on Ecology's website. <https://www.ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Construction-stormwater-permit>

File a blank form under Appendix D.

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

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

Complete the following paragraph for sites that discharge to impaired waterbodies for fine sediment, turbidity, phosphorus, or pH:

The receiving waterbody, insert waterbody name, is impaired for: insert impairment. All stormwater and dewatering discharges from the site are subject to an **effluent limit** of 8.5 su for pH and/or 25 NTU for turbidity.

Site Inspection (4.1)

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

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

Stormwater Quality Sampling (4.2)

Turbidity Sampling (4.2.1)

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

Method for sampling turbidity:

Check the analysis method you will use:

Table 8 – Turbidity Sampling Method

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

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

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

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

3. Document BMP implementation and maintenance in the site log book.

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

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

pH Sampling (4.2.2)

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

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

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

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

1. Prevent high pH water from entering storm sewer systems or surface water.
2. Adjust or neutralize the high pH water to the range of 6.5 to 8.5 su using appropriate technology such as carbon dioxide (CO₂) sparging (liquid or dry ice).
3. Written approval will be obtained from Ecology prior to the use of chemical treatment other than CO₂ sparging or dry ice.

Method for sampling pH:

Check the analysis method you will use:

Table 8 – pH Sampling Method

	pH meter
	pH test kit
	Wide range pH indicator paper

Discharges to 303(d) or Total Maximum Daily Load (TMDL) Waterbodies (5.0)

303(d) Listed Waterbodies (5.1)

The 303(d) status is listed on the Water Quality Atlas: <https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d>

Circle the applicable answer, if necessary:

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

Yes No

List the impairment(s):

[Insert text here]

The receiving waterbody, insert waterbody name, is impaired for: insert impairment. All stormwater and dewatering discharges from the site are subject to an **effluent limit** of 8.5 su for pH and/or 25 NTU for turbidity.

If yes, discharges must comply with applicable effluent limitations in S8.C and S8.D of the CSWGP.

Describe the method(s) for 303(d) compliance:

List and describe BMPs:

[Insert text here]

TMDL Waterbodies (5.2)

Waste Load Allocation for CWSGP discharges:

[Insert text here]

Describe the method(s) for TMDL compliance:

List and describe BMPs:

[Insert text here]

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

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

Reporting and Record Keeping (6.0)

Record Keeping (6.1)

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

Site Log Book (6.1.1)

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

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

Records Retention (6.1.2)

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

Permit documentation to be retained on-site:

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

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

Updating the SWPPP (6.1.3)

The SWPPP will be modified if:

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

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

Reporting (6.2)

Discharge Monitoring Reports (6.2.1)

Select and retain applicable paragraph.

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

Or

Cumulative soil disturbance is one (1) acre or larger; therefore, Discharge Monitoring Reports (DMRs) will be submitted to Ecology monthly. If there was no discharge during a given monitoring period the DMR will be submitted as required, reporting "No Discharge". The DMR due date is fifteen (15) days following the end of each calendar month.

DMRs will be reported online through Ecology's WQWebDMR System.

To sign up for WQWebDMR go to:

<https://www.ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance/WQWebPortal-guidance>

Notification of Noncompliance (6.2.2)

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

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

Specific information to be included in the noncompliance report is found in Special Condition S5.F.3 of the CSWGP.

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

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

Include the following information:

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

In accordance with Special Condition S4.D.5.b of the CSWGP, the Ecology Regional office will be notified if chemical treatment other than CO₂ sparging is planned for adjustment of high pH water.

Appendix/Glossary

A. Site Map

The site map must meet the requirements of Special Condition S9.E of the CSWGP

B. BMP Detail

Insert BMPs specification sheets here.

Download BMPs from the Ecology Construction Stormwater website at:

<https://www.ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Stormwater-manuals>

C. Correspondence

Ecology

EPA

Local Government

D. Site Inspection Form

Create your own or download Ecology's template: <https://www.ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Construction-stormwater-permit>

E. Construction Stormwater General Permit (CSWGP)

Download CSWGP: <https://www.ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Construction-stormwater-permit>

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

Proposed New Discharge to an Impaired Water Body form
SWPPP Addendum addressing impairment

G. Contaminated Site Information

Administrative Order

Sanitary Discharge Permit

Soil Management Plan

Soil and Groundwater Reports

Maps and Figures Depicting Contamination

H. Engineering Calculations

Appendix B

Geotechnical Report(s)

Geotechnical Engineering Report

Arlington Airport Business Park

Prepared For:

SMARTCAP Opportunity Zone Fund II, LLC
8201 164th Avenue NE, Suite 110
Redmond, WA 98052

Attn: Mr. Robert Shipley,
Lead Asset Manager



May 29, 2020
Project No. 20-0458

SMARTCAP Opportunity Zone Fund II, LLC
8201 164th Avenue NE, Suite 110
Redmond, WA 98052

Attention: Mr. Robert Shipley
Lead Asset Manager

Regarding: Geotechnical Engineering Report
Arlington Airport Business Park
Northwest Corner of 172nd Street NE and 51st Avenue NE
Arlington, WA 98223

Dear Mr. Shipley,

As requested, GeoTest Services, Inc. [GeoTest] is pleased to submit the following report summarizing the results of our geotechnical evaluation for the proposed Arlington Airport Business Park, located at the northwest corner of 172nd Street NE and 51st Avenue NE in Arlington, WA (see Vicinity Map, Figure 1). This report has been prepared in general accordance with the terms and conditions established in our services agreement dated May 19, 2020 and authorized by yourself.

We appreciate the opportunity to provide geotechnical services on this project and look forward to assisting you during the construction phase. Should you have any further questions regarding the information contained within the report, or if we may be of service in other regards, please contact the undersigned.

Respectfully,
GeoTest Services, Inc.



Tristan Coragiulo, G.I.T.
Staff Geologist



EXPIRES 3/13/2021

Edwardo Garcia, P.E.
Geotechnical Department Manager

Enclosure: Geotechnical Engineering Report

TABLE OF CONTENTS

PURPOSE AND SCOPE OF SERVICES.....	1
PROJECT DESCRIPTION	1
SITE CONDITIONS.....	2
Surface Conditions	2
Subsurface Soil Conditions.....	2
General Geologic Conditions.....	3
Groundwater.....	4
GEOLOGIC HAZARDS	4
Seismic and Liquefaction Hazards.....	4
CONCLUSIONS AND RECOMMENDATIONS	6
Site Preparation and Earthwork.....	6
Fill and Compaction.....	7
Reuse of On-Site Soil.....	7
Imported Structural Fill.....	7
Backfill and Compaction	8
Wet Weather Earthwork.....	8
Seismic Design Considerations.....	9
Foundation Support	9
Allowable Bearing Capacity	9
Foundation Settlement.....	10
Floor Support	10
Floor Considerations	11
Foundation and Site Drainage.....	11
Resistance to Lateral Loads.....	12
Buoyant Forces	13
Temporary and Permanent Slopes	14
Utilities	14
Utility Trench Backfill Considerations.....	15
Utility Trench Base Support	15



Dewatering Considerations	16
Pavement Subgrade Preparation	16
Light Duty Flexible Pavement	16
Heavy Duty Flexible Pavement	16
Concrete Pavement	17
Stormwater Infiltration Potential.....	17
Test Pit Gradation Results.....	17
Stormwater Treatment.....	19
Geotechnical Consultation and Construction Monitoring	20
USE OF THIS REPORT	21
REFERENCES	22



PURPOSE AND SCOPE OF SERVICES

The purpose of this evaluation is to establish general subsurface conditions beneath the site from which conclusions and recommendations pertaining to project design can be formulated. Our scope of services includes the following tasks:

- Exploration of soil and groundwater conditions underlying the site by advancing 12 test pits with a subcontracted backhoe to evaluate subsurface conditions. GeoTest also advanced a total of 4 cone penetrometers (CPTs) within the footprint of the proposed buildings.
- Laboratory testing on representative samples to classify and evaluate the engineering characteristics of the soils encountered.
- To provide a written report containing a description of subsurface conditions, exploration logs, findings and recommendations pertaining to site preparation and earthwork, fill and compaction, seismic design, foundation recommendations, concrete slab-on-grade construction, foundation and site drainage, utilities, temporary and permanent slopes, geotechnical consultation, and/or construction monitoring.

PROJECT DESCRIPTION

The project site is relatively level and will include the construction of two new buildings ranging in size from approximately 100,000 to 150,000 square feet each. The buildings will be single story and will utilize shallow conventional foundations and slab-on-grade floors. GeoTest has not been provided with a formalized development plan, but the structural loads are expected to be light to moderate. Typical vehicle parking and drive paths are expected around the perimeter of the buildings.

GeoTest understands that the buildings will include loading docks. As such, up to 3 feet of structural fill is expected under the building footprints. However, significant grading outside of the building footprints is not expected.

GeoTest anticipates that stormwater management will include the use of infiltration facilities spread out across the subject site. GeoTest anticipates the use of infiltration trenches and rain gardens instead of detention ponds or similar water-bearing facilities due to the close proximity of the project to Arlington Municipal Airport.

SITE CONDITIONS

This section includes a description of the general surface and subsurface conditions observed at the project site during the time of our field investigation. Interpretations of site conditions are based on the results and review of available information, site reconnaissance, subsurface explorations, laboratory testing, and previous experience in the project vicinity.

Surface Conditions

The project site is bordered to the east by 51st Avenue NE and 172nd Street NE to the south. A forested parcel exists to the north. The property is a historically cleared and graded lot that has less than a few feet of elevation differential across the property. Gravel drive paths cross the property, generally trending east-west, but no other surface developments are present on site. GeoTest is not aware of any historic buildings or structures that previously occupied the property, although utilities were observed around the perimeter and along the 173rd Street alignment.



Image 1. *Subject property surface conditions upon our arrival, facing southwest (Photo taken on May 26th, 2020)*

Subsurface Soil Conditions

Subsurface conditions were explored by advancing 12 test pit explorations on May 23, 2020. The explorations were advanced to depths between 7 and 9 feet below ground surface (BGS) using a subcontracted excavator. The approximate locations of these explorations have been plotted on the *Site and Exploration Plan* (Figure 2).

GeoTest returned to the project site on May 26, 2020 to advance a total of 4 Cone Penetrometer (CPT's) explorations. The explorations were advanced to depths of between 25 and 50 feet BGS. The approximate locations of these explorations have been plotted on the *Site and Exploration Plan* (Figure 2).

The on-site subsurface soils consisted of near-surface topsoil and existing fill soils. **GeoTest observed that topsoil was typically between 6 and 12 inches thick.** Where fill was present, GeoTest generally observed that the fill was less than about 2 feet thick and consisted of slightly silty to silty sand that was compositionally similar to the underlying native soil. The native soils observed in our explorations consisted of near-surface silty sands that graded to predominately clean, medium sands that were interpreted to be representative of the Marysville Sand unit. The near-surface, silty sands were interpreted to be representative of the same Marysville Sand unit but were considered weathered and typically displayed lower densities and elevated silt contents. See attached *Site and Exploration Map* (Figure 2) for approximate locations.

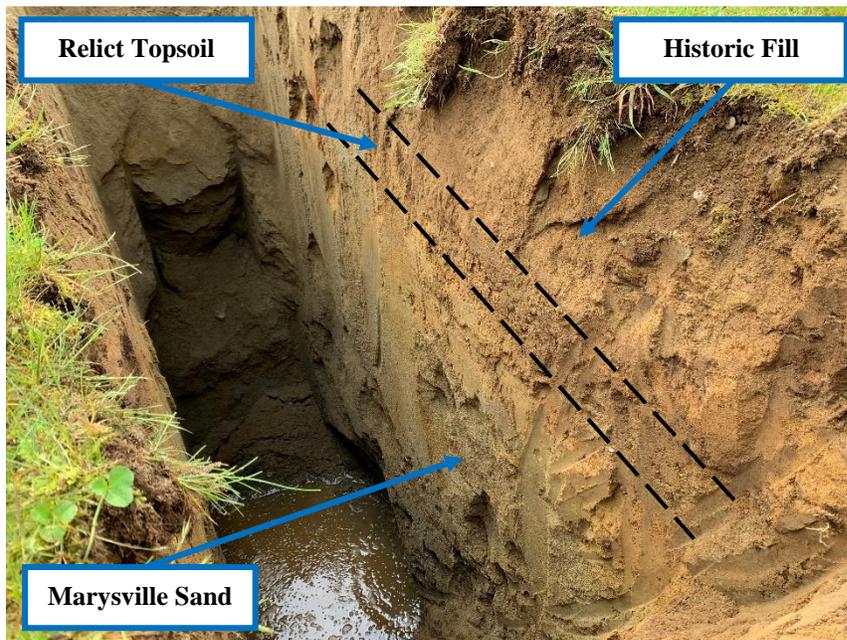


Image 2. Subsurface soil conditions within TP-1, in which historic fill soils were found overlying relict topsoil and Marysville Sand deposits, with moderate seepage observed at 8.0' BGS (Photo taken on May 23rd, 2020).

General Geologic Conditions

Geologic information for the project site was obtained from the geologic map entitled, Geologic map of the Arlington West 7.5-minute quadrangle, Snohomish County, Washington (Minard, 1985), published by the U.S. Geological Survey. According to Minard, the subject property is underlain by Marysville Sand Member Recessional Outwash (Q_{vm}) from the Fraser glaciation. For the purpose of this geotechnical report, this soil unit is referred to as Marysville Sand. This soil unit is generally comprised of well-drained, stratified to massive outwash sand, some gravel, and some areas of silt and clay.

The soils encountered in our subsurface explorations are generally consistent with the published geological information and our experience on projects in the nearby vicinity.

Groundwater

Groundwater was observed at a depth of between 5.5 and 8 feet below existing site grades at the time of our explorations. **GeoTest roughly correlated groundwater elevations to be between 118 and 119 feet,** based on a field review of the topographic plan provided to us. These elevations were not surveyed, so it should be expected that actual, surveyed groundwater elevations may differ slightly than what is listed in this report. The groundwater conditions reported on the exploration logs are for the specific locations and dates indicated, and therefore may not be indicative of other locations and/or times. Groundwater levels are variable and groundwater conditions will fluctuate depending on local subsurface conditions, precipitation, and changes in on-site and off-site use.

GEOLOGIC HAZARDS

As the subject property is located within the City of Arlington, GeoTest reviewed Chapter 20.93.600 (Geologically Hazardous Areas) of the Arlington Municipal Code. As the subject property is flat with no discernible elevation change, it is GeoTest's opinion that the subject property does not contain hazards pertaining to erosion or sliding (i.e., not an Erosion Hazard or Steep Slope Hazard). However, the subject property is mapped as having a low to moderate susceptibility to liquefaction. This is addressed in the next section.

Seismic and Liquefaction Hazards

Based on a review of information obtained from the Washington State Department of Natural Resource Geologic Information Portal, the subject site is classified as having a low to moderate liquefaction susceptibility. However, this map only provides an estimate of the likelihood that soil will liquefy as a result of an earthquake and is meant as a general guide to delineate areas prone to liquefaction.

The site is underlain by native, medium-dense to dense Marysville Sand soils. At the time of our site explorations, groundwater was encountered at approximately 5.5 to 8 feet BGS. For the purposes of the liquefaction analysis discussed in this section, GeoTest utilized the subsurface information from CPT-1 and CPT-3 in our liquefaction analysis.

Liquefaction is defined as a significant rise in pore water pressure within a soil mass caused by earthquake-induced cyclic shaking. The shear strength of liquefiable soil is reduced during large and/or long duration earthquakes as the soil consistency approaches that of semi-solid slurry. Liquefaction can result in significant and widespread structural damage if not properly mitigated. Deposits of loose, granular soil below the groundwater table are most susceptible to liquefaction.

Damage caused by foundation rotation, lateral spreading, and other ground movements can result from soil liquefaction.

The liquefaction potential was evaluated for a large design-level earthquake having a 2 percent probability of exceedance in a 50-year period. The liquefaction analyses assume a peak horizontal ground acceleration of 0.519g (calculated using the procedures given in ASCE 7-16) and an earthquake magnitude of 7.0. The analysis indicated the most liquefaction potential between 20 to 30 feet BGS, with a generally “stiffening” of soil that corresponded to less liquefaction potential at depths greater than 30 feet BGS. Post-liquefaction ground settlements could result in distortion of the proposed structures. Actual ground subsidence will depend on many factors, including the intensity and duration of seismic shaking, and local soil and groundwater conditions. Therefore, the extent of liquefaction, if any, may vary from the estimation above.

The maximum amount of post-liquefaction ground subsidence, assuming no mitigating measures are implemented to improve the soil susceptibility to liquefaction and/or seismically induced ground settlement, can be estimated using an empirical method developed by Robertson et al. (1997). This process is based on field studies of areas that had undergone liquefaction. The magnitude of post-construction settlement under the assumed conditions was calculated to be on the order of 2.2 inches. This settlement is expected to non-uniform with potential differential settlements equaling the total settlement. GeoTest then determined the liquefaction potential with a thin, approximately 1 to 3 foot layer of structural fill overlying the building pads and calculated approximately 1.5 inches of settlement. Thus, it appears that even thin sections of structural fill underlying the building pad areas offer modest amounts of mitigation to reduce overall settlements during a design seismic event. Other earthquake hazards such as ground rupture and lateral spreading are considered to be a moderate risk to this site.

Due to the amount of calculated settlement, GeoTest recommends that the owner confirm with their design team that less than 2 inches of liquefaction-induced settlement can be mitigated through design services and best management practices for the site. This estimate assumes 1 to 3 feet of fill under the building pad areas. It is our experience that less than 2 inches of settlement during a design seismic event is acceptable with adequate mitigations to address life-safety concerns. Should 2 inches of settlement be determined to be unacceptable, GeoTest recommends that the Owner and design team consider alternative mitigations such as rammed aggregate piers, mat-slab construction, or similar construction approaches to reduce total differential settlements across the building.

CONCLUSIONS AND RECOMMENDATIONS

It is GeoTest's opinion that subsurface conditions at the site are suitable for the construction of the proposed buildings provided that the recommendations contained in the geotechnical engineering report are incorporated into the project design.

The test pits and CPT explorations generally exhibited similar subsurface conditions. Native, medium-dense, medium sand (Marysville Sand) was generally located within 2 to 3 feet of the existing site grades. **GeoTest recommends that the topsoil and near-surface loose fill soils (if encountered) be removed from the building footprint down to the native, medium-dense, sand.** Once competent native soils have been exposed, GeoTest recommends that the subgrade surface be compacted to a firm and unyielding condition with a smooth-drum roller or other appropriate piece of construction equipment. The foundations can bear directly on the prepared native subgrade or on compacted structural fill placed atop these soils. Further recommendations regarding the placement and compaction of structural fill can be found in the Fill and Compaction section of this report.

Based on the native soils encountered in the test pits, it appears that the subject site is suitable for stormwater infiltration. We have presented preliminary design infiltration rates based on grain size analyses, per the Stormwater Management Manual for Western Washington (SMMWW), in the Stormwater Infiltration Potential section of this report.

Site Preparation and Earthwork

The portions of the site proposed for foundation(s), floor slabs, pavement and/or sidewalks development should be prepared by removing existing pavements, topsoil, deleterious material and significant accumulations of organics. Prior to placement of any foundation elements or structural fill, the exposed subgrade under all areas to be occupied by soil-supported floor slabs, spread, or continuous foundations should be recompacted to a firm and unyielding condition. Verification of compaction can be accomplished through proof rolling with a loaded dump truck, large self-propelled vibrating roller, or similar piece of equipment applicable to the size of the excavation. The purpose of this effort is to identify loose or soft soil deposits so that, if feasible, the soil distributed during site work can be recompacted.

Proof rolling should be carefully observed by qualified geotechnical personnel. Areas exhibiting significant deflection, pumping, or over-saturation that cannot be readily compacted should be overexcavated to firm soil. Overexcavated areas should be backfilled with compacted granular material placed in accordance with subsequent recommendations for structural fill. During periods of wet weather, proof rolling could damage the exposed subgrade. Under these conditions, qualified geotechnical personnel should observe subgrade conditions to determine if proof rolling is feasible.

Fill and Compaction

Structural fill used to obtain final elevations for footings and soil-supported floor slabs must be properly placed and compacted. In most cases, suitable, non-organic, predominantly granular soil may be used for fill material provided the material is properly moisture conditioned prior to placement and compaction, and the specified degree of compaction is obtained. Material containing topsoil, wood, trash, organic material, or construction debris is not suitable for reuse as structural fill and should be properly disposed offsite or placed in nonstructural areas.

Soils containing more than approximately 5 percent fines are considered moisture sensitive, and are difficult to compact to a firm and unyielding condition when over the optimum moisture content by more than approximately 2 percent. The optimum moisture content is that which allows the greatest dry density to be achieved at a given level of compactive effort.

Reuse of On-Site Soil

Near-surface, weathered, native site soils have somewhat variable, but slightly elevated, 'fines' contents (percent passing the U.S. No. 200 sieve). The native, medium sand (Marysville Sand) found below the near-surface topsoil and/or fill contained generally low fines contents.

It is our opinion that the near-surface native soils are suitable for reuse as structural fill when placed at or near optimum moisture contents as determined by ASTM D1557 and if allowed for in the project plans and specifications. Materials with elevated levels of organics cannot be reused as structural fill and should be segregated from mineral soils.

Shallow groundwater was encountered on the site. Thus, soils below a depth of about 5 to 8 feet should be expected to be saturated. Saturated soils cannot reasonably be assumed to be reused as structural fill materials without extensive moisture conditioning to dry these soils back to within 2 percent of optimum moisture contents.

The contractor and owner should be prepared to manage over optimum moisture content soils. The moisture content of the site soils may be difficult to control during periods of wet weather.

Imported Structural Fill

GeoTest recommends that imported structural fill consist of clean, well-graded sandy gravel, gravelly sand, or other approved naturally occurring granular material (pit run) or a well-graded crushed rock. We recommend structural fill for dry weather construction meet Washington State Department of Transportation (WSDOT) Standard Specification 9-03.14(2) for "Select Borrow" with the added requirement that 100 percent pass a 4-inch-square sieve. Soil containing more than about 5 percent fines (that portion passing the U.S. No. 200 sieve) cannot consistently be compacted to a dense, non-yielding condition when the water content is greater than optimum.

Accordingly, GeoTest recommends that imported structural fill for wet weather construction meet WSDOT Standard Specification 9-03.14(1) for “Gravel Borrow” with the added requirement that no more than 5 percent pass the U.S. No. 200 sieve. Due to wet weather or wet site conditions, soil moisture contents could be high enough that it may be very difficult to compact even ‘clean’ imported select granular fill to a firm and unyielding condition. Soils with over-optimum moisture contents should be scarified and dried back to more suitable moisture contents during periods of dry weather or removed and replaced with fill soils at a more suitable range of moisture contents.

Backfill and Compaction

Structural fill should be placed in horizontal lifts. The structural fill must measure 8 to 10 inches in loose thickness and be thoroughly compacted. All structural fill placed under load bearing areas should be **compacted to at least 95 percent of the maximum dry density**, as determined using test method ASTM D1557. The top of the compacted structural fill should extend outside all foundations and other structural improvements a minimum distance equal to the thickness of the fill. We recommend that compaction be tested after placement of each lift in the fill pad.

Wet Weather Earthwork

Fine grained native soils are particularly susceptible to degradation during wet weather. As a result, it may be difficult to control the moisture content of site soils during the wet season. If construction takes place during wet weather, GeoTest recommends that structural fill consist of imported, clean, well-graded sand or sand and gravel as described above. If fill is to be placed or earthwork is to be performed in wet conditions, the contractor may reduce soil disturbance by:

- Limiting the size of areas that are stripped of topsoil and left exposed
- Accomplishing earthwork in small sections
- Limiting construction traffic over unprotected soil
- Sloping excavated surfaces to promote runoff
- Limiting the size and type of construction equipment used
- Providing gravel ‘working mats’ over areas of prepared subgrade
- Removing wet surficial soil prior to commencing fill placement each day
- Sealing the exposed ground surface by rolling with a smooth drum compactor or rubber-tired roller at the end of each working day
- Providing up-gradient perimeter ditches or low earthen berms and using temporary sumps to collect runoff and prevent water from ponding and damaging exposed subgrades

Seismic Design Considerations

The Pacific Northwest is seismically active, and the site could be subject to movement from a moderate or major earthquake. Consequently, moderate levels of seismic shaking should be accounted for during the design life of the project, and the proposed structure should be designed to resist earthquake loading using appropriate design methodology.

For structures designed using the seismic design provisions of the 2018 International Building Code, the medium-dense Marysville Sand is classified as Site Class D, according to ASCE 7-16. The structural engineer should select the appropriate design response spectrum based on Site Class D soil and the geographical location of the proposed construction.

Foundation Support

Foundation support for the proposed improvements may be provided by continuous and individual spread footings founded directly on native, medium-dense, medium sand (Marysville Sand) soils, or on compacted, structural fill placed over competent, native soils. GeoTest recommends that qualified geotechnical personnel confirm that suitable bearing conditions have been reached prior to placement of structural fill or foundation formwork.

To provide proper support, GeoTest recommends that existing topsoil (if present) and existing fill be removed from beneath the building foundation areas down to the native soils. The surface should be compacted to a firm and unyielding condition with a smooth-drum roller or a similar piece of construction equipment. Once suitable bearing conditions have been confirmed, then foundations can bear directly on native soils, or the footprints constructed with property compacted structural fill.

Continuous and isolated spread footings should be founded a minimum of 18 inches below the lowest adjacent final grade for freeze/thaw protection. The footings should be sized in accordance with the structural engineer's prescribed design criteria and seismic considerations.

Allowable Bearing Capacity

Assuming the above foundation support criteria are satisfied, continuous or isolated spread footings founded directly on medium dense native soils or on compacted structural fill placed directly over undisturbed native soils may be proportioned using a net allowable soil bearing pressure of 2,500 pounds per square foot (psf).

The "net allowable bearing pressure" refers to the pressure that can be imposed on the soil at foundation level. This pressure includes all dead loads, live loads, the weight of the footing, and

any backfill placed above the footing. The net allowable bearing pressure may be increased by one-third for transient wind or seismic loads.

Foundation Settlement

Settlement of shallow foundations depends on foundation size and bearing pressure, as well as the strength and compressibility characteristics of the underlying soil. If construction is accomplished as recommended and at the maximum allowable soil bearing pressure, GeoTest estimates the total settlement of building foundations under static conditions to be less than one inch. Differential settlement between two adjacent load-bearing components supported on competent soil is estimated to be less than one half the total settlement.

As previously stated, GeoTest determined that additional settlements are feasible during a design earthquake event. GeoTest calculated slightly over 2 inches of liquefaction-induced settlement if no mitigations are included in the design and less than 2 inches of liquefaction-induced with only minimal amounts of structural fill below the building. Should the Owner or design team determine that the liquefaction-induced settlement is not acceptable, alternatives such as rammed aggregate piers, mat-slabs, or similar mitigations should be considered. GeoTest is not currently contracted to provide these mitigations, but can consult with the Owner and/or design team as part of an expanded scope of services should additional mitigations be required.

Floor Support

Conventional slab-on-grade floor construction is feasible for the planned site improvements. Floor slabs may be supported on properly prepared native subgrade or on properly placed and compacted structural fill placed over properly prepared native soil. Prior to placement of the structural fill, the native soil should be proof-rolled as recommended in the *Site Preparation and Earthwork* section of this report.

GeoTest recommends that interior concrete slab-on-grade floors be underlain with at least 6 inches of clean, crushed, compacted, free-draining gravel. The gravel should contain less than 3 percent passing the U.S. Standard No. 200 sieve (based on a wet sieve analysis of that portion passing the U.S. Standard No. 4 sieve). The purpose of this gravel layer is to provide uniform support for the slab, provide a capillary break, and act as a drainage layer. To help reduce the potential for water vapor migration through floor slabs, a continuous 15-mil minimum thick polyethylene sheet with tape-sealed joints should be installed below the slab to serve as an impermeable vapor barrier. The vapor barrier should be installed and sealed in accordance with the manufacturer's instructions.

The American Concrete Institute (ACI) guidelines suggest that the slab may either be poured directly on the vapor barrier or on a granular curing layer placed over the vapor barrier depending on construction conditions. GeoTest recommends that the architect or structural engineer

specify if a curing layer should be used. If moisture control within the building is critical, we recommend a representative of GeoTest observe the vapor barrier to confirm that joints and penetrations have been properly sealed.

Exterior concrete slabs-on-grade, such as sidewalks, may be supported directly on undisturbed native soil or on properly placed and compacted structural fill; however, long-term performance will be enhanced if exterior slabs are placed on a layer of clean, durable, well-draining granular material. For design purposes, a vertical modulus of subgrade reaction of 200 pounds per cubic inch (pci) should be expected for concrete slabs constructed over properly prepared subgrades as recommended above.

Floor Considerations

In a large warehouse or industrial facility such as the ones proposed for this site, long spans of slab-on-grade concrete floors may be more susceptible to cracking and floor flatness issues due to normally occurring concrete shrinkage and/or minor floor settlements that would not normally impact smaller facilities. Thus, special considerations may be required in order to mitigate against post-construction cracking and/or settling of the floor slab. These considerations could include, but are not limited to, the inclusion of additional structural steel within the slab, fibers added to concrete mixes, more frequent crack control joints, a reduction in the water-cement ratio of concrete in floor areas, or a specialized and/or enhanced structural fill section below floor slabs. It is our expectation that inclusions or considerations to mitigate post-construction floor cracking and/or settlement will be a collaborative effort from the design team, but that the Structural Engineer will likely have the most influence on the final design of the floor slab. GeoTest is available to participate in discussions regarding the mitigation of floor slab cracking and/or settlement issues.

Foundation and Site Drainage

Positive surface gradients should be provided adjacent to the proposed building to direct surface water away from the building and toward suitable drainage facilities. Roof drainage should not be introduced into the perimeter footing drains but should be separately discharged directly to the stormwater collection system or similar municipality-approved outlet. Pavement and sidewalk areas, if present, should be sloped and drainage gradients should be maintained to carry surface water away from the building towards an approved stormwater collection system. Surface water should not be allowed to pond and soak into the ground surface near buildings or paved areas during or after construction. Construction excavations should be sloped to drain to sumps where water from seepage, rainfall, and runoff can be collected and pumped to a suitable discharge facility.

To reduce the potential for groundwater and surface water to seep into interior spaces, GeoTest recommends that an exterior footing drain system be constructed around the perimeter of new

building foundations as shown in the Typical Footing Drain Section (Figure 3) of this report. The drain should consist of a perforated pipe measuring 4 inches in diameter at minimum, surrounded by at least 12 inches of filtering media. The pipe should be sloped to carry water to an approved collection system.

The filtering media may consist of open-graded drain rock wrapped in a nonwoven geotextile fabric such as Mirafi 140N (or equivalent) or wrapped with a graded sand and gravel filter. For foundations supporting retaining walls, drainage backfill should be carried up the back of the wall and be at least 12 inches wide. The drainage backfill should extend from the foundation drain to within approximately 1 foot of the finished grade and consist of open-graded drain rock containing less than 3 percent fines by weight passing the U.S. Standard No. 200 sieve (based on a wet sieve analysis of that portion passing the U.S. Standard No. 4 sieve). The invert of the footing drain pipe should be placed at approximately the same elevation as the bottom of the footing or 12 inches below the adjacent floor slab grade, whichever is deeper, so that water will be contained. This process prevents water from seeping through walls or floor slabs. The drain system should include cleanouts to allow for periodic maintenance and inspection.

Resistance to Lateral Loads

The lateral earth pressures that develop against retaining walls will depend on the method of backfill placement, degree of compaction, slope of backfill, type of backfill material, provisions for drainage, magnitude and location of any adjacent surcharge loads, and the degree to which the wall can yield laterally during or after placement of backfill. If the wall is allowed to rotate or yield so the top of the wall moves an amount equal to or greater than about 0.001 to 0.002 times its height (a yielding wall), the soil pressure exerted comprises the active soil pressure. When a wall is restrained against lateral movement or tilting (a nonyielding wall), the soil pressure exerted comprises the at rest soil pressure. Wall restraint may develop if a rigid structural network is constructed prior to backfilling or if the wall is inherently stiff.

GeoTest recommends that yielding walls under drained conditions be designed for an equivalent fluid density of 35 pounds per cubic ft (pcf), for structural fill in active soil conditions. Nonyielding walls under drained conditions should be designed for an equivalent fluid density of 55 pcf, for structural fill in at-rest conditions. GeoTest should be notified if the final design will include structural elements below the water table. It should be understood that the parameters given in this report assume dry (i.e., drained) soil conditions.

The design of walls should include appropriate lateral pressures caused by surcharge loads located within a horizontal distance equal to or less than the height of the wall. For uniform surcharge pressures, a uniformly distributed lateral pressure equal to 35 percent and 50 percent of the vertical surcharge pressure should be added to the lateral soil pressures for yielding and nonyielding walls, respectively. For structures designed using the seismic design provisions of the International Building Code, GeoTest recommends that retaining walls include a seismic

surcharge in addition to the equivalent fluid densities presented above. We recommend that a seismic surcharge of approximately $12H$ (where H is the height of the wall in feet) be used for design purposes.

Passive earth pressures developed against the sides of building foundations, in conjunction with friction developed between the base of the footings and the supporting subgrade, will resist lateral loads transmitted from the structure to its foundation. For design purposes, the passive resistance of well-compacted fill placed against the sides of foundations is equivalent to a fluid with a density of 275 pcf. The recommended value includes a safety factor of about 1.5 and is based on the assumption that the ground surface adjacent to the structure is level in the direction of movement for a distance equal to or greater than twice the embedment depth. The recommended value also assumes drained conditions that will prevent the buildup of hydrostatic pressure in the compacted fill. Retaining walls should include a drain system constructed in general accordance with the recommendations presented in the *Foundation and Site Drainage* section of this report. In design computations, the upper 24 inches of passive resistance should be neglected if the soil is not covered by floor slabs or pavement. If future plans call for the removal of the soil providing resistance, the passive resistance should not be considered.

An allowable coefficient of base friction of 0.35, applied to vertical dead loads only, may be used between the underlying imported granular structural fill and the base of the footing. If passive and frictional resistance are considered together, one half the recommended passive soil resistance value should be used since larger strains are required to mobilize the passive soil resistance as compared to frictional resistance. A safety factor of about 1.5 is included in the base friction design value. GeoTest does not recommend increasing the coefficient of friction to resist seismic or wind loads.

Buoyant Forces

Buoyant forces develop when a submerged structural element is placed below a water table, with the resultant force having the potential to “float” the structure. Buoyant forces are likely to develop if structural elements are included in the design that are more than about 5.5 to 8 feet below existing site grades. Below grade elements such as vaults and elevator pits that extend below the water table should be designed to resist buoyant forces. GeoTest also recommends that, where appropriate, submerged elements have adequate water stops and waterproofing to resist the intrusion of water into the structural element.

GeoTest recommends that additional information be provided for our review once a construction plan has been developed so that we can get a better understanding of where buoyant forces may develop. GeoTest should be allowed to revise our recommendations if submerged structural elements are included in the final design.

Temporary and Permanent Slopes

The contractor is responsible for construction slope configurations and maintaining safe working conditions, including temporary excavation stability. All applicable local, state, and federal safety codes should be followed. All open cuts should be monitored during and after excavation for any evidence of instability. If instability is detected, the contractor should flatten the side slopes or install temporary shoring.

Temporary excavations in excess of 4 ft should be shored or sloped in accordance with Safety Standards for Construction Work Part N, WAC 296-155-66403.

Temporary unsupported excavations in the medium dense Marysville Sand encountered at the project site are classified as a Type B soil according to WAC 296-155-66401 and may be sloped as steep as 1H:1V (Horizontal: Vertical). All soils encountered are classified as Type C soil in the presence of groundwater seepage. Flatter slopes or temporary shoring may be required in areas where groundwater flow is present and unstable conditions develop.

GeoTest recommends that permanent cut or fill slopes be designed for inclinations of 2H:1V or flatter. Permanent cuts or fills used in detention ponds, retention ponds, or earth slopes intended to hold water should be 3H:1V or flatter, although it should be understood that there may be limitations to the use of water-bearing facilities given the proximity to the airport. All permanent slopes should be vegetated or otherwise protected to limit the potential for erosion as soon as practical after construction.

Utilities

Utility trenches must be properly backfilled and compacted to reduce cracking or localized loss of foundation, slab, or pavement support. Excavations for new shallow underground utilities are expected to be placed within medium dense Marysville Sand.

Trench backfill in improved areas (beneath structures, pavements, sidewalks, etc.) should consist of structural fill as defined in the *Fill and Compaction* section of this report. Outside of improved areas, trench backfill may consist of reused native material provided the backfill can be compacted to the project specifications. Trench backfill should be placed and compacted in general accordance with the recommendations presented in the *Fill and Compaction* section of this report and *Typical Utility Trench* section (Figure 4).

Surcharge loads on trench support systems due to construction equipment, stockpiled material, and vehicle traffic should be included in the design of any anticipated shoring system. The contractor should implement measures to prevent surface water runoff from entering trenches

and excavations. In addition, vibration as a result of construction activity and traffic may cause caving of the trench walls.

The contractor is responsible for trench configurations. All applicable local, state, and federal safety codes should be followed. All open cuts should be monitored by the contractor during excavation for any evidence of instability. If instability is detected, the contractor should flatten the side slopes or install temporary shoring. If groundwater or groundwater seepage is present, and the trench is not properly dewatered, the soil within the trench zone may be prone to caving, channeling, and running. Trench widths may be substantially wider than under dewatered conditions.

Utility Trench Backfill Considerations

The majority of the near-surface soils excavated from the site will be moist, fine to medium sand with relatively low amounts of silt and gravel. These soils are suitable for use as backfill material provided they are placed at or near optimum moisture contents. It should be noted, however, that GeoTest encountered shallow ground water at all of our exploration locations. GeoTest anticipates that soil below the water table will consist of saturated fine to medium sands that will not be suitable for backfill without significant moisture conditioning efforts.

Utility Trench Base Support

There is a potential that utility trenches excavated below the ground water table could experience a “quick” condition. A quick condition develops when the seepage pressure exceeds the resisting pressure. In this case, it would be the upwards vertical flow of water exceeding the unit weight of the soils at the bottom of the trench. The potential for a quick condition to develop is based on the hydraulic head difference between the water table level and the trench bottom and the unit weight of the surrounding soils. We encountered relatively shallow groundwater conditions in all of our subsurface explorations, with the ground water elevation having the potential for being higher than the bottom of utility trenches. The probability of a quick condition developing decreases as the elevation differential between groundwater levels and the bottom of the trench decreases.

If a quick condition does develop within utility trenches, it will be necessary to add quarry spall rock to the bottom of the trench during the excavation process. The quarry spall rock will add weight to the saturated sands and provide resistance against hydrostatic forces. If quick conditions develop in a lateral direction (i.e., running sand), mitigating the differential forces will be more difficult and will likely require that the water table be lowered to below the depth of the excavation.

Dewatering Considerations

Ground water was encountered at approximately 5.5 to 8 feet below existing site grades within our exploration test pits. Based on our previous experience, ground water elevations seasonally vary and can raise or lower several feet. Typically, groundwater elevations are highest in the late winter and early spring months, and lowest in late summer or early fall. Ground water elevations vary with season, adjacent site land usage, and recent rainfall.

When feasible, GeoTest recommends that utility trenching occur during late summer or early fall, when the water table is at its lowest elevation. Even if excavations occur during seasonal lows, it is likely that dewatering may have to occur. Based on our experience, it is likely that ground water will be controlled by using sump pumps during trench excavations or through the use of well points placed along the trench alignment. It is, however, the Contractor's responsibility to provide a suitable dewatering plan based on the type and depth of the excavation and the ground water elevation during construction.

Pavement Subgrade Preparation

Selection of a pavement section is typically a choice relative to its higher initial cost and lower long-term maintenance, or lower initial cost with more frequent maintenance. For this reason, we recommend that the owner participate in the selection of proposed pavement improvements planned for the site. Site grading plans should include provisions for sloping of the subgrade soils in proposed pavement areas, so that passive drainage of the pavement section(s) can proceed uninterrupted during the life of the project. The proposed pavement areas should be prepared as indicated in the *Site Preparation and Earthwork* section of this report.

Light Duty Flexible Pavement

GeoTest anticipates that asphalt pavement will be used for new passenger vehicle access drives and parking areas. We recommend that a standard, or 'light duty,' pavement section consist of 2.5 inches of ½-inch HMA asphalt above 6 inches of crushed surfacing base course (CSBC) meeting criteria set forth in the Washington State Department of Transportation (WSDOT) Standard Specification 9-03.9[3].

Heavy Duty Flexible Pavement

Areas that will be accessed by more heavily loaded vehicles, semi and garbage trucks, etc. will require a thicker asphalt section and should be designed using a paving section consisting of 4 inches of Class ½-inch HMA asphalt surfacing above 8 inches of CSBC meeting criteria set forth in WSDOT Standard Specification 9-03.9[3].

Concrete Pavement

Concrete pavements could be used for access and drive areas. Design of concrete pavements is a function of concrete strength, reinforcement steel, and the anticipated loading conditions for the roads. For design purposes, a vertical modulus of subgrade reaction of 200 pounds per cubic inch (pci) should be expected for concrete roadways constructed over properly placed and compacted Structural Fill. GeoTest expects that concrete pavement sections, if utilized, will be at least 8 inches thick and be founded on a minimum of 8 inches of compacted CSBC. The design of concrete pavements will need to be performed by a structural engineer. GeoTest recommends that subgrade soils supporting concrete pavement sections include minor grade changes to allow for passive drainage away from the pavement.

GeoTest is available to further consult, review and/or modify our pavement section recommendations based on further discussion and/or analysis with the project team/owner. The above pavement sections are initial recommendations and may be accepted and/or modified by the site civil engineer based on the actual finished site grading elevations and/or the owner's preferences.

Stormwater Infiltration Potential

Based on the presence of predominantly granular materials, it is our opinion that the on-site infiltration of stormwater is feasible for this project site.

Test Pit Gradation Results

From the explorations excavated in the areas of interest, 9 representative soil samples were selected and mechanically tested for grain size distribution and calculation according to the soil grain size analysis method per the SMMWW. A summary of these results is reproduced in Table 1 below.

Table 1			
Preliminary Infiltration Results Based on Grain Size Analysis			
Test Pit ID & Depth	Geologic Unit	Uncorrected K_{sat} Infiltration Rate [in/hr]	Corrected K_{sat} Infiltration Rate [in/hr]
TP-2 (2.0 ft)	Weathered Marysville Sand	65.2	18.8
TP-2 (5.0 ft)	Marysville Sand	65.9	19.0
TP-4 (1.5 ft)	Weathered Marysville Sand	10.3	3.0
TP-5 (2.0 ft)	Weathered Marysville Sand	50.0	14.4
TP-5 (5.3 ft)	Marysville Sand	132.2	38.1
TP-8 (2.3 ft)	Weathered Marysville Sand	84.8	24.4
TP-8 (5.0 ft)	Marysville Sand	109.0	31.4
TP-10 (1.5 ft)	Weathered Marysville Sand	10.1	2.9
TP-11 (2.0ft)	Weathered Marysville Sand	14.8	4.3
Notes: -Ksat = Initial Saturated Hydraulic Conductivity -Correction Factors Used: CFv = 0.8, CFt = 0.40, CFm =0.9, -Total Correction Factor = 0.288			

The rates presented in Table 1 are representative of loose soil conditions and do not take the relative density of the soil into account.

Stormwater infiltration potential is a function of the relatively permeability of the site soils, and the separation between the base of the proposed stormwater facility and the groundwater table. Based on the results presented in Table 1, and the relative depth to the groundwater table (observed at 5.5 to 8 feet BGS and roughly correlated to elevation 118 to 119), the on-site infiltration of stormwater is feasible for the project site. For facilities based in the silty weathered Marysville Sand typically encountered in the upper 2 to 2.5 feet BGS, we recommend a preliminary design infiltration rate of 2.9 inches per hour. For facilities based in the native unweathered Marysville Sand and at depths greater than about 2.5 feet below existing site grades, we recommend a preliminary design infiltration rate of 10 inches per hour, with the assumption that at least 5 vertical feet of separation exists between the bottom of proposed facilities and seasonal groundwater. GeoTest recommends an infiltration rate no more than 10 inches per hour for unweathered Marysville Sand based on the limitations associated with the grain size approach, even though field-measured infiltration rates could potentially be higher.

It should be noted that adequate separation between the bottom of the facility and groundwater may not be feasible given that the shallowest groundwater was encountered at or near elevations 118 to 119 in May of 2020. In the event that facilities are designed with less than 5 vertical feet of separation between the bottom of the facility and groundwater, it seems likely

that a reduction of the infiltration rate to account for mounding would be required. At the time of this report, GeoTest is not aware of a specific stormwater plan, nor is GeoTest aware of the depths of proposed facilities. The final design is likely to require a collaborative effort between GeoTest and the Civil designer. **Should stormwater facilities be designed with less than 5 feet of separation, GeoTest recommends that a preliminary, mounded rate of 2.5 inches per hour be used. This mounded rate assumes that the facility bottom is in unweathered Marysville Sand, that there is at least 3 feet of separation between the facility and groundwater, and that a Pilot Infiltration Test will be performed to confirm the infiltration rate.**

Stormwater Treatment

The stormwater facilities on-site may require some form of pollutant pretreatment with an amended soil prior to on-site infiltration or offsite discharge. The reuse of on-site topsoil is often the most sustainable and cost-effective method for pollutant treatment purposes. Cation exchange capacities, organic contents, and pH of site subsurface soils were also tested to determine possible pollutant treatment suitability.

Cation exchange capacity, organic content, and pH tests were performed by Northwest Agricultural Consultants on 7 soil samples collected from the explorations shown in Table 2. A summary of the laboratory test results is presented in Table 2 below.

TABLE 2 Cation Exchange Capacity, Organic Content, and pH Laboratory Test Results					
Test Pit ID	Sample Depth (ft)	Geologic Unit	Cation Exchange Capacity (meq/100 grams)	Organic Content (%)	pH
TP-1	0.5	Topsoil	8.8	2.89	6.9
TP-3	2.2	Marysville Sand	6.9	2.93	6.1
TP-4	0.5	Topsoil	10.9	5.07	6.0
TP-4	1.5	Weathered Marysville Sand	5.3	1.94	6.1
TP-7	2.0	Weathered Marysville Sand	3.1	1.56	6.1
TP-8	1.25	Weathered Marysville Sand	6.0	2.43	6.0
TP-10	0.5	Topsoil	10.4	5.19	5.6

Suitability for onsite pollutant treatment is determined in accordance with SSC-6 of the 2012 Washington State Department of Ecology *Stormwater Management Manual for Western Washington*. Soils with an organic content of greater than or equal to 1 percent and a cation exchange capacity of greater than or equal to 5 meq/100 grams are characterized as suitable for stormwater treatment. Based on the results shown in Table 2, topsoil and weathered Marysville Sand typically encountered in the upper 1.5 feet are suitable for stormwater treatment. However, the weathered Marysville Sand has elevated silt contents which should be expected to reduce the overall infiltration potential for these soils.

On-site soils can be amended by mixing higher silt content soils or adding mulch (or other admixtures) to elevate the cation exchange capacity and organic contents. On-site amended soil requires additional testing to confirm compliance with ecological regulations. GeoTest is available to perform additional laboratory testing as part of an expanded scope of services if the soil is to be amended. Alternatively, the owner may elect to import amended soils with the desired properties for planned treatment facilities.

Geotechnical Consultation and Construction Monitoring

GeoTest recommends that we be involved in the project design review process. The purpose of the review is to verify that the recommendations presented in this report are understood and incorporated in the design and specifications.

We also recommend that geotechnical construction monitoring services be provided. These services should include observation by GeoTest personnel during structural fill placement, compaction activities and subgrade preparation operations to confirm that design subgrade conditions are obtained beneath the areas of improvement.

Periodic field density testing should be performed to verify that the appropriate degree of compaction is obtained. The purpose of these services is to observe compliance with the design concepts, specifications, and recommendations of this report. In the event that subsurface conditions differ from those anticipated before the start of construction, GeoTest Services would be pleased to provide revised recommendations appropriate to the conditions revealed during construction.

GeoTest is available to provide a full range of materials testing and special inspection during construction as required by the local building department and the International Building Code. This may include specific construction inspections on materials such as reinforced concrete, reinforced masonry, wood framing and structural steel. These services are supported by our fully accredited materials testing laboratory.

USE OF THIS REPORT

GeoTest has prepared this report for the exclusive use of SMARTCAP and their design consultants for specific application to the design of the proposed Arlington Airport Business Park located in Arlington, WA. Use of this report by others is at the user's sole risk. This report is not applicable to other site locations. Our services are conducted in accordance with accepted practices of the geotechnical engineering profession; no other warranty, express or implied, is made as to the professional advice included in this report.

Our site explorations indicate subsurface conditions at the dates and locations indicated. It is not warranted that these conditions are representative of conditions at other locations and times. The analyses, conclusions, and recommendations contained in this report are based on site conditions to the limited depth and time of our explorations, a geological reconnaissance of the area, and a review of previously published USGS geological information for the site. If variations in subsurface conditions are encountered during construction that differs from those contained within this report, GeoTest should be allowed to review the recommendations and, if necessary, make revisions. If there is a substantial lapse of time between submission of this report and the start of construction, or if conditions change due to construction operations at or adjacent to the project site, we recommend that we review this report to determine the applicability of the conclusions and recommendations contained herein.

The earthwork contractor is responsible to perform all work in conformance with all applicable WISHA/OSHA regulations. GeoTest Services, Inc. is not responsible for job site safety on this project, and this responsibility is specifically disclaimed.

Attachments: Figure 1	Vicinity Map
Figure 2	Site and Exploration Plan
Figure 3	Typical Footing and Wall Drain Section
Figure 4	Typical Utility Trench Section
Figures 5 - 14	Field Explorations and Laboratory Testing
Appendix A	Northwest Agricultural Consultants Lab Results
Appendix B	In-Situ Engineering Cone Penetrometer Logs
Appendix C	Liquefaction Analysis
Appendix D	Report Limitations and Guidelines

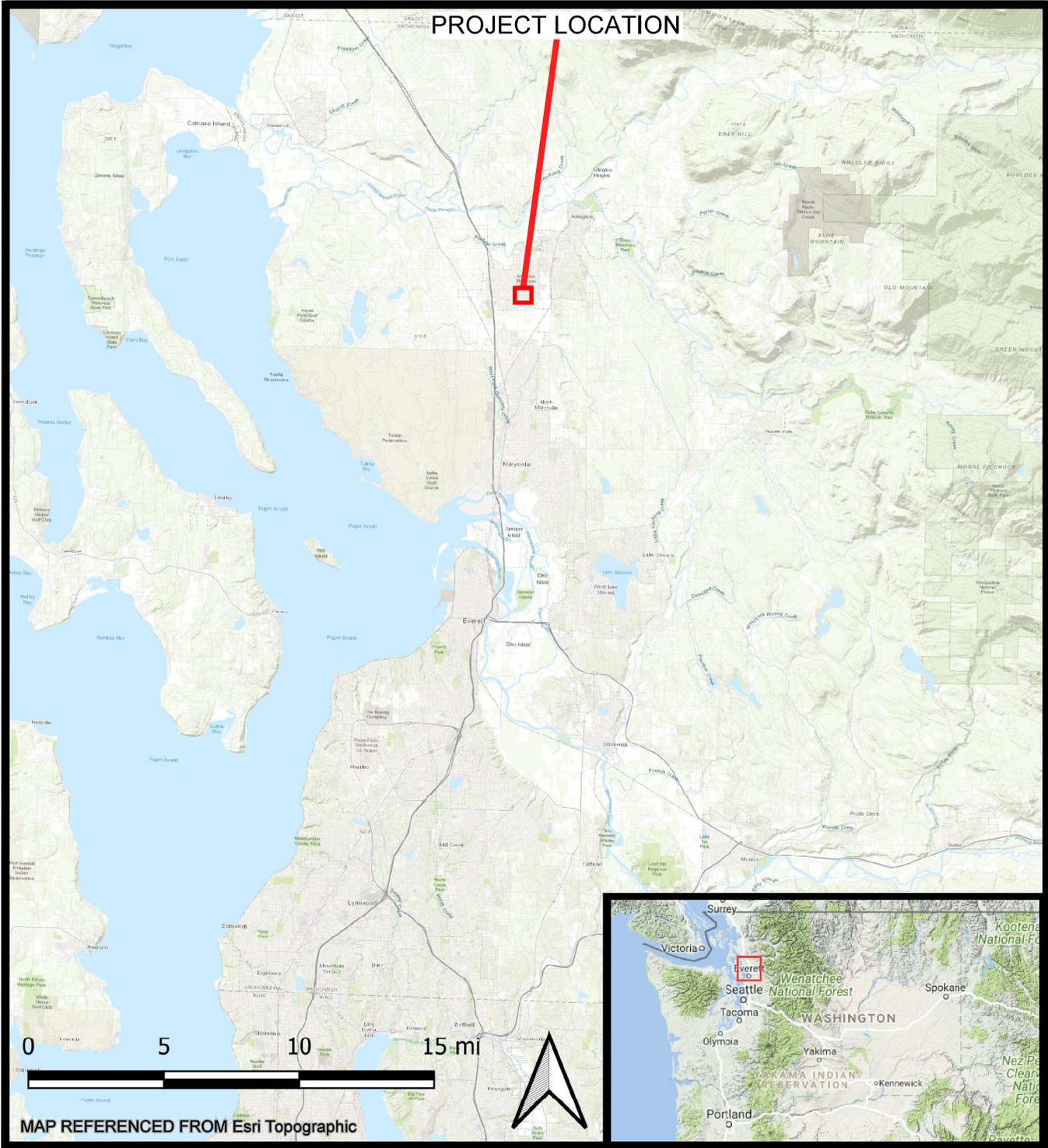
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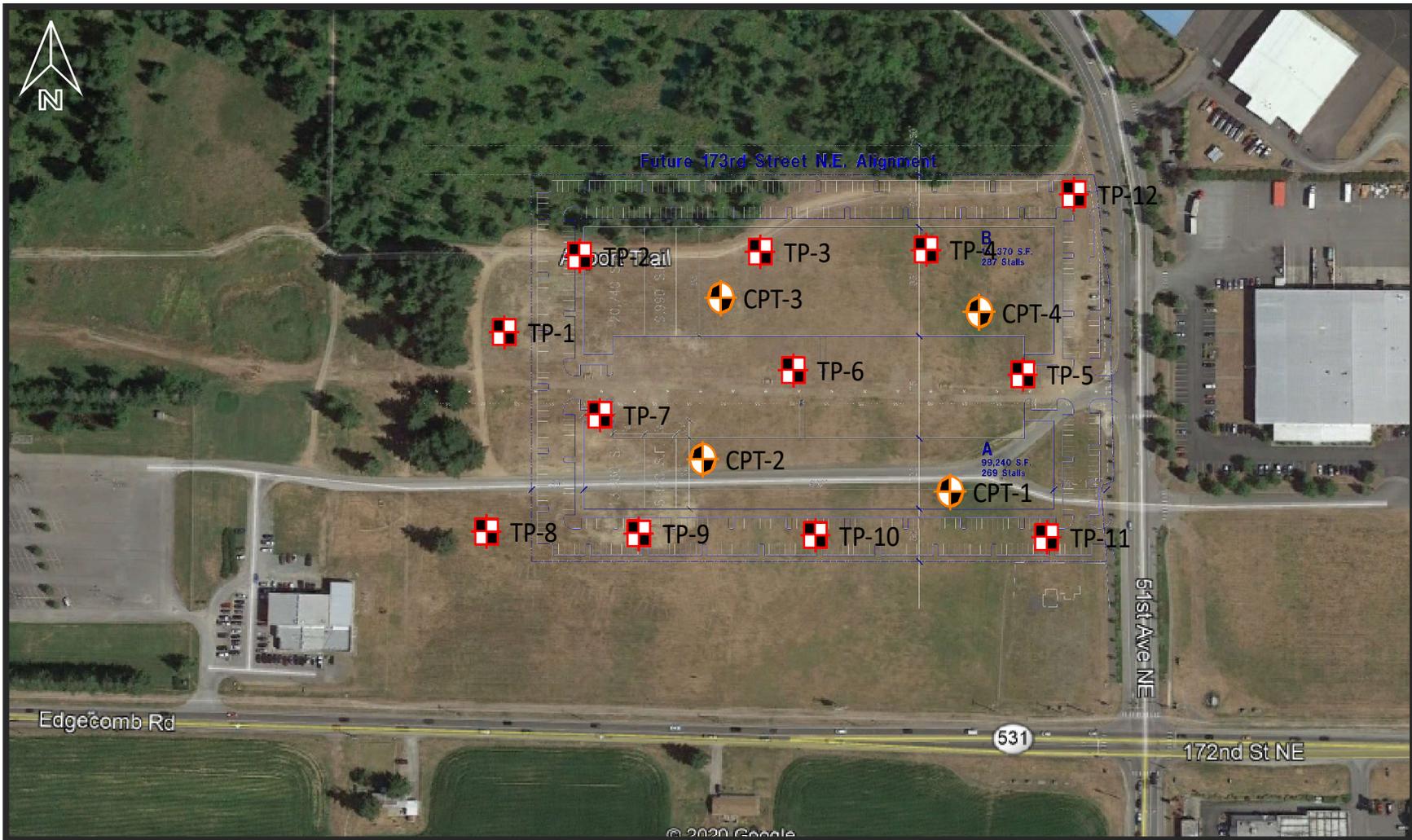


Date: 5-20-2020 By: TAC Scale: As Shown

VICINITY MAP
ARLINGTON AIRPORT BUSINESS PARK
NORTHWEST CORNER OF 172ND ST. NE & 51ST AVE. NE
ARLINGTON, WA 98223

Project
20-0458

Figure
1



SITE PLAN PROVIDED BY LANCE MUELLER & ASSOCIATES
 AERIAL IMAGERY TAKEN FROM GOOGLE MAPS

LEGEND

-  TP-# = Approximate Excavated Test Pit Location
-  CPT-# = Approximate Cone Penetrometer Test Location



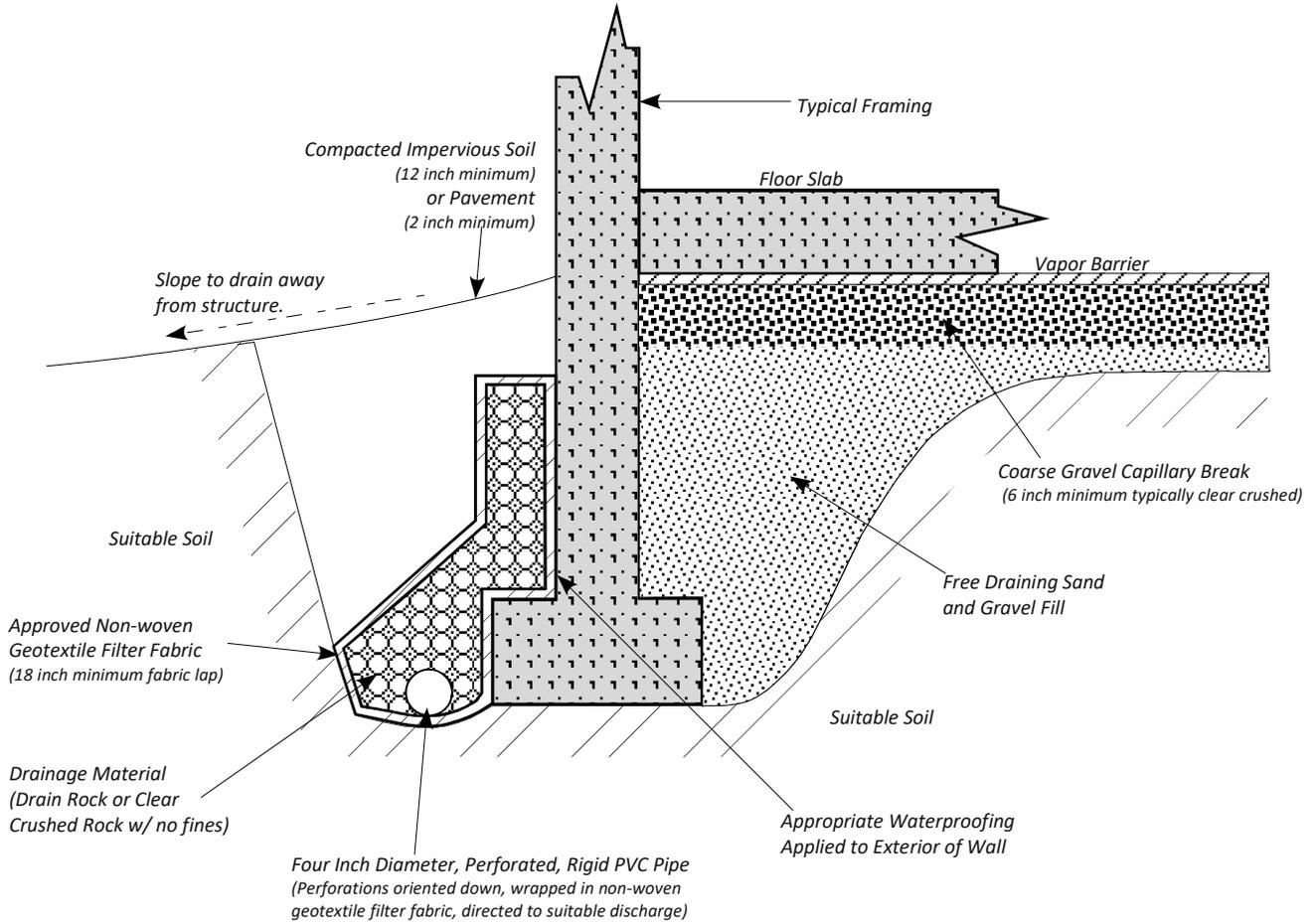
Date: 5-26-2020	By: TAC	Scale: NTS
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SITE AND EXPLORATION PLAN
ARLINGTON AIRPORT BUSINESS PARK
NORTHWEST CORNER OF 172ND ST. NE & 51ST AVE. NE
ARLINGTON, WA 98223

Project
20-0458

Figure
2

SHALLOW FOOTINGS WITH INTERIOR SLAB-ON-GRADE



Notes:

Footings should be properly buried for frost protection in accordance with International Building Code or local building codes
(Typically 18 inches below exterior finished grades)

The footing drain will need to be modified from this typical drawing to fit the dimensions of the planned footing and slab configuration



Date: 05.26.2020

By: TAC

Scale: None

Project

TYPICAL FOOTING & WALL DRAIN SECTION

20-0458

ARLINGTON AIRPORT BUSINESS PARK

Figure

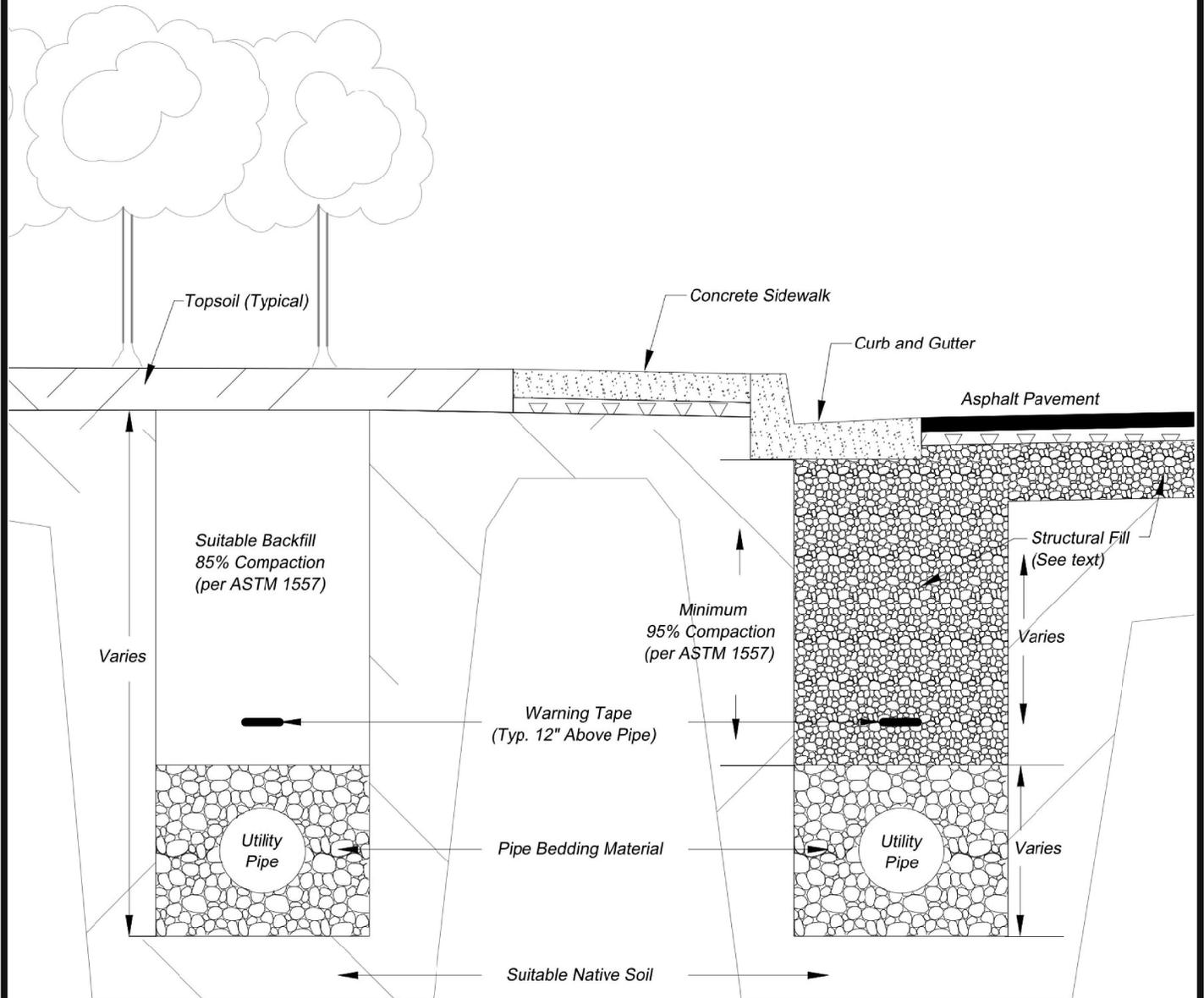
NORTHWEST CORNER OF 172ND ST. NE & 51ST AVE. NE

3

ARLINGTON, WA 98223

LANDSCAPING AREAS

LOAD BEARING AREAS



Date: 05.26.2020

By: TAC

Scale: None

Project
20-0458

TYPICAL UTILITY TRENCH SECTION
 ARLINGTON AIRPORT BUSINESS PARK
 NORTHWEST CORNER OF 172ND ST. NE & 51ST AVE. NE
 ARLINGTON, WA 98223

Figure
4

Soil Classification System

	MAJOR DIVISIONS	CLEAN GRAVEL (Little or no fines)	GRAPHIC SYMBOL	USCS LETTER SYMBOL	TYPICAL DESCRIPTIONS ⁽¹⁾⁽²⁾
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SP	Poorly graded sand; gravelly sand; little or no fines
				SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)		ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity	
			CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay	
			OL	Organic silt; organic, silty clay of low plasticity	
	SILT AND CLAY (Liquid limit greater than 50)		MH	Inorganic silt; micaceous or diatomaceous fine sand	
			CH	Inorganic clay of high plasticity; fat clay	
			OH	Organic clay of medium to high plasticity; organic silt	
	HIGHLY ORGANIC SOIL		PT	Peat; humus; swamp soil with high organic content	

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes: 1. Soil descriptions are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D 2487.

2. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

- Primary Constituent: > 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
- Secondary Constituents: > 30% and ≤ 50% - "very gravelly," "very sandy," "very silty," etc.
- > 12% and ≤ 30% - "gravelly," "sandy," "silty," etc.
- Additional Constituents: > 5% and ≤ 12% - "slightly gravelly," "slightly sandy," "slightly silty," etc.
- ≤ 5% - "trace gravel," "trace sand," "trace silt," etc., or not noted.

Drilling and Sampling Key		Field and Lab Test Data		
SAMPLE NUMBER & INTERVAL	SAMPLER TYPE	Code	Description	
	Code			
	a	3.25-inch O.D., 2.42-inch I.D. Split Spoon	PP = 1.0	Pocket Penetrometer, tsf
	b	2.00-inch O.D., 1.50-inch I.D. Split Spoon	TV = 0.5	Torvane, tsf
	c	Shelby Tube	PID = 100	Photoionization Detector VOC screening, ppm
	d	Grab Sample	W = 10	Moisture Content, %
e	Other - See text if applicable	D = 120	Dry Density, pcf	
1	300-lb Hammer, 30-inch Drop	-200 = 60	Material smaller than No. 200 sieve, %	
2	140-lb Hammer, 30-inch Drop	GS	Grain Size - See separate figure for data	
3	Pushed	AL	Atterberg Limits - See separate figure for data	
4	Other - See text if applicable	GT	Other Geotechnical Testing	
		CA	Chemical Analysis	
Groundwater				
Approximate water elevation at time of drilling (ATD) or on date noted. Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.				



Arlington Airport
Business Park
Arlington, WA 98223

Soil Classification System and Key

Figure
5

TP-1

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
						Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~126.0</u> Excavated By: <u>North River Enterprises / TAC</u>
0					OH	Loose, light brown, damp, silty SAND, trace gravel, sod, organics (Topsoil)
1			W = 22 GS		OH	Medium dense, weathered tan to light orange, damp, silty SAND, rootlets (Historic Fill)
2						Medium dense, light red/orange to purple, damp, very silty SAND, trace gravel, rootlets (Relict Topsoil)
3						Medium dense to dense, light tan, damp, slightly silty SAND, trace gravel, rootlets (Weathered Marysville Sand)
4						12" of penetration with a 3/8" steel T-probe @ 3' BGS
5						Dense, gray, moist, slightly silty, gravelly SAND, stratified (Marysville Sand)
6						Moderate caving @ 6.5' BGS
8						▽ Moderate groundwater seepage encountered at 8.0 ft.
10	Test Pit Completed 05/23/20					

TP-2

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
						Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~125.5</u> Excavated By: <u>North River Enterprises / TAC</u>
0					OH	Dense, dark brown, damp, gravelly, very silty SAND, sod, organics (Compacted Topsoil)
1			W = 5 GS		SP	Medium dense, weathered tan, damp, poorly graded SAND, rootlets (Weathered Marysville Sand)
2						Dense, light gray, damp, poorly graded SAND, stratified (Marysville Sand)
3			W = 10 GS			"12" of penetration with a 3/8" steel T-probe @ 4' BGS
4						Transitions to wet at 6' BGS
5						Moderate caving @ 6.5' BGS
6						▽ Moderate groundwater seepage encountered at 6.5 ft.
8	Test Pit Completed 05/23/20 Total Depth of Test Pit = 7.0 ft.					

- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.



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Arlington, WA 98223

Log of Test Pits

Figure
6

TP-3

SAMPLE DATA			SOIL PROFILE		GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: <u>Tracked Excavator</u>
						Ground Elevation (ft): <u>~126.3</u>
						Excavated By: <u>North River Enterprises / TAC</u>
	9			W = 14 GS	OH	Medium dense, dark brown to tan, damp, silty SAND, trace gravel, sod, organics (Topsoil)
10			SP	SP	Medium dense, weathered tan, damp, poorly graded SAND, rootlets (Weathered Marysville Sand)	
11			SP	SP	Dense, light gray, damp, slightly gravelly, poorly graded SAND, stratified (Marysville Sand)	
6					Moderate caving @ 6.75' BGS	
8						▽ Moderate groundwater seepage encountered at 7.8 ft.
10	Test Pit Completed 05/23/20 Total Depth of Test Pit = 8.0 ft.					

TP-4

SAMPLE DATA			SOIL PROFILE		GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: <u>Tracked Excavator</u>
						Ground Elevation (ft): <u>~125.7</u>
						Excavated By: <u>North River Enterprises / TAC</u>
	12			W = 12 GS	OH	Loose, light brown, damp, silty SAND, trace gravel, sod, organics (Topsoil)
13			SM	SM	Loose to medium dense, mottled tan, damp, silty SAND, trace gravel, rootlets (Weathered Marysville Sand)	
14			SP/SM	SP/SM	Medium dense, light tan to gray, damp, slightly silty, gravelly SAND, stratified (Marysville Sand)	
4					Slight caving @ 2.75' BGS	
6					Moderate caving @ 7.25' BGS	
8						▽ Moderate groundwater seepage encountered at 7.3 ft.
10	Test Pit Completed 05/23/20 Total Depth of Test Pit = 8.0 ft.					

- Notes:
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 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

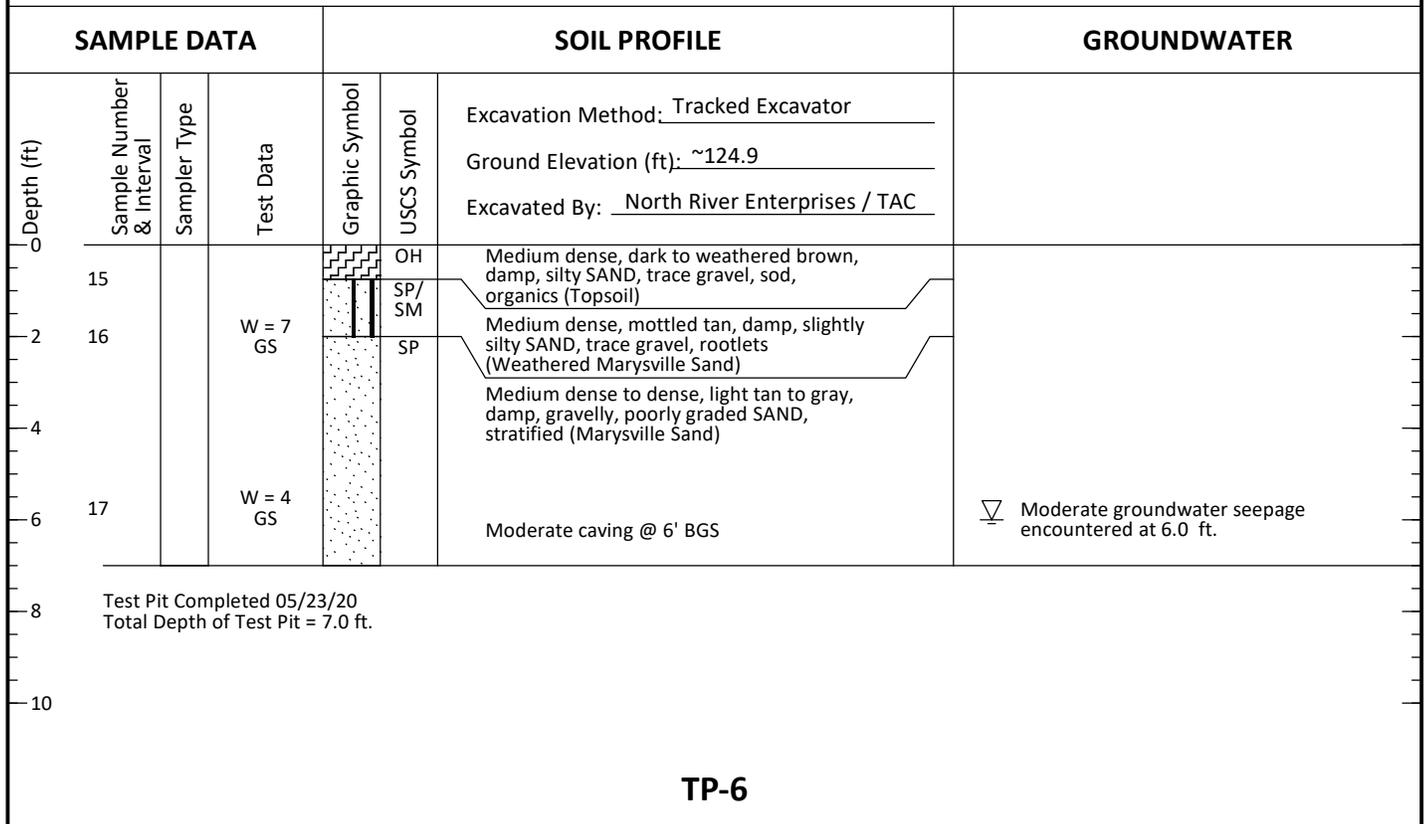


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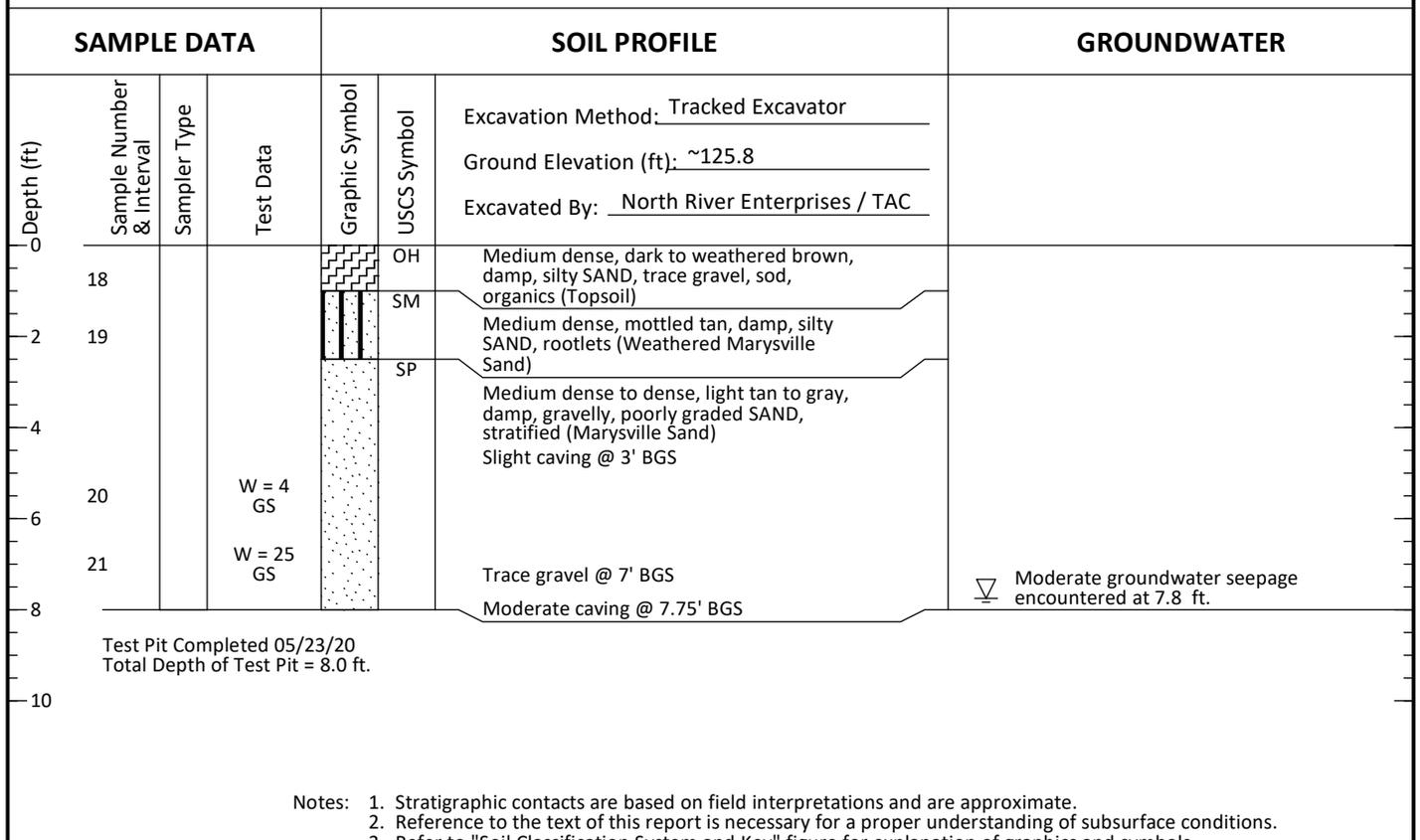
Log of Test Pits

Figure
7

TP-5



TP-6



- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

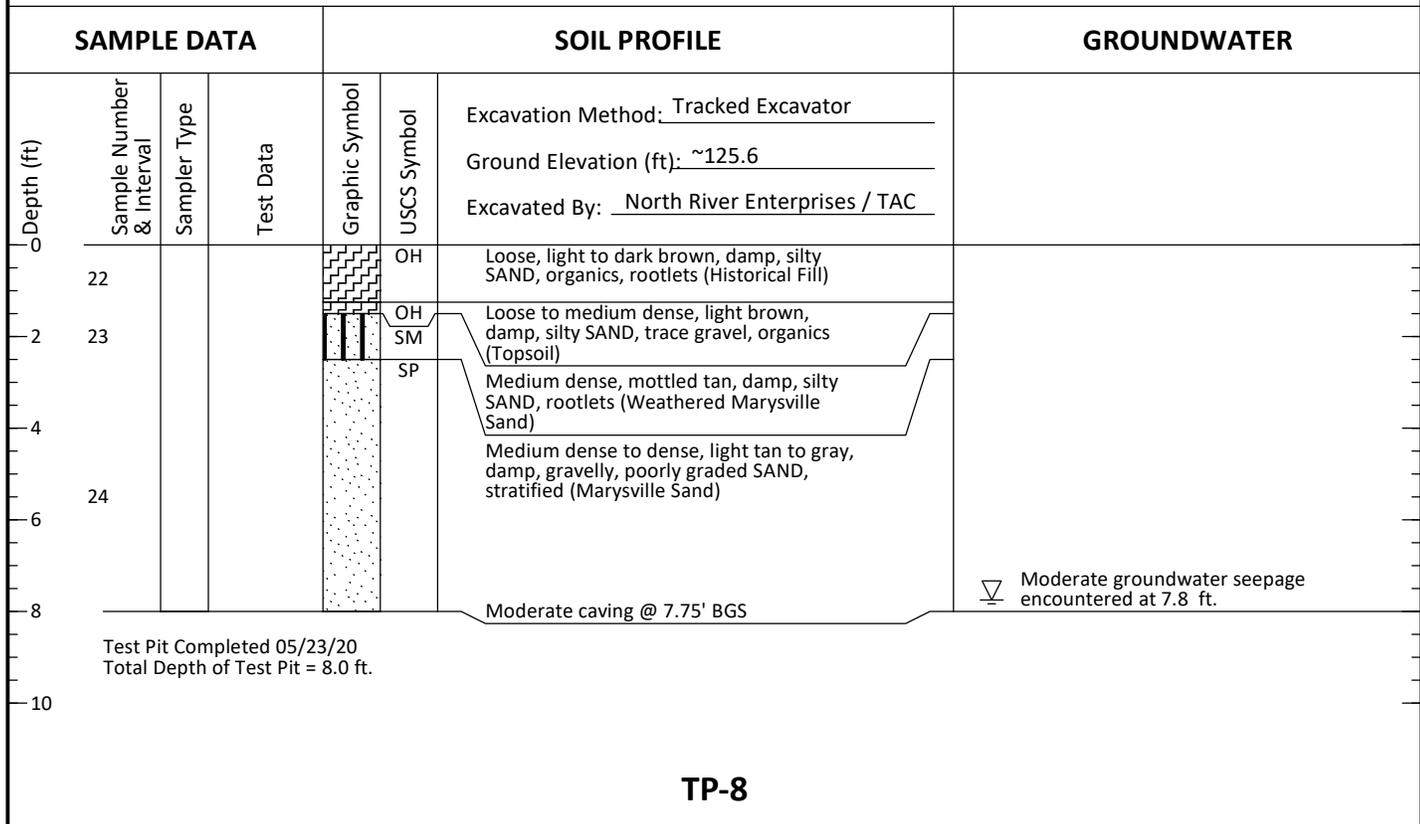


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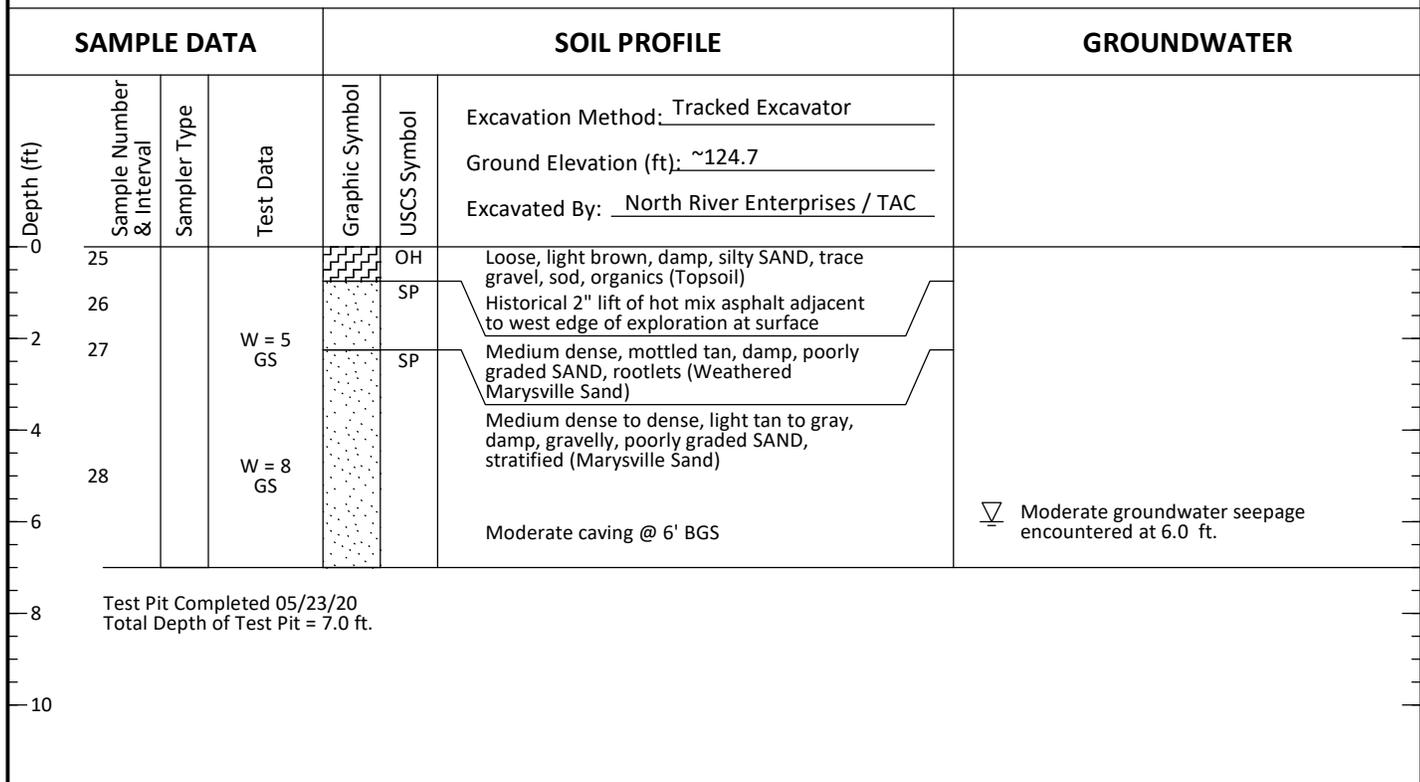
Log of Test Pits

Figure
8

TP-7



TP-8



- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
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Log of Test Pits

Figure
9

TP-9

SAMPLE DATA			SOIL PROFILE		GROUNDWATER		
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: <u>Tracked Excavator</u>	
						Ground Elevation (ft): <u>~124.6</u>	
0						Excavated By: <u>North River Enterprises / TAC</u>	
2					SP	Medium dense, mottled tan, damp, poorly graded SAND, rootlets (Weathered Marysville Sand)	
4					SP	Medium dense to dense, light tan to gray, damp, gravelly, poorly graded SAND, stratified (Marysville Sand)	
6						Moderate caving @ 5.5' BGS	
8	Test Pit Completed 05/23/20 Total Depth of Test Pit = 7.0 ft.					▽	Rapid groundwater seepage encountered at 5.5 ft.
10							

TP-10

SAMPLE DATA			SOIL PROFILE		GROUNDWATER		
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: <u>Tracked Excavator</u>	
						Ground Elevation (ft): <u>~125.4</u>	
0						Excavated By: <u>North River Enterprises / TAC</u>	
29					OH	Loose, light brown, damp, very silty SAND, trace gravel, sod, organics (Topsoil)	
30			W = 17 GS		SM	Medium dense, mottled tan, damp, silty SAND, trace gravel, rootlets (Weathered Marysville Sand)	
31			W = 6 GS		SP	Medium dense to dense, light tan to gray, damp, poorly graded SAND, stratified (Marysville Sand)	
32						Moderate caving @ 2.25' BGS	
8	Test Pit Completed 05/23/20 Total Depth of Test Pit = 8.0 ft.					▽	Moderate groundwater seepage encountered at 7.3 ft.
10							

- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.



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Arlington, WA 98223

Log of Test Pits

Figure
10

TP-11

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
			W = 16 GS		OH	Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~125.5</u> Excavated By: <u>North River Enterprises / TAC</u>
	33				SM	
34		W = 9 GS		SP		
				Moderate caving @ 6.9' BGS		Moderate groundwater seepage encountered at 6.9 ft.
Test Pit Completed 05/23/20 Total Depth of Test Pit = 7.5 ft.						

TP-12

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
					OH	Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~126.1</u> Excavated By: <u>North River Enterprises / TAC</u>
					SM	
				SP		
				Moderate caving @ 7.25' BGS		Moderate groundwater seepage encountered at 7.3 ft.
Test Pit Completed 05/23/20 Total Depth of Test Pit = 8.0 ft.						

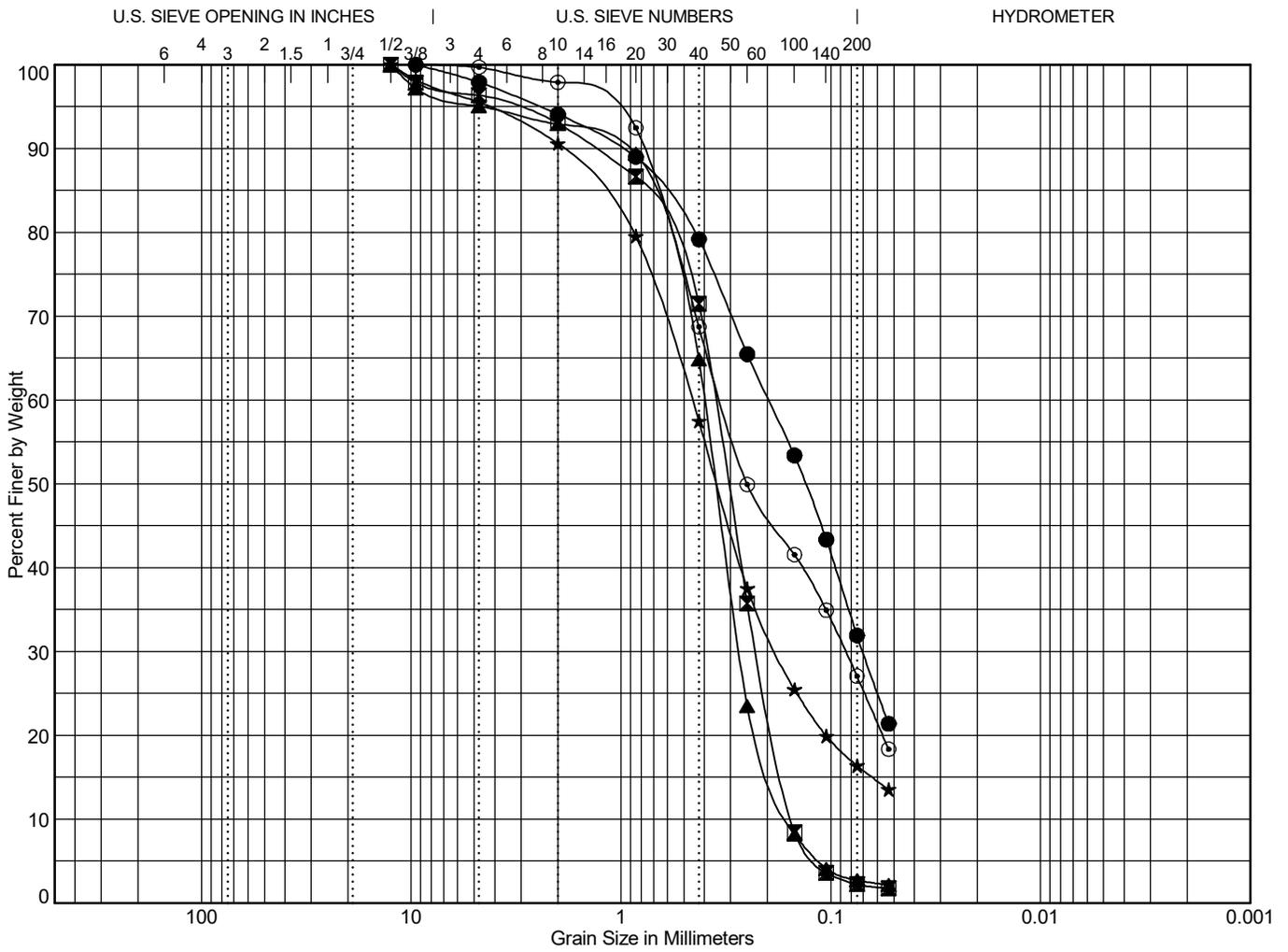
- Notes:
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 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.



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Log of Test Pits

Figure
11



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C _c	C _u
●	TP-1	2.0	Very silty SAND, trace gravel (SM)				
■	TP-2	2.0	POORLY GRADED SAND (SP)			0.91	2.34
▲	TP-2	5.0	POORLY GRADED SAND (SP)			1.17	2.52
★	TP-3	0.4	Silty SAND, trace gravel (SM)				
○	TP-4	1.5	Silty SAND, trace gravel (SM)				

Point	Depth	D ₉₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	TP-1	2.0	1.006	0.198	0.132	0.07						
■	TP-2	2.0	1.332	0.358	0.309	0.224	0.0	3.6	3.3	21.5	69.3	2.2
▲	TP-2	5.0	0.985	0.399	0.351	0.272	0.0	4.9	2.1	28.0	62.1	2.7
★	TP-3	0.4	1.907	0.46	0.348	0.181						
○	TP-4	1.5	0.791	0.332	0.251	0.085	0.0	0.3	1.8	29.2	41.7	27.1

$$C_c = D_{30}^2 / (D_{60} * D_{10})$$

$$C_u = D_{60} / D_{10}$$

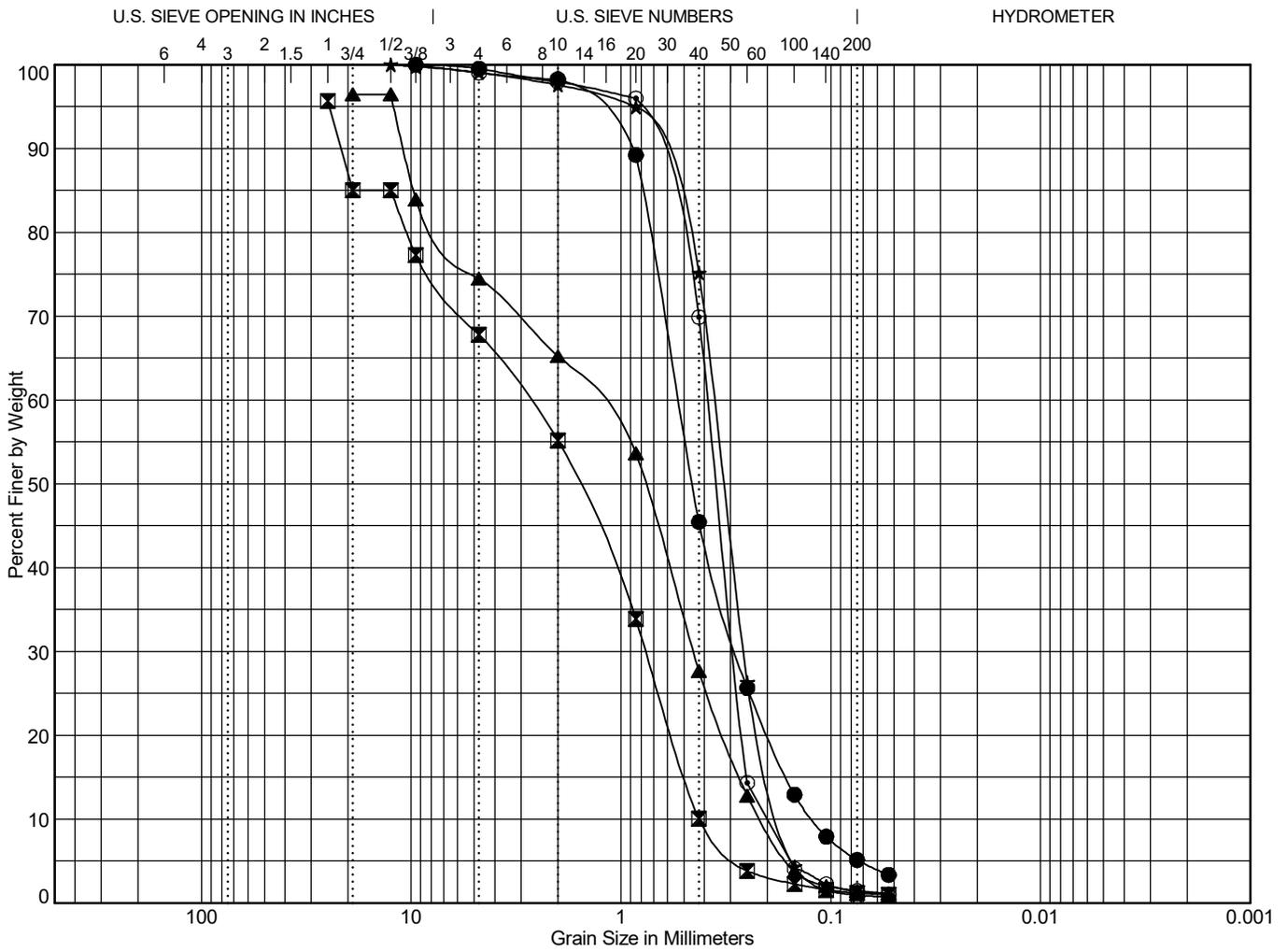
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW



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Arlington, WA 98223

Grain Size Test Data

Figure
12



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C _c	C _u
●	TP-5 2.0	Slightly silty SAND, trace gravel (SP/SM)				1.21	4.41
☒	TP-5 5.3	POORLY GRADED SAND with GRAVEL (SP)				0.49	6.59
▲	TP-6 5.5	POORLY GRADED SAND with GRAVEL (SP)				0.71	6.37
★	TP-6 7.0	POORLY GRADED SAND (SP)				1.10	2.12
◎	TP-8 2.3	POORLY GRADED SAND (SP)				1.09	1.93

Point	Depth	D ₉₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	TP-5 2.0	0.913	0.535	0.457	0.281	0.121	0.0	0.5	1.2	52.8	40.3	5.2
☒	TP-5 5.3	21.601	2.786	1.624	0.759	0.423	10.6	17.3	12.6	45.1	8.8	1.2
▲	TP-6 5.5	10.845	1.357	0.771	0.452	0.213	0.0	22.0	9.2	37.6	26.3	1.4
★	TP-6 7.0	0.714	0.36	0.323	0.26	0.17	0.0	0.9	1.5	22.4	74.2	0.9
◎	TP-8 2.3	0.725	0.387	0.351	0.29	0.201	0.0	1.0	1.1	28.1	68.4	1.5

$$C_c = D_{30}^2 / (D_{60} * D_{10})$$

$$C_u = D_{60} / D_{10}$$

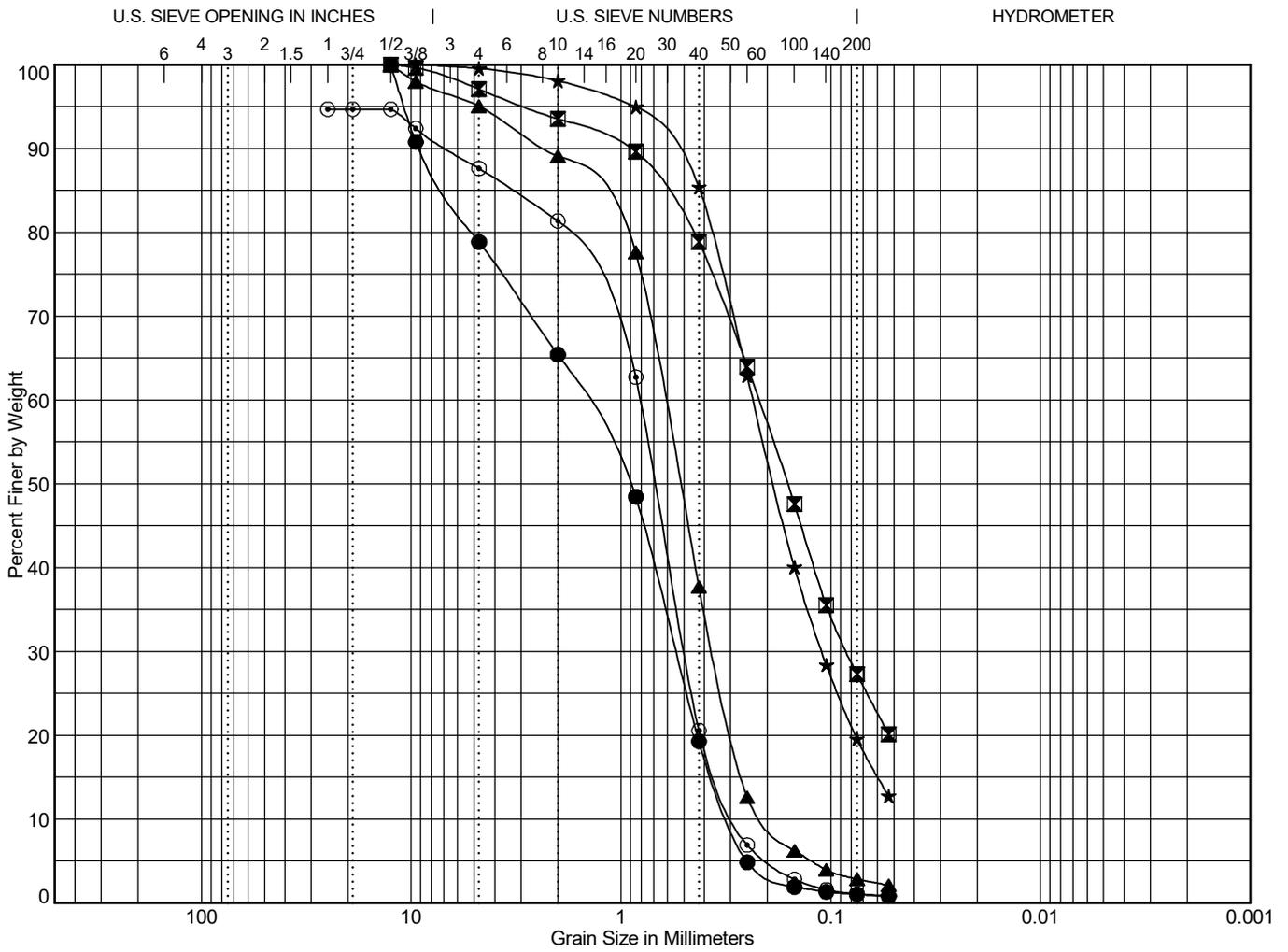
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW



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Grain Size Test Data

Figure
13



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C _c	C _u
●	TP-8 5.0	POORLY GRADED SAND with GRAVEL (SP)				0.65	5.04
☒	TP-10 1.5	Silty SAND, trace gravel (SM)					
▲	TP-10 2.8	POORLY GRADED SAND (SP)				1.03	3.10
★	TP-11 2.0	Silty SAND, trace gravel (SM)					
◎	TP-11 5.5	POORLY GRADED SAND (SP)				1.08	2.88

Point	Depth	D ₉₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	TP-8 5.0	9.065	1.521	0.918	0.548	0.302	0.0	21.1	13.4	46.1	18.2	1.1
☒	TP-10 1.5	0.918	0.22	0.161	0.084		0.0	2.9	3.5	14.7	51.6	27.3
▲	TP-10 2.8	2.282	0.626	0.526	0.361	0.202	0.0	4.9	6.0	51.4	34.9	2.9
★	TP-11 2.0	0.593	0.234	0.187	0.11		0.0	0.4	1.5	12.7	65.8	19.6
◎	TP-11 5.5	6.71	0.813	0.689	0.496	0.282	0.0	7.1	6.3	60.8	19.5	1.0

$$C_c = D_{30}^2 / (D_{60} * D_{10})$$

$$C_u = D_{60} / D_{10}$$

To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW



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Grain Size Test Data

Figure
14

Appendix A:

Northwest Agricultural Consultants Laboratory Results





**Northwest Agricultural
Consultants**

2545 W Falls Avenue
Kennewick, WA 99336
509.783.7450
www.nwag.com
lab@nwag.com

PAP-Accredited



GeoTest Services Inc.
741 Marine Drive
Bellingham, WA 98225

Report: 51638-1-1
Date: May 27, 2020
Project No: 20-0458
Project Name: Arlington Airport Business
Park

Sample ID	pH	Organic Matter	Cation Exchange Capacity
TP-1 @ 0.5'	6.9	2.89%	8.8 meq/100g
TP-3 @ 2.2'	6.1	2.93%	6.9 meq/100g
TP-4 @ 0.5'	6.0	5.07%	10.9 meq/100g
TP-4 @ 1.5'	6.1	1.94%	5.3 meq/100g
TP-7 @ 2.0'	6.1	1.56%	3.1 meq/100g
TP-8 @ 1.25'	6.0	2.43%	6.0 meq/100g
TP-10 @ 0.5'	5.6	5.19%	10.4 meq/100g
Method	SM 4500-H⁺ B	ASTM D2974	EPA 9081

Appendix B:

In-Situ Engineering Cone Penetrometer Logs

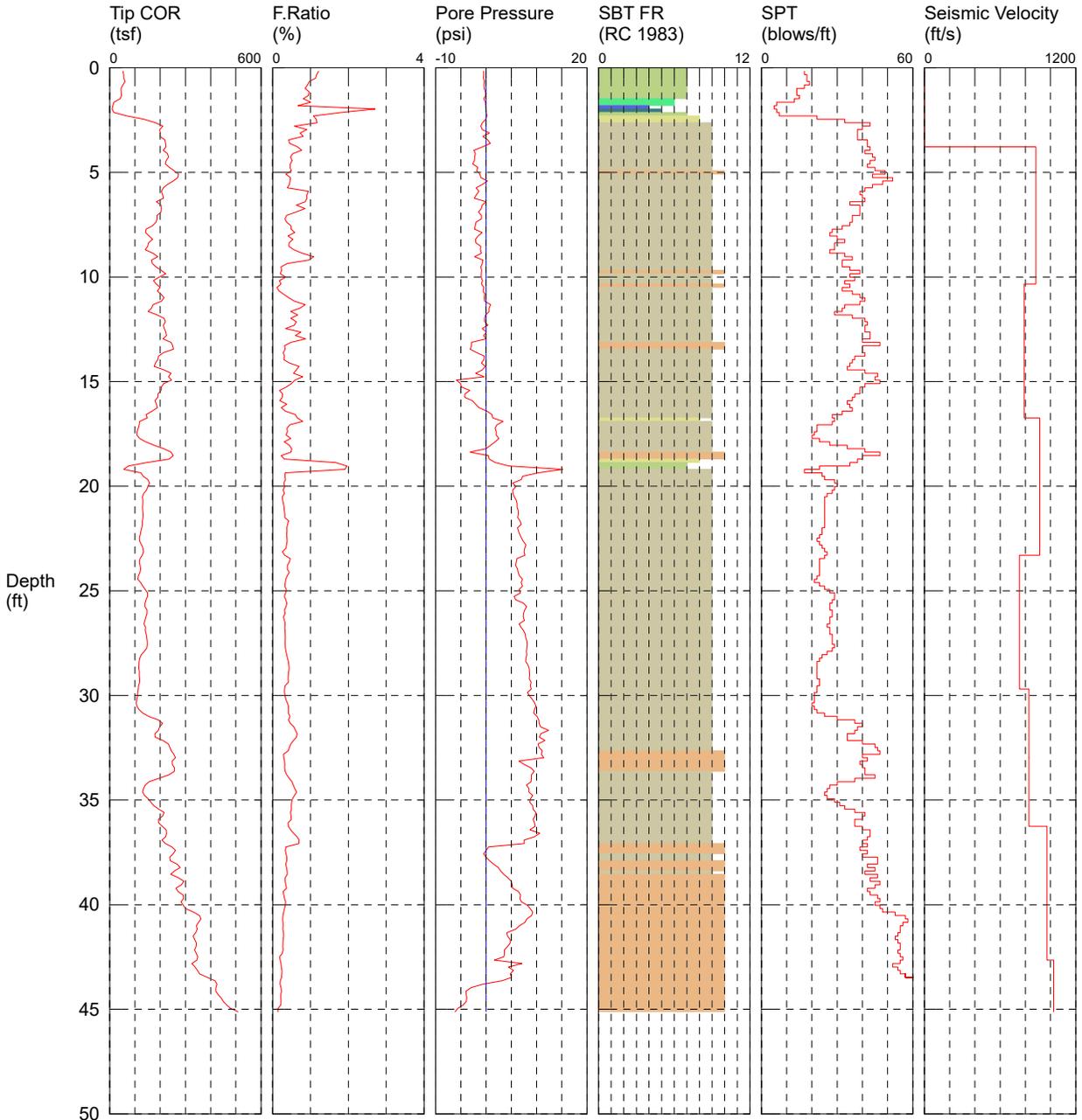




sCPT-01

CPT Contractor: In Situ Engineering
 CUSTOMER: GeoTest Services
 LOCATION: Arlington
 JOB NUMBER: 20-0458
 NOTES: Refused at 550 TSF,
 lifting truck

OPERATOR: Mayfield
 CONE ID: DDG1263
 TEST DATE: 5/26/2020 9:29:22 AM
 Predrill:
 Backfill: 20% Bentonite Slurry
 Surface Patch:



COMMENT:

- | | | | |
|---|---|--|--|
| <ul style="list-style-type: none"> ■ 1 sensitive fine grained ■ 2 organic material ■ 3 clay | <ul style="list-style-type: none"> ■ 4 silty clay to clay ■ 5 clayey silt to silty clay ■ 6 sandy silt to clayey silt | <ul style="list-style-type: none"> ■ 7 silty sand to sandy silt ■ 8 sand to silty sand ■ 9 sand | <ul style="list-style-type: none"> ■ 10 gravelly sand to sand ■ 11 very stiff fine grained (*) ■ 12 sand to clayey sand (*) |
|---|---|--|--|

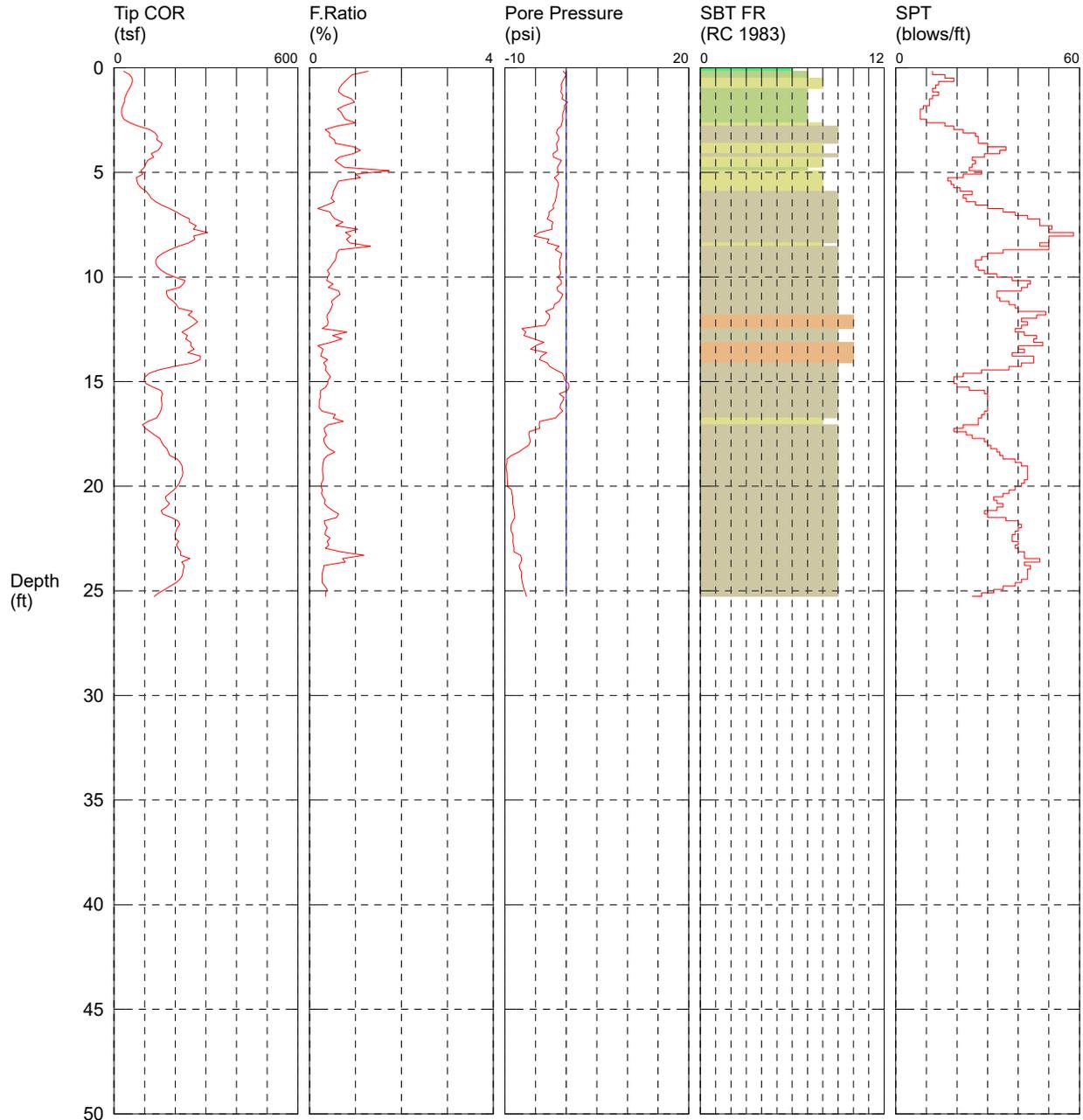
*SBT/SPT CORRELATION: UBC-1983



CPT-02

CPT Contractor: In Situ Engineering
 CUSTOMER: GeoTest Services
 LOCATION: Arlington
 JOB NUMBER: 20-0458

OPERATOR: Mayfield
 CONE ID: DDG1263
 TEST DATE: 5/26/2020 11:09:27 AM
 Predrill:
 Backfill: 20% Bentonite Slurry
 Surface Patch:



COMMENT:

- | | | | |
|---|---|--|--|
| <ul style="list-style-type: none"> ■ 1 sensitive fine grained ■ 2 organic material ■ 3 clay | <ul style="list-style-type: none"> ■ 4 silty clay to clay ■ 5 clayey silt to silty clay ■ 6 sandy silt to clayey silt | <ul style="list-style-type: none"> ■ 7 silty sand to sandy silt ■ 8 sand to silty sand ■ 9 sand | <ul style="list-style-type: none"> ■ 10 gravelly sand to sand ■ 11 very stiff fine grained (*) ■ 12 sand to clayey sand (*) |
|---|---|--|--|

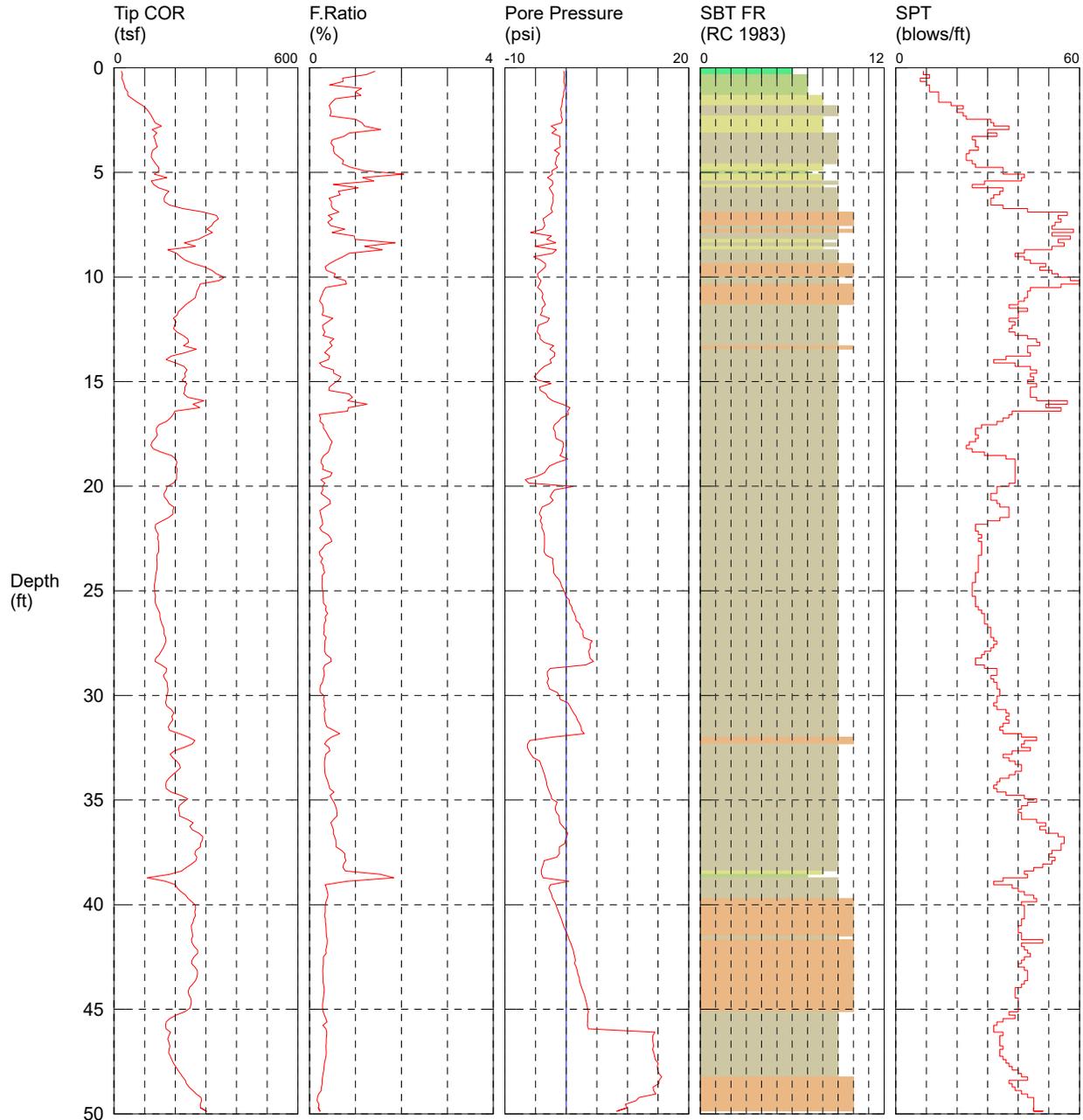
*SBT/SPT CORRELATION: UBC-1983



CPT-03

CPT Contractor: In Situ Engineering
 CUSTOMER: GeoTest Services
 LOCATION: Arlington
 JOB NUMBER: 20-0458

OPERATOR: Mayfield
 CONE ID: DDG1263
 TEST DATE: 5/26/2020 11:42:39 AM
 Predrill:
 Backfill: 20% Bentonite Slurry
 Surface Patch:



COMMENT:

- | | | | |
|---|---|--|--|
| <ul style="list-style-type: none"> ■ 1 sensitive fine grained ■ 2 organic material ■ 3 clay | <ul style="list-style-type: none"> ■ 4 silty clay to clay ■ 5 clayey silt to silty clay ■ 6 sandy silt to clayey silt | <ul style="list-style-type: none"> ■ 7 silty sand to sandy silt ■ 8 sand to silty sand ■ 9 sand | <ul style="list-style-type: none"> ■ 10 gravelly sand to sand ■ 11 very stiff fine grained (*) ■ 12 sand to clayey sand (*) |
|---|---|--|--|

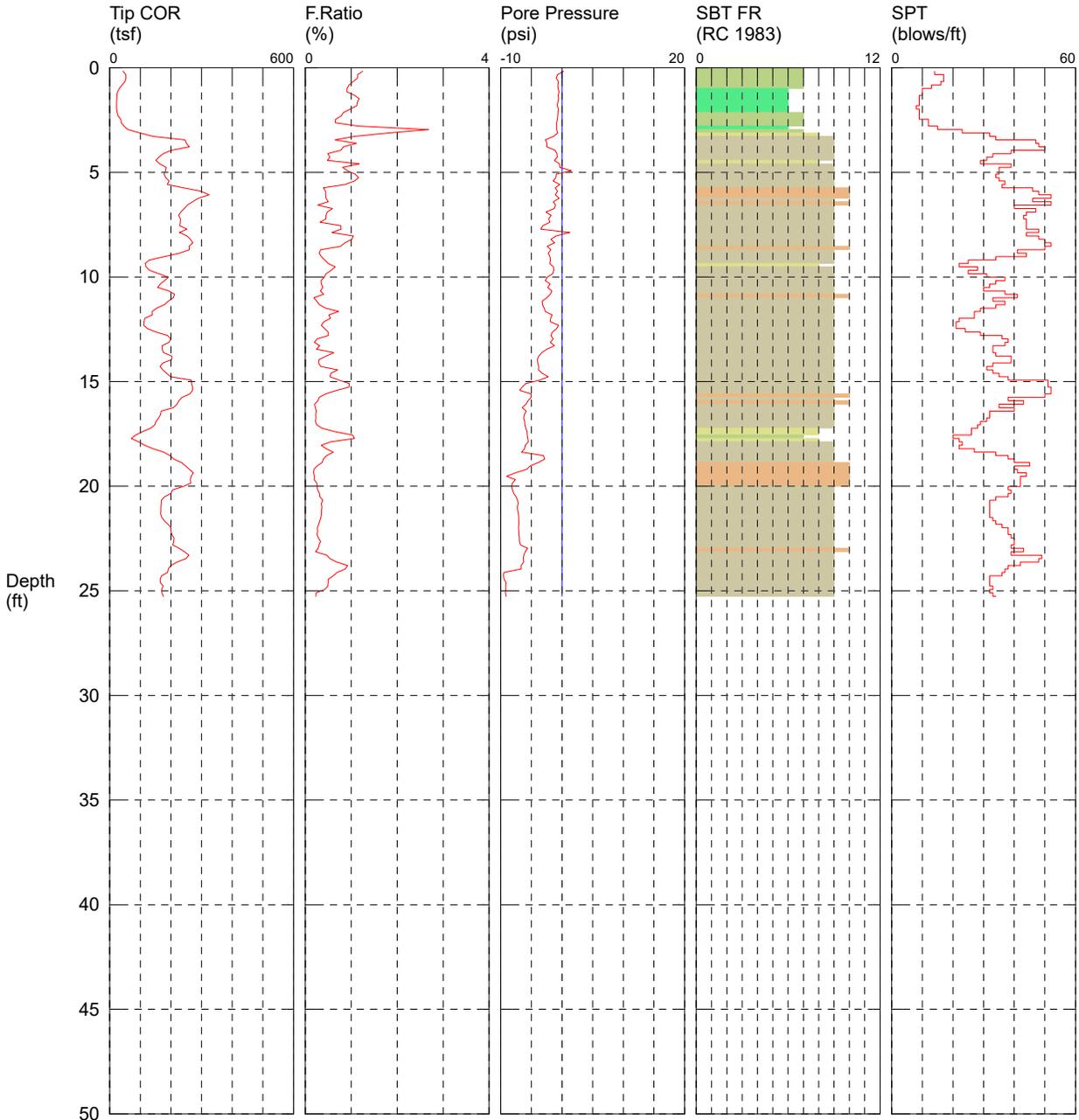
*SBT/SPT CORRELATION: UBC-1983



CPT-04

CPT Contractor: In Situ Engineering
 CUSTOMER: GeoTest Services
 LOCATION: Arlington
 JOB NUMBER: 20-0458

OPERATOR: Mayfield
 CONE ID: DDG1263
 TEST DATE: 5/26/2020 1:34:04 PM
 Predrill:
 Backfill: 20% Bentonite Slurry
 Surface Patch:



COMMENT:

- | | | | |
|--------------------------|-----------------------------|----------------------------|--------------------------------|
| 1 sensitive fine grained | 4 silty clay to clay | 7 silty sand to sandy silt | 10 gravelly sand to sand |
| 2 organic material | 5 clayey silt to silty clay | 8 sand to silty sand | 11 very stiff fine grained (*) |
| 3 clay | 6 sandy silt to clayey silt | 9 sand | 12 sand to clayey sand (*) |

*SBT/SPT CORRELATION: UBC-1983

Appendix C:

Liquefaction Analysis

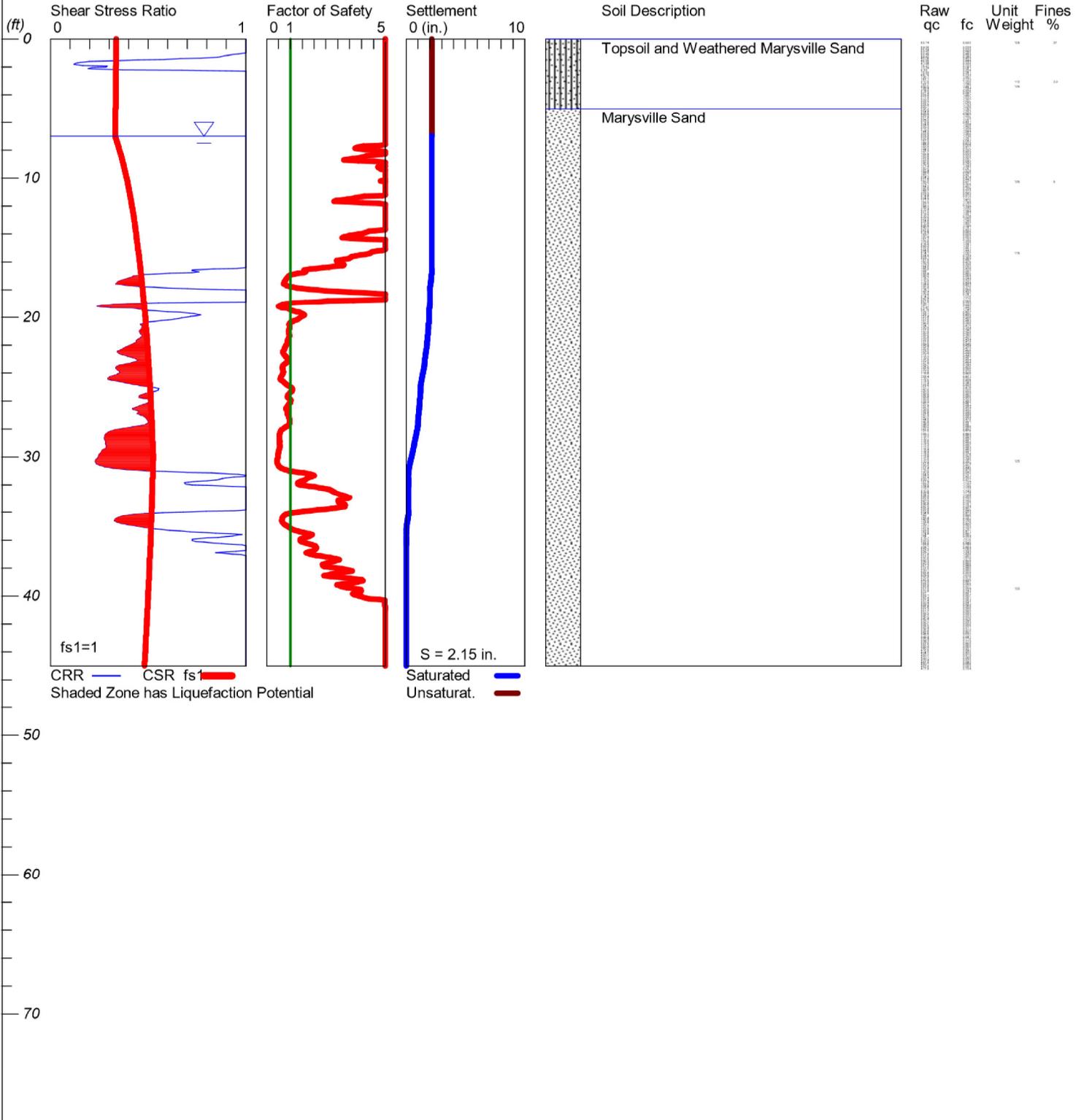


LIQUEFACTION ANALYSIS

SMARTCAP Airport Business Park

Hole No.=CPT-1 Water Depth=7 ft

Magnitude=7
Acceleration=0.517g



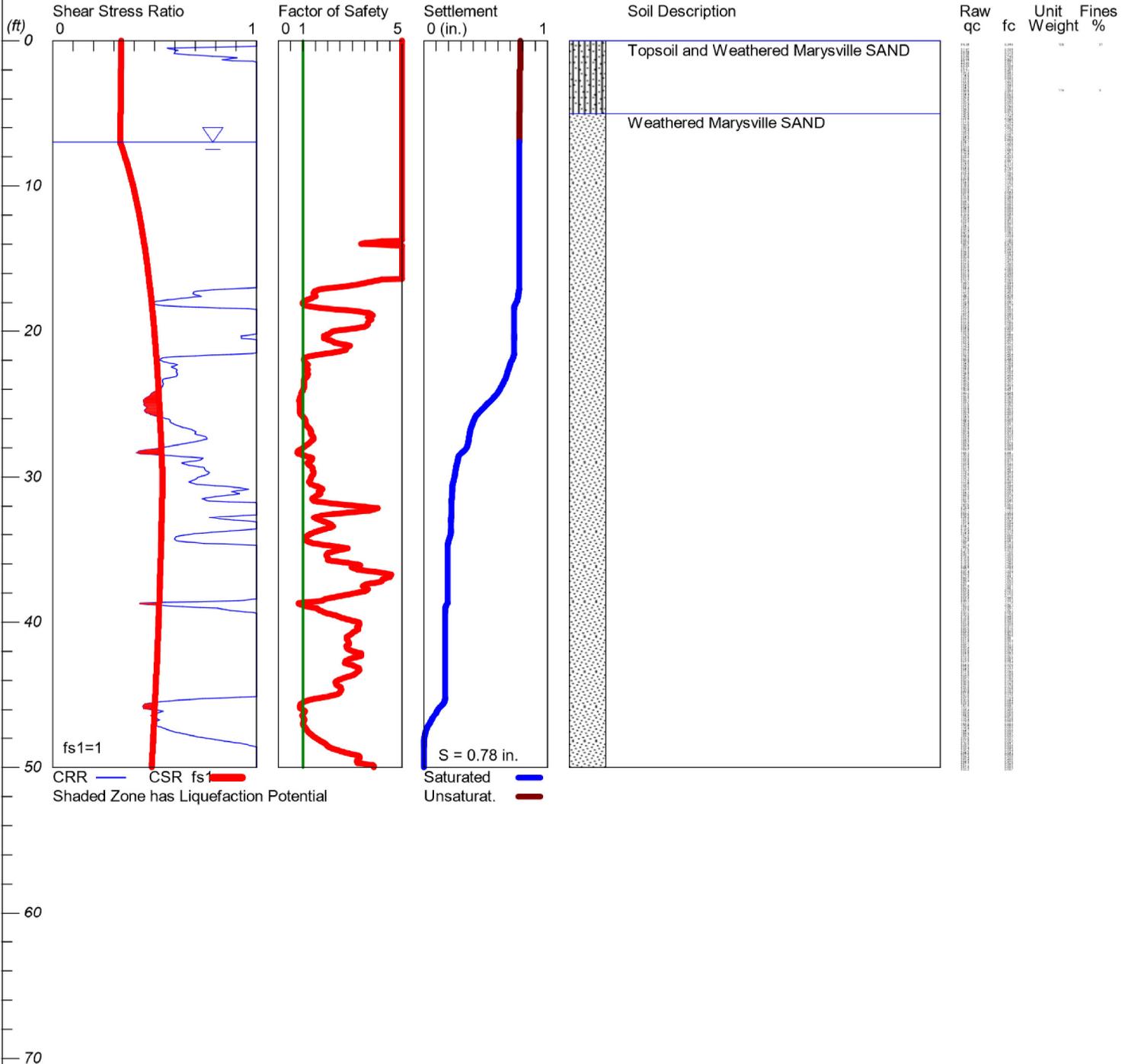
LiquefyPro CivilTech Software USA www.civiltech.com

LIQUEFACTION ANALYSIS

SMARTCAP

Hole No.=CPT-3 Water Depth=7 ft

**Magnitude=7
Acceleration=0.517g**



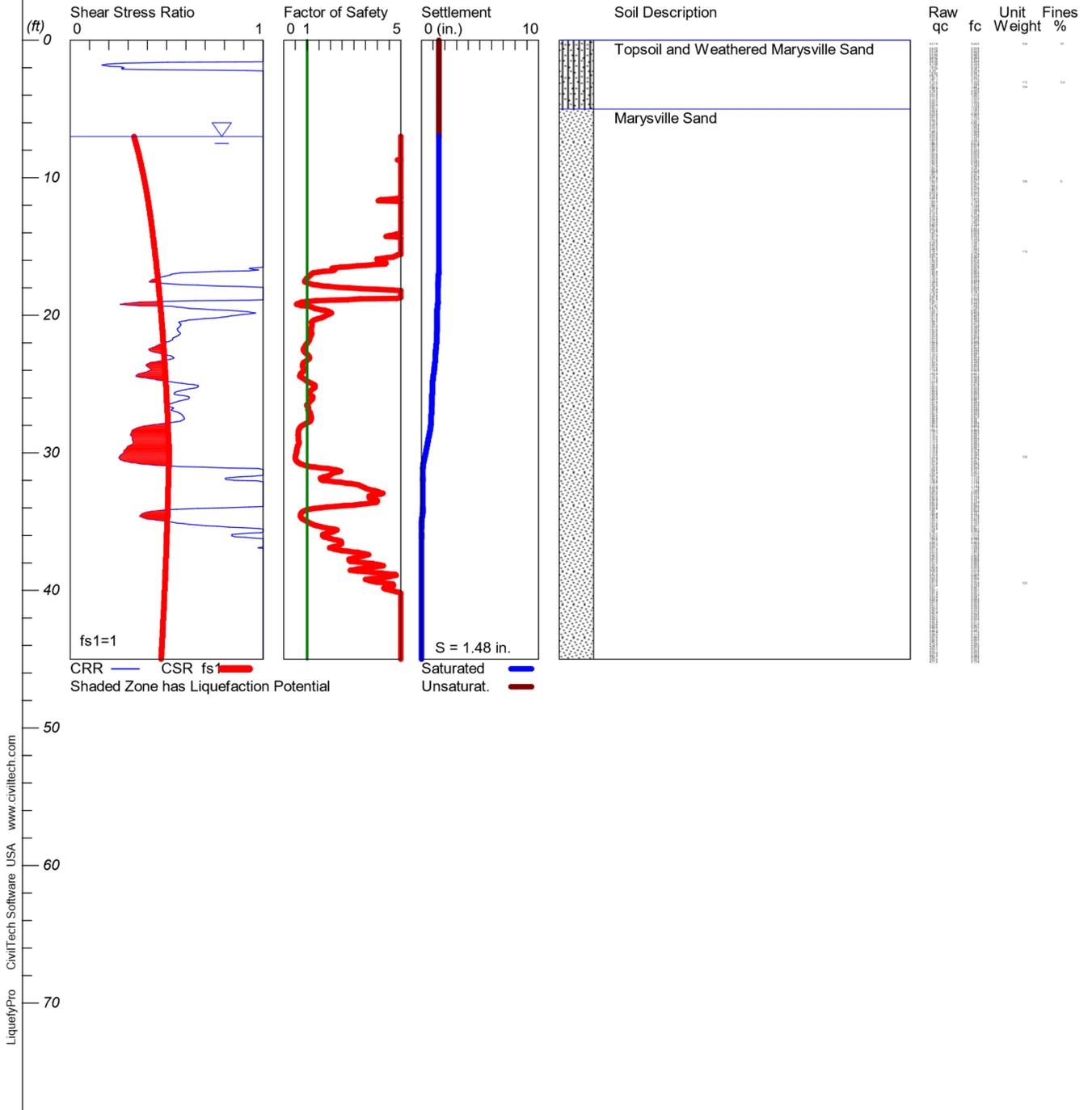
LiquefyPro CivilTech Software USA www.civiltech.com

LIQUEFACTION ANALYSIS

SMARTCAP Airport Business Park

Hole No.=CPT-1 Water Depth=7 ft
Ground Improvement of Fill=1 ft

Magnitude=7
Acceleration=0.517g



LiquefyPro CivilTech Software USA www.civiltech.com

Appendix D:

Report Limitations and Guidelines





REPORT LIMITATIONS AND GUIDELINES FOR ITS USE¹

Subsurface issues may cause construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help:

Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

At GeoTest our geotechnical engineers and geologists structure their services to meet specific needs of our clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of an owner, a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineer who prepared it. And no one – not even you – should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

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

GeoTest's geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the clients goals, objectives, and risk management preferences; the general nature of the structure involved its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless GeoTest, who conducted the study specifically states otherwise, do not rely on a geotechnical engineering report that was:

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



Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed, for example, from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed construction,
- alterations in drainage designs; or
- composition of the design team; the passage of time; man-made alterations and construction whether on or adjacent to the site; or by natural alterations and events, such as floods, earthquakes or groundwater fluctuations; or project ownership.

Always inform GeoTest's geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. Do not rely on the findings and conclusions of this report, whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact GeoTest before applying the report to determine if it is still relevant. A minor amount of additional testing or analysis will help determine if the report remains applicable.

Most Geotechnical and Geologic Findings are Professional Opinions

Our site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoTest's engineers and geologists review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in your report. Retaining GeoTest who developed this report to provide construction observation is the most effective method of managing the risks associated with anticipated or unanticipated conditions.



A Report's Recommendations are Not Final

Do not over-rely on the construction recommendations included in this report. Those recommendations are not final, because geotechnical engineers or geologists develop them principally from judgment and opinion. GeoTest's geotechnical engineers or geologists can finalize their recommendations only by observing actual subsurface conditions revealed during construction. GeoTest cannot assume responsibility or liability for the report's recommendations if our firm does not perform the construction observation.

A Geotechnical Engineering or Geologic Report may be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. Lower that risk by having GeoTest confer with appropriate members of the design team after submitting the report. Also, we suggest retaining GeoTest to review pertinent elements of the design teams plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having GeoTest participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do not Redraw the Exploration Logs

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

Give Contractors a Complete Report and Guidance

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



In addition, it is recommended that a contingency for unanticipated conditions be included in your project budget and schedule.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering or geology is far less exact than other engineering disciplines. This lack of understanding can create unrealistic expectations that can lead to disappointments, claims, and disputes. To help reduce risk, GeoTest includes an explanatory limitations section in our reports. Read these provisions closely. Ask questions and we encourage our clients or their representative to contact our office if you are unclear as to how these provisions apply to your project.

Environmental Concerns Are Not Covered in this Geotechnical or Geologic Report

The equipment, techniques, and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated containments, etc. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. Do not rely on environmental report prepared for some one else.

Obtain Professional Assistance to Deal with Biological Pollutants

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts biological pollutants from growing on indoor surfaces. Biological pollutants includes but is not limited to molds, fungi, spores, bacteria and viruses. To be effective, all such strategies should be devised for the express purpose of prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional biological pollutant prevention consultant. Because just a small amount of water or moisture can lead to the development of severe biological infestations, a number of prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of this study, the geotechnical engineer or geologist in charge of this project is not a biological pollutant prevention consultant; none of the services performed in connection with this geotechnical engineering or geological study were designed or conducted for the purpose of preventing biological infestations.

Stormwater Infiltration Assessment

Arlington Airport Business Park

Prepared For:

SMARTCAP Opportunity Zone Fund II, LLC
8201 164th Avenue NE, Suite 110
Redmond, WA 98052

Attn.: Mr. Robert Shipley,
Lead Asset Manager



1.888.251.5276
Bellingham | Arlington | Oak Harbor
www.geotest-inc.com

June 24, 2020
Project No. 20-0458

SMARTCAP Opportunity Zone Fund II, LLC
8201 164th Avenue NE, Suite 110
Redmond, WA 98052

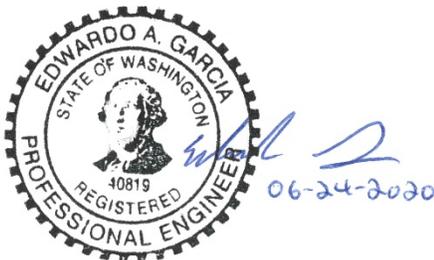
Attention: Mr. Robert Shipley
Lead Asset Manager

**Regarding: Stormwater Infiltration Assessment
Pilot Infiltration Testing**
Arlington Airport Business Park
Northwest Corner of 172nd Street NE and 51st Avenue NE
Arlington, WA 98223

Dear Mr. Shipley:

As requested, GeoTest Services, Inc. [GeoTest] is pleased to submit the following report summarizing the results of our stormwater infiltration assessment for the proposed Arlington Airport Business Park located near the intersection of 172nd Street NE and 51st Avenue NE in Arlington, Washington (Vicinity Map, Figure 1). This report has been prepared in general accordance with the terms and conditions established in our services agreement dated June 4, 2020. We appreciate the opportunity to provide geotechnical services on this project and look forward to assisting you during further geotechnical, design, and construction phases. Should you have any questions regarding the information contained within the report, or if we may be of service in other regards, please contact the undersigned.

Respectfully,
GeoTest Services, Inc.



Edwardo Garcia, P.E.
Geotechnical Department Manager



Ryan Z Mullen
Project Geologist

Enclosure: Stormwater Infiltration Assessment



TABLE OF CONTENTS

PURPOSE AND SCOPE OF SERVICES.....1

PROJECT DESCRIPTION1

SITE CONDITIONS.....1

 Surface Conditions 1

 Subsurface Soil Conditions 3

 General Geologic Conditions..... 4

 Groundwater..... 4

CONCLUSIONS AND RECOMMENDATIONS5

 Stormwater Infiltration Potential..... 5

 Design Infiltration Rates 7

 Planned Stormwater Facilities 8

 Stormwater Treatment..... 8

 Geotechnical Consultation and Construction Monitoring 9

USE OF THIS REPORT9

REFERENCES10

PURPOSE AND SCOPE OF SERVICES

The purpose of this service is to perform four Pilot Infiltration Tests to establish general subsurface conditions beneath the site from which conclusions and recommendations pertaining to stormwater infiltration feasibility can be formulated. Our scope of services includes the following tasks:

- Perform four Pilot Infiltration Tests (PITs) on the project site, two in the southwest corner and two in the northeast corner, in accordance with the *Stormwater Management Manual for Western Washington (SWMMWW)*.
- Provide a written report containing a description of subsurface conditions, present long-term infiltration rates based on the PIT results, and to summarize our findings and recommendations pertaining to stormwater design recommendations.

PROJECT DESCRIPTION

GeoTest previously prepared a Geotechnical Engineering Report for the proposed development planned at the property dated May 29, 2020. Our report presented initial subsurface soil information regarding the project site but excluded PITs as part of our contracted services. At the request of the Civil Engineer, GeoTest performed the PITs to confirm infiltration concepts at locations specified by the design team.

SITE CONDITIONS

This section includes a description of the general surface and subsurface conditions observed at the project site during the time of our field investigation. Interpretations of site conditions are based on the results and review of available information, site reconnaissance, subsurface explorations, laboratory testing and previous experience in the project vicinity.

Surface Conditions

The surface conditions that were observed on the subject property were unchanged from our last site visit. GeoTest conducted four PITs at two locations on the subject property. PIT-1 and PIT-2 were conducted in the southwest portion of the site and PIT-3 and PIT-4 were conducted in the northeast portion of the site. The surface cover at both tested locations consisted of grassy open fields.



Image 1: Existing surface conditions at the subject property. Testing of PIT-3 and PIT-4 in progress. (Images taken on June 11 - 12, 2020.)



Image 2: Setup of Pilot Infiltration Test prior to pre-soak period. A self-logging sensor was using in conjunction with manual measurements to record water depth in the pit.



Image 3: Pilot Infiltration Test in progress. The cumulative volume and instantaneous flow rate in gallons per minutes were recorded throughout the duration of the testing.

Subsurface Soil Conditions

Subsurface conditions were explored in each of the four Pilot Infiltration Tests (PIT-1 through PIT-4) on June 11 through 12, 2020. The PIT testing program was designed to evaluate infiltration rates at 1-foot and 3 feet of separation between the bottom of the infiltration facility and the regional groundwater table. Prior to testing, test pits were dug near each PIT location to confirm the depth to groundwater. PIT-1 and PIT-3 were then advanced to a depth of 3.0 and 4.25 feet below ground surface (BGS) and maintained a separation of 3 feet from the groundwater table. PIT-2 and PIT-4 were advanced to a depth of 5.0 and 6.25 feet BGS, maintaining a separation of 1 foot from the groundwater table. The approximate location of the PITs are shown in the *Site and Exploration Plan* (Figure 2) of this report.

The on-site subsurface soils encountered in the PIT test explorations were generally consistent with the soils encountered in our previous explorations. The near-surface soils consisted of approximately 0.75 to 1.0 feet silty, sandy, topsoil. Approximately 1 foot of slightly silty, gravelly, sand, interpreted to be weather Marysville Sand, was encountered beneath the topsoil. Below, the weathered Marysville Sand transitioned into poorly graded, stratified layers of sand and gravel. GeoTest interpreted these soils to be unweathered Marysville Sand. These deposits typically had higher densities with lower silt contents. The bases of all PITs exposed the native unweathered Marysville Sand.

More detailed logs of the subsurface conditions encountered at the exploration locations are presented in the PIT Logs (Figures 12 and 13) attached at the end of this report.

General Geologic Conditions

Geologic information for the project site was obtained from the *Geologic Map of Arlington West 7.5-minute quadrangle, Snohomish County Washington* (Minard, 1985) published by the U.S. Geological Survey. According to the map, the subject property is underlain by the Marysville Sand Member (map unit Qvrm) of the Vashon Drift Recessional Outwash. The Marysville Sand Member consists of mostly well-drained, outwash sand with minor amounts of gravel. Sediment was deposited as valley fill by meltwater flowing south from the stagnating and receding Vashon glacier during the Pleistocene.

Our on-site exploration indicates that the encountered subsurface soil conditions are generally in accordance with the mapped Marysville Sand Member (Qvrm). For the purpose of this report, the recessional outwash is referred to as 'Marysville sand'.

Groundwater

At the time of our investigation on June 11 and 12, 2020, groundwater was encountered at depths of 6.0 feet BGS in the southwest portion of the site and at 7.0 feet BGS in the northeastern portion of the site. GeoTest roughly interpreted the groundwater elevation to be 118 feet, based on field review of the topographic plan provided to us. These elevations were not surveyed and it should be expected that actual, surveyed groundwater elevations may differ slightly than what is listed in this report.

The groundwater table encountered is representative of a regional groundwater condition and part of the shallow recessional outwash (Marysville Sand) aquifer system. Shallow aquifers contained within Marysville Sand are often continuous and occur atop the surface of the underlying glacial till that can be found at depth. Fluctuations in the water table occur seasonally with precipitation and groundwater level are expected to be their highest in late winter to early spring.

The groundwater conditions reported on the exploration logs are for the specific locations and dates indicated, and therefore may not be indicative of other locations and/or times. Groundwater levels are variable and groundwater conditions will fluctuate depending on local subsurface conditions, precipitation, and changes in on-site and off-site use. At the time of this report, GeoTest Services is not performing concurrent groundwater monitoring in accordance with the SWMMWW wet season requirements in order to determine seasonal variations for civil design.

CONCLUSIONS AND RECOMMENDATIONS

This report constitutes a stormwater infiltration evaluation for design purposes. The below recommended rates are intended to inform the stormwater facility engineer of feasibility and potential design rates. Our final recommended design rates will be based on calculations performed in this report. GeoTest recommends that we review and confirm soils types at the base of the final infiltration facility location during construction. Additional infiltration tests should be conducted at the final infiltration facility locations during the construction phase in order to confirm that design rates are attained.

Stormwater Infiltration Potential

GeoTest performed four small-scale Pilot Infiltration Tests (PITs) between June 11 and 12, 2020 per the *SWMMWW* in order to determine the initial saturated hydraulic conductivity rate (K_{sat} initial) in inches per hour. The base of all four PITs were excavated to the dimensions of approximately 8.5 feet by 7.5 feet with a depth ranging from 3 to 6 feet below ground surface (BGS). PITs were conducted at various depths below the ground surface in order to evaluate the infiltration potential at a 1-foot and 3-foot separation between the bottom of the proposed infiltration facility and the regional groundwater table. The bottom of all four PITs extended through the existing topsoil horizon and weathered material into the native Marysville Sand.

Infiltration testing was conducted by discharging water into the flat-bottom excavation for a 6-hour "soaking period". The purpose of the 6-hour pre-soak was to allow the soils in the immediate vicinity of the test area to exhibit saturated conditions. Water was discharged into the excavation at a metered rate while keeping the water level within the testing area approximately fixed. The cumulative volume and instantaneous flow rate in gallons per minutes were recorded approximately every 15 to 30 minutes. Data recorded during the last hour of the steady-state period was used to calculate the infiltration rate. Water for the infiltration testing was obtained from Municipal hydrant.

Following the 6-hour pre-soak and steady-state period, the water was shutoff at the hydrant and the rate of infiltration (the drop of the standing water) in inches per hour was recorded until fully drained.

At the conclusion of the testing, the bottoms of the PITs were excavated an additional 1-3 feet, down to the regional groundwater table, to identify possible restrictive layers. During the additional over excavation, GeoTest did not observed any noticeable indication of mounding or hydraulically restrictive layers.

Table 1 below presents topographic information for the surface elevations, bottom of PIT elevations, and the regional groundwater table elevations based on available data.

Table 1. PIT Test Elevations

PIT ID	Test Date	Surface Elevation * (ft)	Bottom of PIT Elevation (ft)	Groundwater Elevation (ft)	Groundwater Separation (ft)
PIT-1	6/11/2020	124	121	118	3
PIT-2	6/11/2020	124	119	118	1
PIT-3	6/12/2020	125	121	118	3
PIT-4	6/12/2020	125	119	118	1

*Surface elevation data is approximate and derived from the Snohomish County PDS Map Portal Digital Elevation Model.



Image 4 and 5: Over-excavation of PIT-1 and PIT-2 post infiltration testing. Unweathered Marysville Sand (grey colored material) was encountered below the base of the PITs. Over-excavation was terminated once the regional groundwater table was encountered.

Design Infiltration Rates

The initial, uncorrected hydraulic conductivity (K_{sat} initial) was calculated for each PIT using the infiltration rate recorded during the falling-head test. This is measured as change in depth per 15-minute interval times 4. The K_{sat} initial values are shown in Table 2. GeoTest then determined the corrected, long-term infiltration rate (K_{sat} design) by applying the following correction factors in accordance with the *SWMMWW*:

- Site variability and number of locations tests, $CF_v = 0.8$
- Test method (small-scale test), $CF_t = 0.5$
- Degree of influent control to prevent siltation and bio-buildup, $CF_m = 0.9$.

Table 2 provides a summary of the calculated infiltration rates determined at each PIT location.

Table 2. Calculated Infiltration Rates

PIT ID	K_{sat} Initial (in/hr)	Reduction Factor *	K_{sat} Design (in/hr)
PIT-1	16.54	0.36	5.9
PIT-2	8.07	0.36	2.9
PIT-3	18.31	0.36	6.6
PIT-4	8.44	0.36	3.0
* Total Reduction Factor = (0.80)(0.75)(0.90) = 0.36			

Based on our PIT results and analysis of the subsurface soils, the infiltration rates within the subject site range between 2.9 in/hr to 6.6 in/hr. Higher infiltration rates (5.9in/hr to 6.6 in/hr) were calculated in the PITs designed with a 3-foot separation between the bottom of the PIT and the regional groundwater table. Lower infiltration rates (2.9in/hr to 3.0 in/hr) were observed in the PITs designed with only a 1-foot separation. Furthermore, higher infiltration rates were observed in the northeast corner of the site compared to the southwest corner of the site. Based on the grain size test data, the base of the PITs in the northeast corner of the site contained higher gravel contents which likely supported slightly higher infiltration rates.

From the results shown in Table 2, the Civil Engineer should perform infiltration facility sizing based on the appropriate infiltration rate at representative locations. The Civil Engineer must also design facilities based on the amount of separation between facilities and seasonal groundwater highs. The presented infiltration rates are corrected for site use and take into account the mounding of groundwater due to reduced amounts of vertical separation (either 1 foot or 3 feet) between the bottom of the facility and regional groundwater table.

Planned Stormwater Facilities

It is GeoTest's understanding that the infiltration facility design is in progress. At the time of this report, GeoTest does not have a formal plan or specific information about the size or location of the planned facilities. GeoTest anticipates that infiltration facilities will be spread out across the subject site. GeoTest also anticipates the use of infiltration trenches and rain gardens instead of detention ponds or other similar water-bearing facilities due to the close proximity of the project to the Arlington Municipal Airport.

The PIT locations were selected based on information that was provided to GeoTest by the Civil Engineer, but it should be expected that the final design may vary from initial concepts.

In accordance with SWMMWW, the geotechnical engineer should observe the bottom of all planned infiltration facilities during construction activities to confirm that the exposed soils are as expected. The SWMMWW also recommends that a verification test be performed to confirm that the measured field rate at the time of construction is equal to or greater than the infiltration rate in the approved design. If the measured rates are lower than the design infiltration rate, additional measures to improve the infiltration may be implemented within the footprint of the constructed infiltration facility.

Stormwater Treatment

The proposed stormwater facilities on-site may require some form of pollutant pretreatment with an existing or amended soil prior to on-site infiltration or offsite discharge. The reuse of on-site topsoil is often the most sustainable and cost-effective method for pollutant treatment purposes. Cation exchange capacities, organic contents, and pH of site subsurface soils were tested to determine possible pollutant treatment suitability.

Suitability for the use of onsite soils for pollutant treatment is determined in accordance with SSC-6 of the 2019 SMMWW. Soils with an organic content of greater than or equal to 1 percent and a cation exchange capacity of greater than or equal to 5 meq/100 grams are characterized as suitable for stormwater treatment. Based on the results shown in Table 3 (on the next page), soils within the upper 1.75 feet appear suitable for stormwater treatment. However, the weathered Marysville Sand has elevated silt contents which should be expected to reduce the overall infiltration potential for these soils.

On-site soils can be amended by mixing higher silt content soils or adding mulch (or other admixtures) to elevate the cation exchange capacity and organic contents, if required. On-site amended soil may require additional testing to confirm compliance with ecological regulations. GeoTest is available to perform additional laboratory testing as part of an expanded scope of services if the soil is to be amended. Alternatively, the owner may elect to import amended soils with the desired properties for the planned treatment facilities.

Table 3. Stormwater Treatment Testing Results

PIT ID	Depth (ft)	Geologic Unit	Cation Exchange Capacity (meq/100 grams)	Organic Content	pH
PIT-2	0.50	Topsoil	13.2	7.04	5.8
PIT-2	1.75	Weathered Marysville Sand	5.4	2.08	6.1
PIT-3	1.40	Topsoil	9.1	3.87	6.0
PIT-3	2.70	Weathered Marysville Sand	3.6	1.33	6.4
Notes:					
- 2019 SMMWW SCC-6 Criteria for Treatment: CEC \geq 5.0 meq/100g; Organic Content \geq 1%					

Geotechnical Consultation and Construction Monitoring

GeoTest recommends that we be involved in the project design review process. The purpose of the review is to verify that the recommendations presented in this report are understood and incorporated in the design and specifications.

GeoTest is available to provide a full range of materials testing and special inspection during construction as required by the local building department and the International Building Code. This may include specific construction inspections on materials such as reinforced concrete, reinforced masonry, wood framing and structural steel. These services are supported by our fully accredited materials testing laboratory.

USE OF THIS REPORT

GeoTest Services has prepared this report for the exclusive use of SMARTCAP and their consultants for specific application to the design of the proposed development to be located at the Arlington Airport Business Park in Arlington, Washington. Use of this report by others is at the user's sole risk. This report is not applicable to other site locations. Our services are conducted in accordance with accepted practices of the geotechnical engineering profession; no other warranty, express or implied, is made as to the professional advice included in this report.

Our site explorations indicate subsurface conditions at the dates and locations indicated. It is not warranted that these conditions are representative of conditions at other locations and times. The analyses, conclusions, and recommendations contained in this report are based on site conditions to the limited depth and time of our explorations, a geological reconnaissance of the area, and a review of previously published geological information for the site. If variations in subsurface conditions are encountered during construction that differ from those contained

within this report, GeoTest should be allowed to review the recommendations and, if necessary, make revisions. If there is a substantial lapse of time between submission of this report and the start of construction, or if conditions change due to construction operations at or adjacent to the project site, we recommend that we review this report to determine the applicability of the conclusions and recommendations contained herein.

The earthwork contractor is responsible to perform all work in conformance with all applicable WISHA/OSHA regulations. GeoTest Services, Inc. is not responsible for job site safety on this project, and this responsibility is specifically disclaimed.

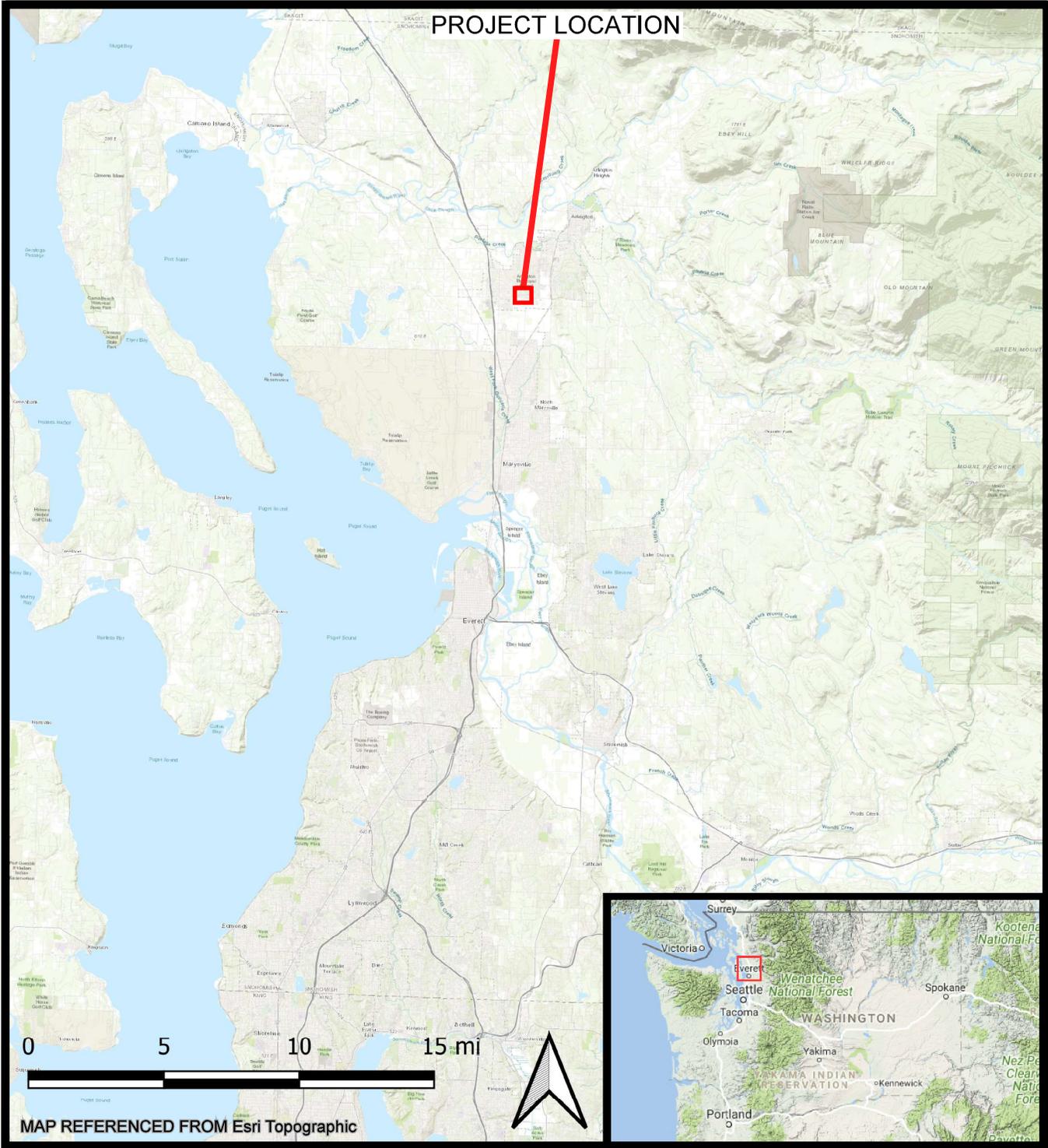
Attachments: Figure 1	Vicinity Map
Figure 2	Site and Exploration Plan
Figure 3	Typical Foot and Wall Drain Section
Figure 4	Typical Utility Trench Section
Figure 5	Soil Classification System and Key
Figures 6-11	Log of Test Pits
Figures 12-13	Log of Pilot Infiltration Tests
Figures 14-19	Grain Size Test Data
Attached	CEC, pH, OC Test Results
Attached	Report Limitations and Guidelines

REFERENCES

Minard, J.P., 1985, Geologic map of the Arlington West 7.5-minute quadrangle, Snohomish County, Washington, scale 1:24,000.: U.S. Geological Survey, Miscellaneous Field Studies Map MF-1740

Bakeman, S., Dan, G., Howie, D., Killelea, J., Labib, F., & Ed, O. (n.d.). 2012 Stormwater Management Manual for Western Washington, as Amended in December 2014 (The 2014 SWMMWW) (pp. 1-1042) (United States, Washington State Department of Ecology).

Washington Geologic Information Portal. (n.d.). Retrieved June 2020, from <https://geologyportal.dnr.wa.gov/>

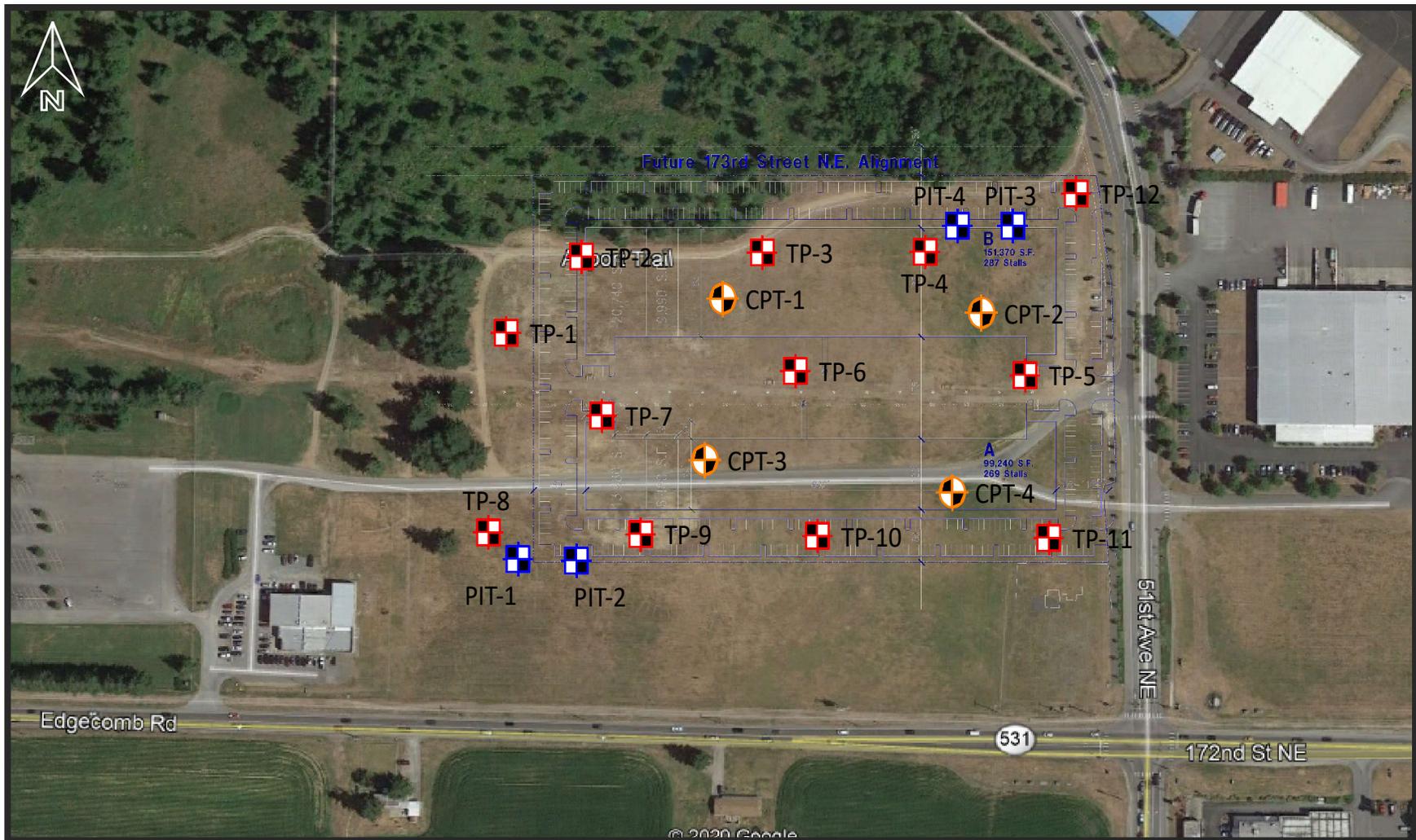


Date: 5-20-2020 By: TAC Scale: As Shown

VICINITY MAP
ARLINGTON AIRPORT BUSINESS PARK
NORTHWEST CORNER OF 172ND ST. NE & 51ST AVE. NE
ARLINGTON, WA 98223

Project
20-0458

Figure
1



SITE PLAN PROVIDED BY LANCE MUELLER & ASSOCIATES
 AERIAL IMAGERY TAKEN FROM GOOGLE MAPS

LEGEND

-  TP-# = Approximate Excavated Test Pit Location
-  PIT-# = Approximate Pilot Infiltration Test Location
-  CPT-# = Approximate Cone Penetrometer Test Location



Date: 6-12-2020

By: TAC

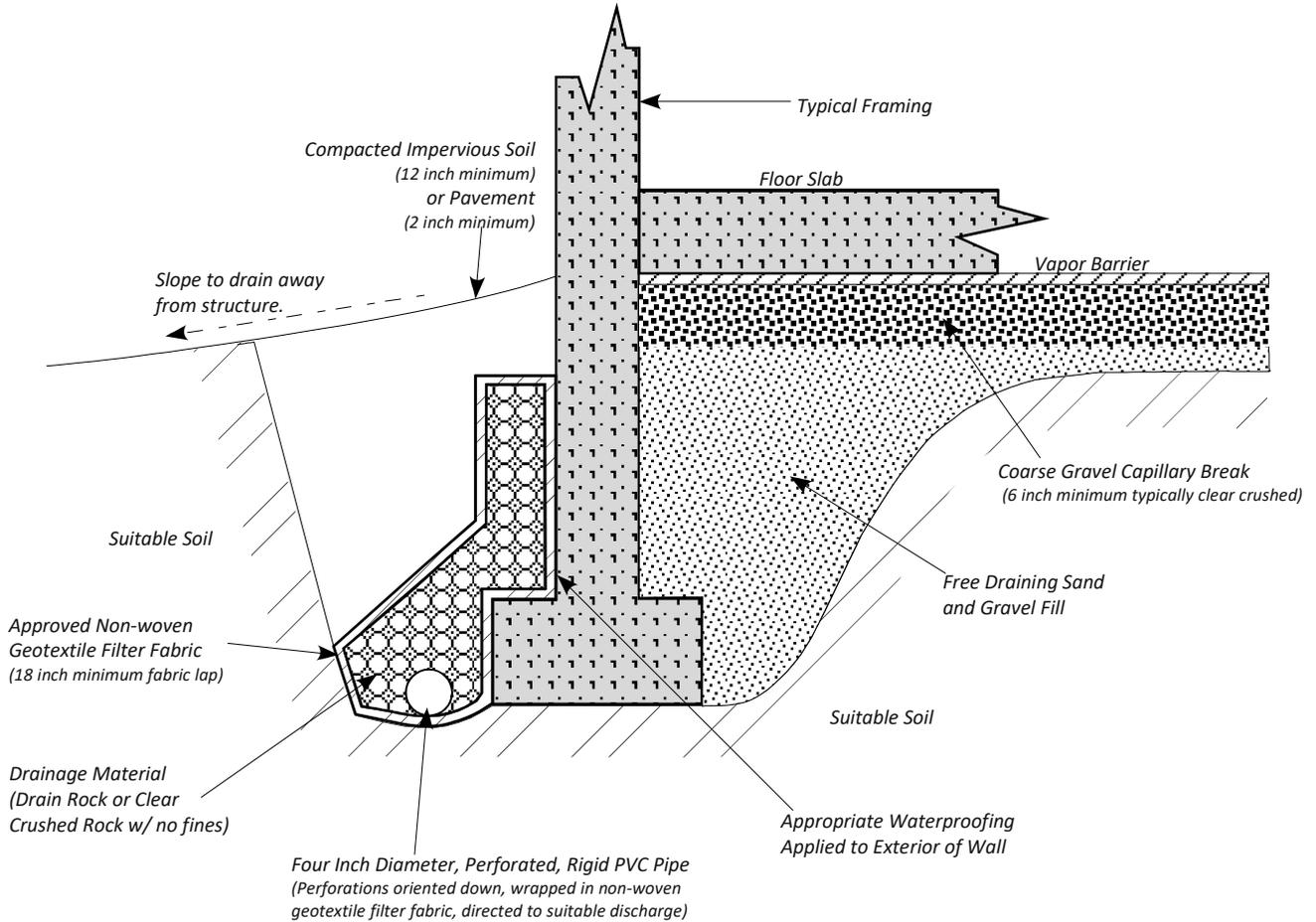
Scale: NTS

SITE AND EXPLORATION PLAN
ARLINGTON AIRPORT BUSINESS PARK
NORTHWEST CORNER OF 172ND ST. NE & 51ST AVE. NE
ARLINGTON, WA 98223

Project
20-0458

Figure
2

SHALLOW FOOTINGS WITH INTERIOR SLAB-ON-GRADE



Notes:

Footings Should be properly buried for frost protection in accordance with International Building Code or local building codes
(Typically 18 inches below exterior finished grades)

The footing drain will need to be modified from this typical drawing to fit the dimensions of the planned footing and slab configuration



Date: 05.26.2020

By: TAC

Scale: None

Project

TYPICAL FOOTING & WALL DRAIN SECTION

20-0458

ARLINGTON AIRPORT BUSINESS PARK

Figure

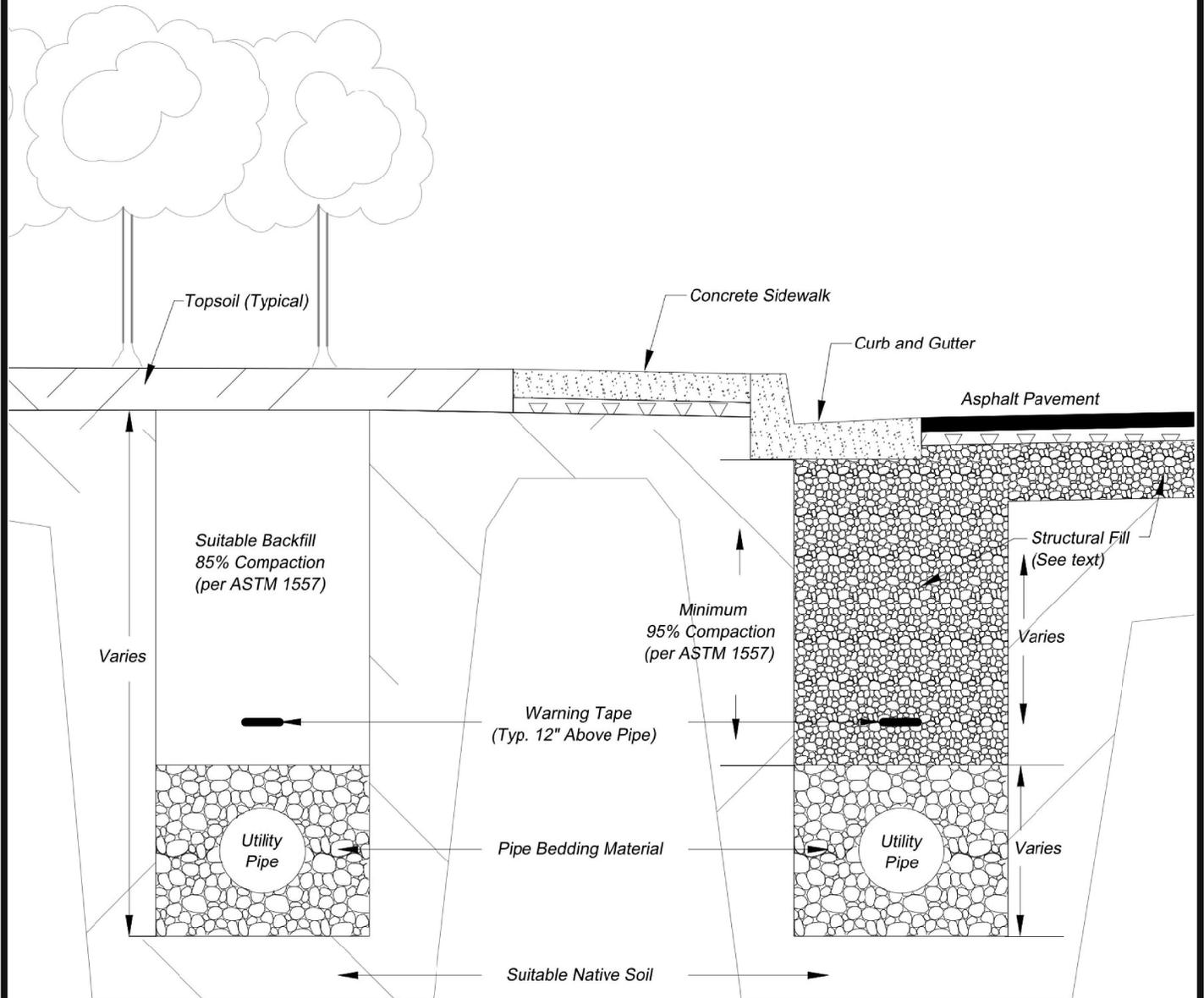
NORTHWEST CORNER OF 172ND ST. NE & 51ST AVE. NE

3

ARLINGTON, WA 98223

LANDSCAPING AREAS

LOAD BEARING AREAS



Date: 05.26.2020

By: TAC

Scale: None

Project

TYPICAL UTILITY TRENCH SECTION
 ARLINGTON AIRPORT BUSINESS PARK
 NORTHWEST CORNER OF 172ND ST. NE & 51ST AVE. NE
 ARLINGTON, WA 98223

20-0458

Figure

4

Soil Classification System

	MAJOR DIVISIONS	CLEAN GRAVEL (Little or no fines)	GRAPHIC SYMBOL	USCS LETTER SYMBOL	TYPICAL DESCRIPTIONS ⁽¹⁾⁽²⁾
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SP	Poorly graded sand; gravelly sand; little or no fines
				SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)		ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity	
			CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay	
			OL	Organic silt; organic, silty clay of low plasticity	
	SILT AND CLAY (Liquid limit greater than 50)		MH	Inorganic silt; micaceous or diatomaceous fine sand	
			CH	Inorganic clay of high plasticity; fat clay	
			OH	Organic clay of medium to high plasticity; organic silt	
	HIGHLY ORGANIC SOIL		PT	Peat; humus; swamp soil with high organic content	

OTHER MATERIALS	GRAPHIC SYMBOL	USCS LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

Notes: 1. Soil descriptions are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D 2487.

2. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

- Primary Constituent: > 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
- Secondary Constituents: > 30% and ≤ 50% - "very gravelly," "very sandy," "very silty," etc.
- > 12% and ≤ 30% - "gravelly," "sandy," "silty," etc.
- Additional Constituents: > 5% and ≤ 12% - "slightly gravelly," "slightly sandy," "slightly silty," etc.
- ≤ 5% - "trace gravel," "trace sand," "trace silt," etc., or not noted.

Drilling and Sampling Key	Field and Lab Test Data																																										
<p>SAMPLE NUMBER & INTERVAL SAMPLER TYPE</p> <div style="display: flex; align-items: center;"> <table border="0" style="font-size: small;"> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">Description</th> </tr> <tr> <td>a</td> <td>3.25-inch O.D., 2.42-inch I.D. Split Spoon</td> </tr> <tr> <td>b</td> <td>2.00-inch O.D., 1.50-inch I.D. Split Spoon</td> </tr> <tr> <td>c</td> <td>Shelby Tube</td> </tr> <tr> <td>d</td> <td>Grab Sample</td> </tr> <tr> <td>e</td> <td>Other - See text if applicable</td> </tr> <tr> <td>1</td> <td>300-lb Hammer, 30-inch Drop</td> </tr> <tr> <td>2</td> <td>140-lb Hammer, 30-inch Drop</td> </tr> <tr> <td>3</td> <td>Pushed</td> </tr> <tr> <td>4</td> <td>Other - See text if applicable</td> </tr> </table> </div>	Code	Description	a	3.25-inch O.D., 2.42-inch I.D. Split Spoon	b	2.00-inch O.D., 1.50-inch I.D. Split Spoon	c	Shelby Tube	d	Grab Sample	e	Other - See text if applicable	1	300-lb Hammer, 30-inch Drop	2	140-lb Hammer, 30-inch Drop	3	Pushed	4	Other - See text if applicable	<table border="0" style="font-size: small;"> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">Description</th> </tr> <tr> <td>PP = 1.0</td> <td>Pocket Penetrometer, tsf</td> </tr> <tr> <td>TV = 0.5</td> <td>Torvane, tsf</td> </tr> <tr> <td>PID = 100</td> <td>Photoionization Detector VOC screening, ppm</td> </tr> <tr> <td>W = 10</td> <td>Moisture Content, %</td> </tr> <tr> <td>D = 120</td> <td>Dry Density, pcf</td> </tr> <tr> <td>-200 = 60</td> <td>Material smaller than No. 200 sieve, %</td> </tr> <tr> <td>GS</td> <td>Grain Size - See separate figure for data</td> </tr> <tr> <td>AL</td> <td>Atterberg Limits - See separate figure for data</td> </tr> <tr> <td>GT</td> <td>Other Geotechnical Testing</td> </tr> <tr> <td>CA</td> <td>Chemical Analysis</td> </tr> </table>	Code	Description	PP = 1.0	Pocket Penetrometer, tsf	TV = 0.5	Torvane, tsf	PID = 100	Photoionization Detector VOC screening, ppm	W = 10	Moisture Content, %	D = 120	Dry Density, pcf	-200 = 60	Material smaller than No. 200 sieve, %	GS	Grain Size - See separate figure for data	AL	Atterberg Limits - See separate figure for data	GT	Other Geotechnical Testing	CA	Chemical Analysis
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<p>Groundwater</p> <p> Approximate water elevation at time of drilling (ATD) or on date noted. Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.</p>																																											



Arlington Airport
Business Park
Arlington, WA 98223

Soil Classification System and Key

Figure
5

TP-1

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
						Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~126.0</u> Excavated By: <u>North River Enterprises / TAC</u>
0					OH	Loose, light brown, damp, silty SAND, trace gravel, sod, organics (Topsoil)
1			W = 22 GS		OH	Medium dense, weathered tan to light orange, damp, silty SAND, rootlets (Historic Fill)
2						Medium dense, light red/orange to purple, damp, very silty SAND, trace gravel, rootlets (Relict Topsoil)
3						Medium dense to dense, light tan, damp, slightly silty SAND, trace gravel, rootlets (Weathered Marysville Sand)
4						12" of penetration with a 3/8" steel T-probe @ 3' BGS
5						Dense, gray, moist, slightly silty, gravelly SAND, stratified (Marysville Sand)
6						Moderate caving @ 6.5' BGS
8						▽ Moderate groundwater seepage encountered at 8.0 ft.
10	Test Pit Completed 05/23/20					

TP-2

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
						Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~125.5</u> Excavated By: <u>North River Enterprises / TAC</u>
0					OH	Dense, dark brown, damp, gravelly, very silty SAND, sod, organics (Compacted Topsoil)
1			W = 5 GS		SP	Medium dense, weathered tan, damp, poorly graded SAND, rootlets (Weathered Marysville Sand)
2						Dense, light gray, damp, poorly graded SAND, stratified (Marysville Sand)
3			W = 10 GS			"12" of penetration with a 3/8" steel T-probe @ 4' BGS
4						Transitions to wet at 6' BGS
5						Moderate caving @ 6.5' BGS
6						▽ Moderate groundwater seepage encountered at 6.5 ft.
8	Test Pit Completed 05/23/20 Total Depth of Test Pit = 7.0 ft.					

- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.



Arlington Airport
Business Park
Arlington, WA 98223

Log of Test Pits

Figure
6

TP-3

SAMPLE DATA			SOIL PROFILE		GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
0						Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~126.3</u> Excavated By: <u>North River Enterprises / TAC</u>
9			W = 14 GS		OH	Medium dense, dark brown to tan, damp, silty SAND, trace gravel, sod, organics (Topsoil)
10					SP	Medium dense, weathered tan, damp, poorly graded SAND, rootlets (Weathered Marysville Sand)
11					SP	Dense, light gray, damp, slightly gravelly, poorly graded SAND, stratified (Marysville Sand)
6						Moderate caving @ 6.75' BGS
8						▽ Moderate groundwater seepage encountered at 7.8 ft.
10	Test Pit Completed 05/23/20 Total Depth of Test Pit = 8.0 ft.					

TP-4

SAMPLE DATA			SOIL PROFILE		GROUNDWATER	
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
0						Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~125.7</u> Excavated By: <u>North River Enterprises / TAC</u>
12			W = 12 GS		OH	Loose, light brown, damp, silty SAND, trace gravel, sod, organics (Topsoil)
13					SM	Loose to medium dense, mottled tan, damp, silty SAND, trace gravel, rootlets (Weathered Marysville Sand)
14					SP/SM	Medium dense, light tan to gray, damp, slightly silty, gravelly SAND, stratified (Marysville Sand) Slight caving @ 2.75' BGS
6						Moderate caving @ 7.25' BGS
8						▽ Moderate groundwater seepage encountered at 7.3 ft.
10	Test Pit Completed 05/23/20 Total Depth of Test Pit = 8.0 ft.					

- Notes:
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 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

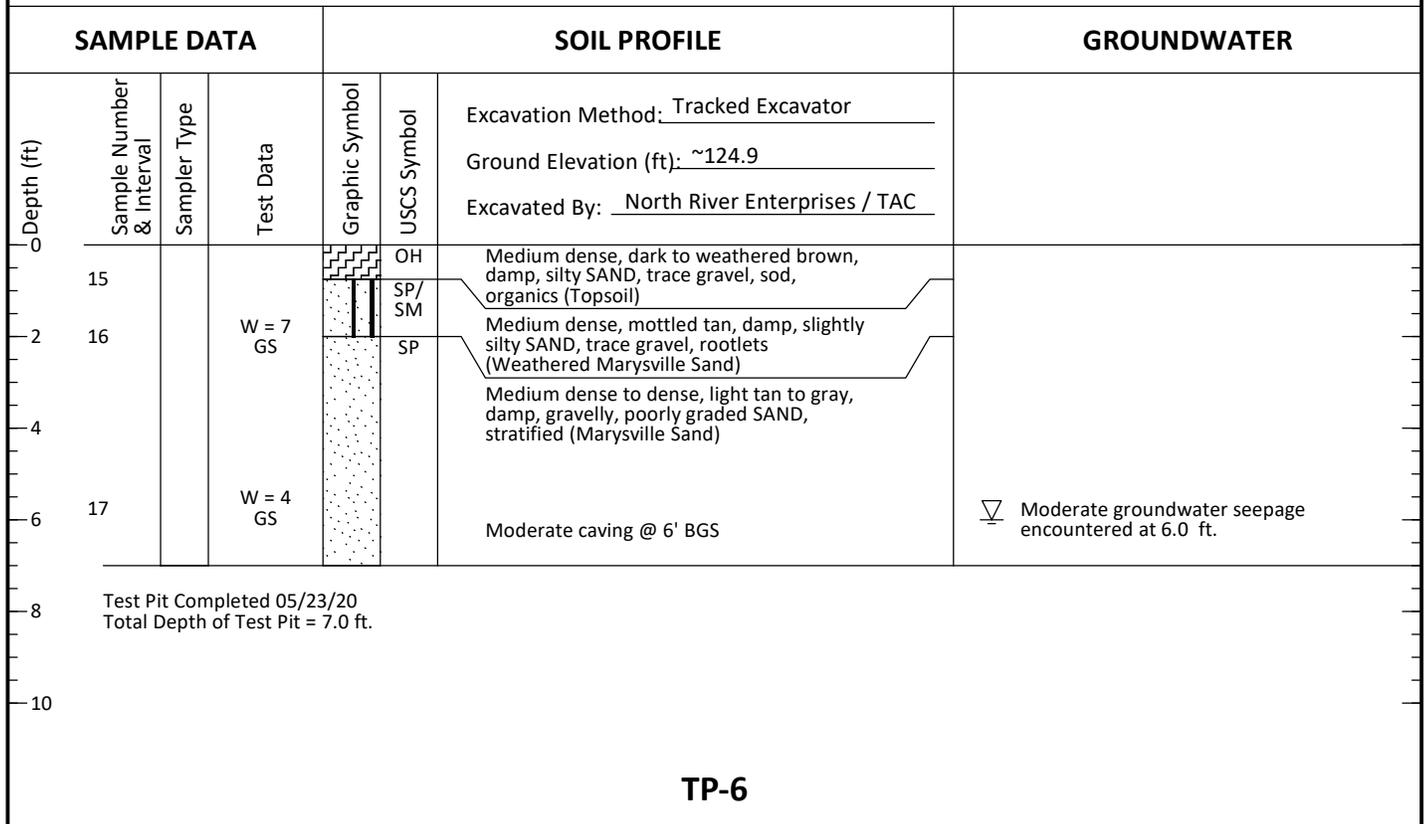


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Arlington, WA 98223

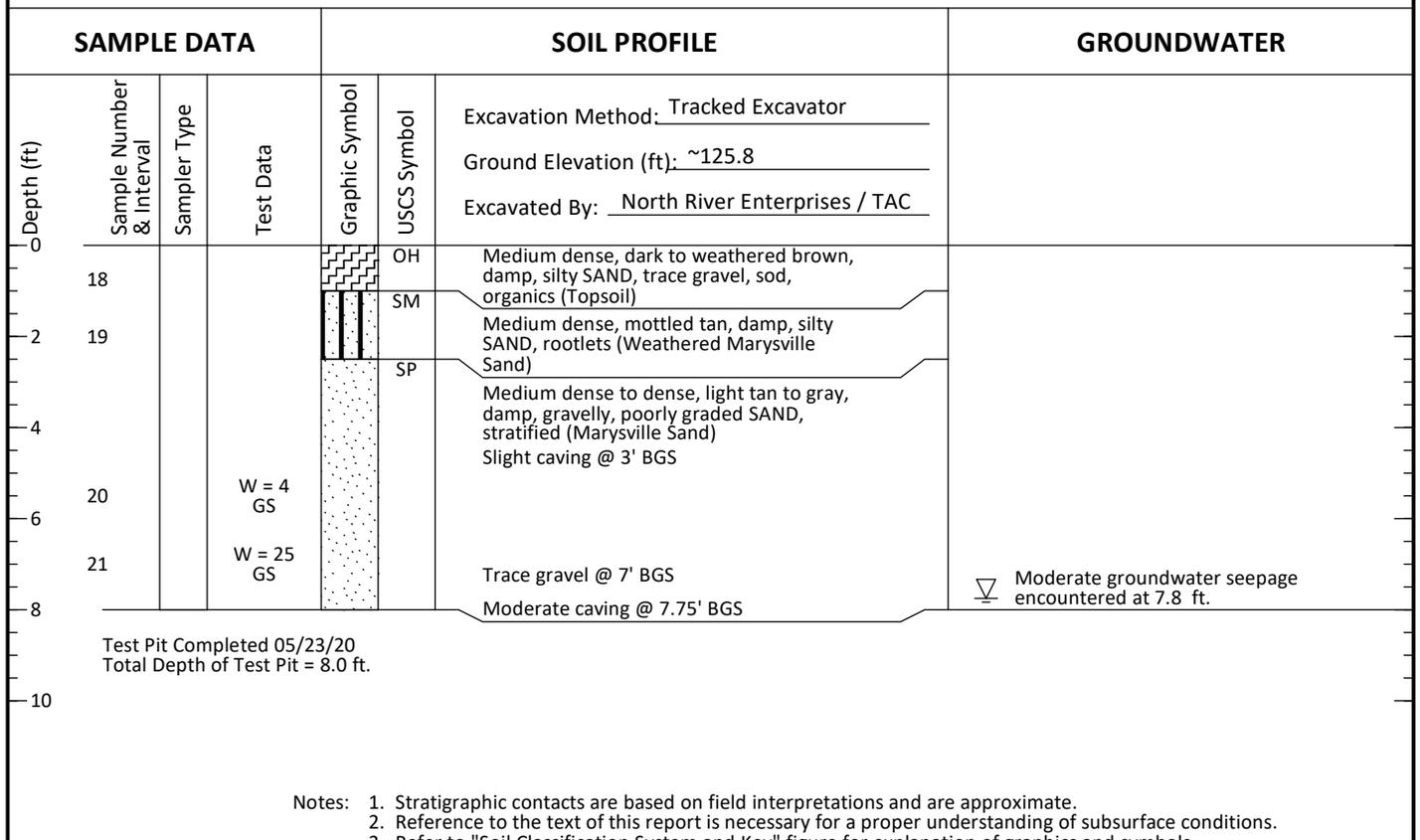
Log of Test Pits

Figure
7

TP-5



TP-6



- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

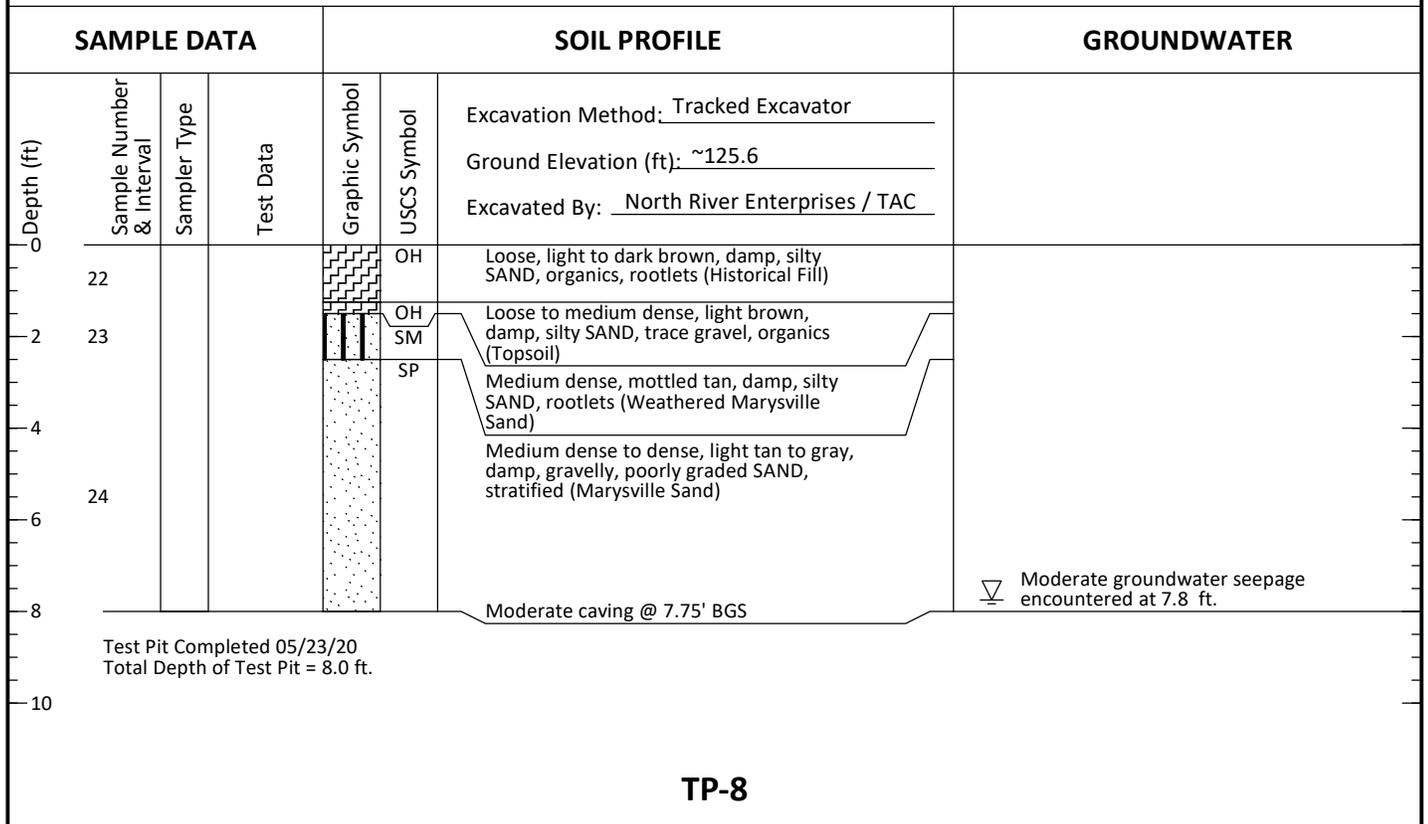


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 Business Park
 Arlington, WA 98223

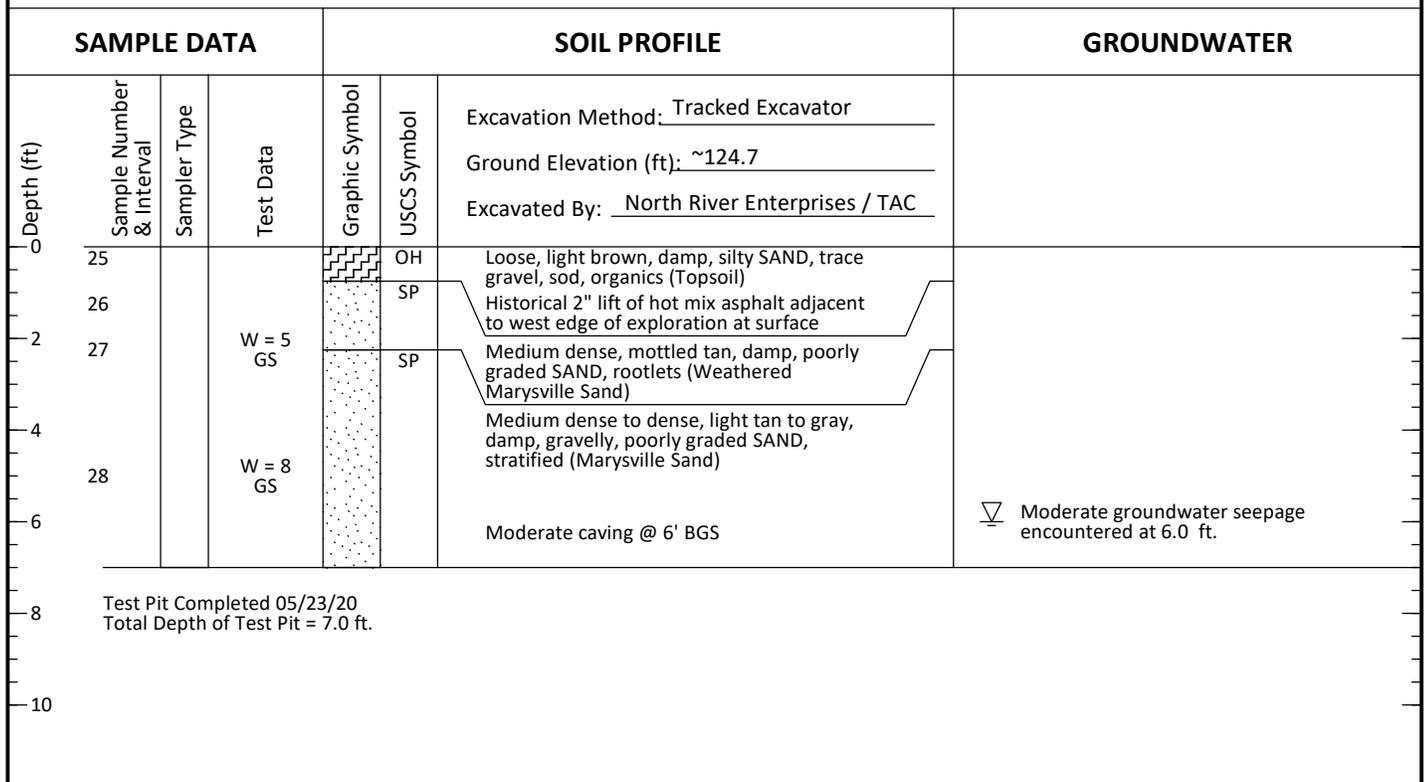
Log of Test Pits

Figure
8

TP-7



TP-8



- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

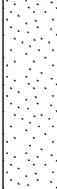


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 Business Park
 Arlington, WA 98223

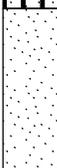
Log of Test Pits

Figure
9

TP-9

SAMPLE DATA			SOIL PROFILE		GROUNDWATER		
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: <u>Tracked Excavator</u>	
						Ground Elevation (ft): <u>~124.6</u>	
0						Excavated By: <u>North River Enterprises / TAC</u>	
2					SP	Medium dense, mottled tan, damp, poorly graded SAND, rootlets (Weathered Marysville Sand)	
4					SP	Medium dense to dense, light tan to gray, damp, gravelly, poorly graded SAND, stratified (Marysville Sand)	
6						Moderate caving @ 5.5' BGS	
8	Test Pit Completed 05/23/20 Total Depth of Test Pit = 7.0 ft.					▽	Rapid groundwater seepage encountered at 5.5 ft.
10							

TP-10

SAMPLE DATA			SOIL PROFILE		GROUNDWATER		
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: <u>Tracked Excavator</u>	
						Ground Elevation (ft): <u>~125.4</u>	
0						Excavated By: <u>North River Enterprises / TAC</u>	
29					OH	Loose, light brown, damp, very silty SAND, trace gravel, sod, organics (Topsoil)	
30			W = 17 GS		SM	Medium dense, mottled tan, damp, silty SAND, trace gravel, rootlets (Weathered Marysville Sand)	
31			W = 6 GS		SP	Medium dense to dense, light tan to gray, damp, poorly graded SAND, stratified (Marysville Sand)	
32						Moderate caving @ 2.25' BGS	
8	Test Pit Completed 05/23/20 Total Depth of Test Pit = 8.0 ft.					▽	Moderate groundwater seepage encountered at 7.3 ft.
10							

- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.



Arlington Airport
Business Park
Arlington, WA 98223

Log of Test Pits

Figure
10

TP-11

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
			W = 16 GS		OH	Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~125.5</u> Excavated By: <u>North River Enterprises / TAC</u>
	33				SM	
34		W = 9 GS		SP		
				Moderate caving @ 6.9' BGS		 Moderate groundwater seepage encountered at 6.9 ft.
Test Pit Completed 05/23/20 Total Depth of Test Pit = 7.5 ft.						

TP-12

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
					OH	Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~126.1</u> Excavated By: <u>North River Enterprises / TAC</u>
					SM	
				SP		
				Moderate caving @ 7.25' BGS		 Moderate groundwater seepage encountered at 7.3 ft.
Test Pit Completed 05/23/20 Total Depth of Test Pit = 8.0 ft.						

- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

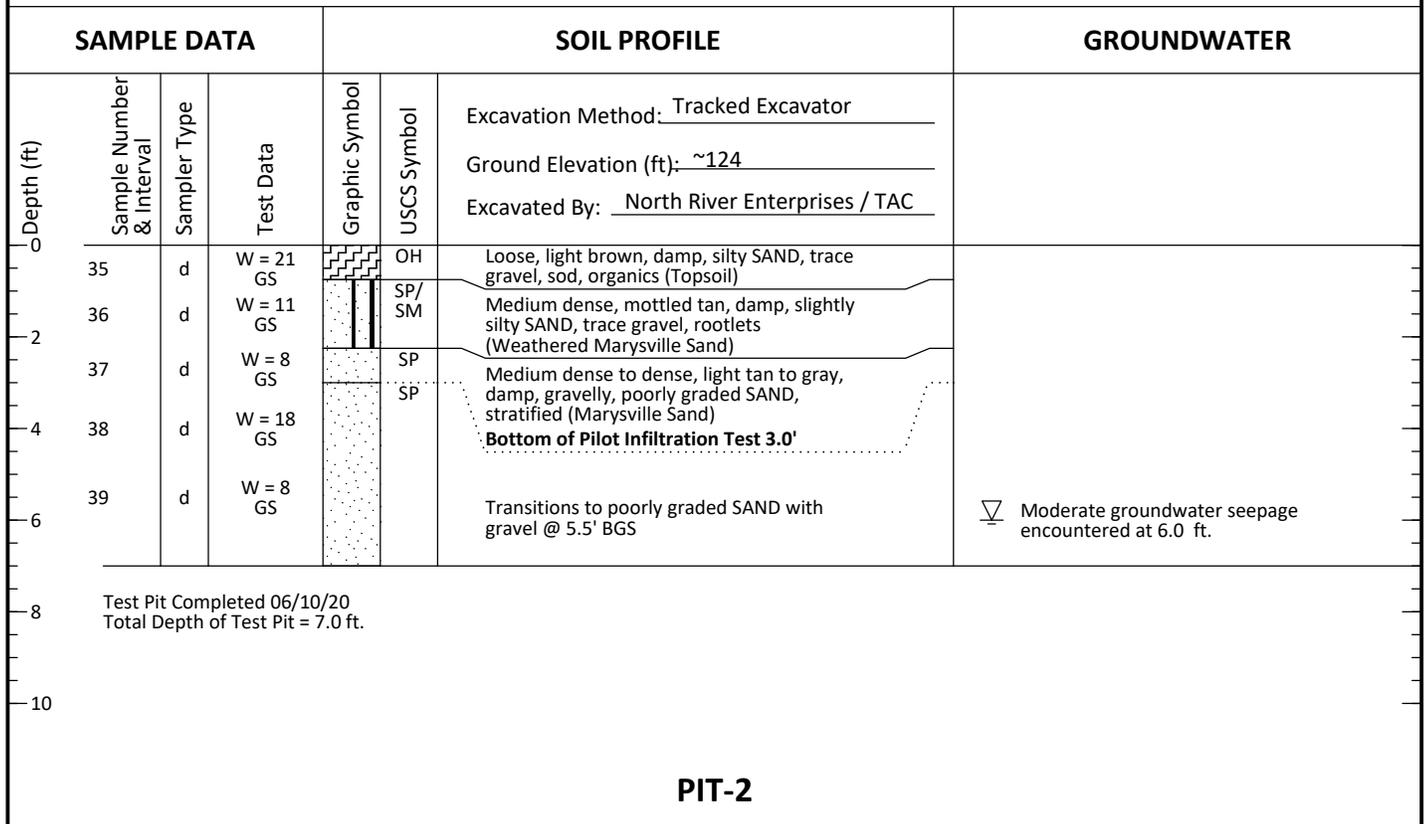


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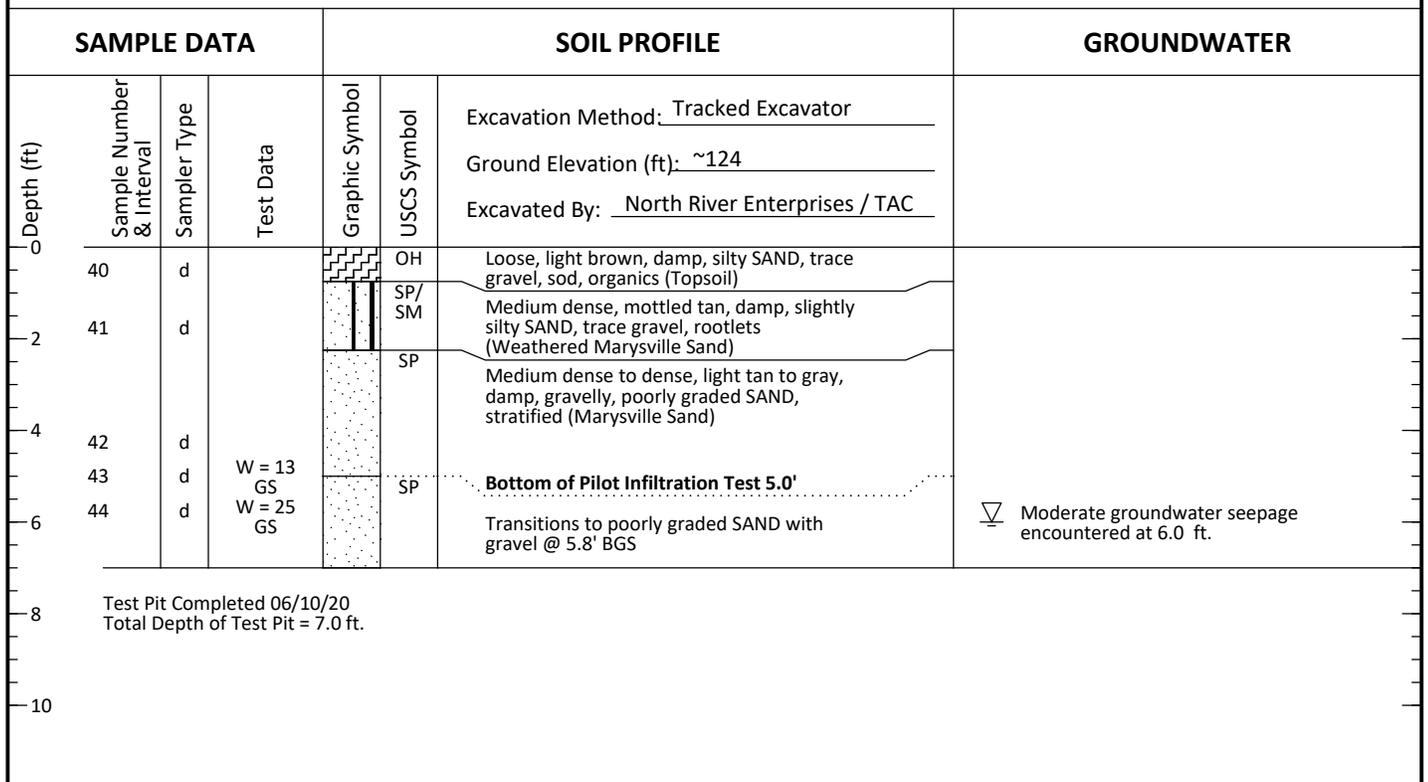
Log of Test Pits

Figure
11

PIT-1



PIT-2



- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.



Arlington Airport
Business Park
Arlington, WA 98223

Log of Pilot Infiltration Tests

Figure
12

PIT-3

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
						Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~125</u> Excavated By: <u>North River Enterprises / TAC</u>
0					OH	Loose, light brown, damp, silty SAND, trace gravel, sod, organics (Topsoil)
45	d				SP/SM	Medium dense, mottled tan, damp, slightly silty SAND, trace gravel, rootlets (Weathered Marysville Sand)
46	d				SP	Medium dense to dense, light tan to gray, damp, poorly graded SAND with gravel, stratified (Marysville Sand)
47	d		W = 4 GS		SP	Bottom of Pilot Infiltration Test 4.0'
48	d		W = 19 GS		SP/SM	Transitions to slightly silty, gravelly SAND @ 5.3' BGS
Moderate groundwater seepage encountered at 7.0 ft.						
Test Pit Completed 06/11/20 Total Depth of Test Pit = 7.5 ft.						

PIT-4

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	
						Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>~125</u> Excavated By: <u>North River Enterprises / TAC</u>
0					OH	Loose, light brown, damp, silty SAND, trace gravel, sod, organics (Topsoil)
49	d				SP/SM	Medium dense, mottled tan, damp, slightly silty SAND, trace gravel, rootlets (Weathered Marysville Sand)
50	d				SP	Medium dense to dense, light tan to gray, damp, gravelly, poorly graded SAND, stratified (Marysville Sand)
51	d		W = 7 GS		SP	Bottom of Pilot Infiltration Test 6.0'
52	d		W = 12 GS		SP	Transitions to poorly graded SAND with gravel @ 6.3' BGS
Moderate groundwater seepage encountered at 7.0 ft.						
Test Pit Completed 06/11/20 Total Depth of Test Pit = 8.0 ft.						

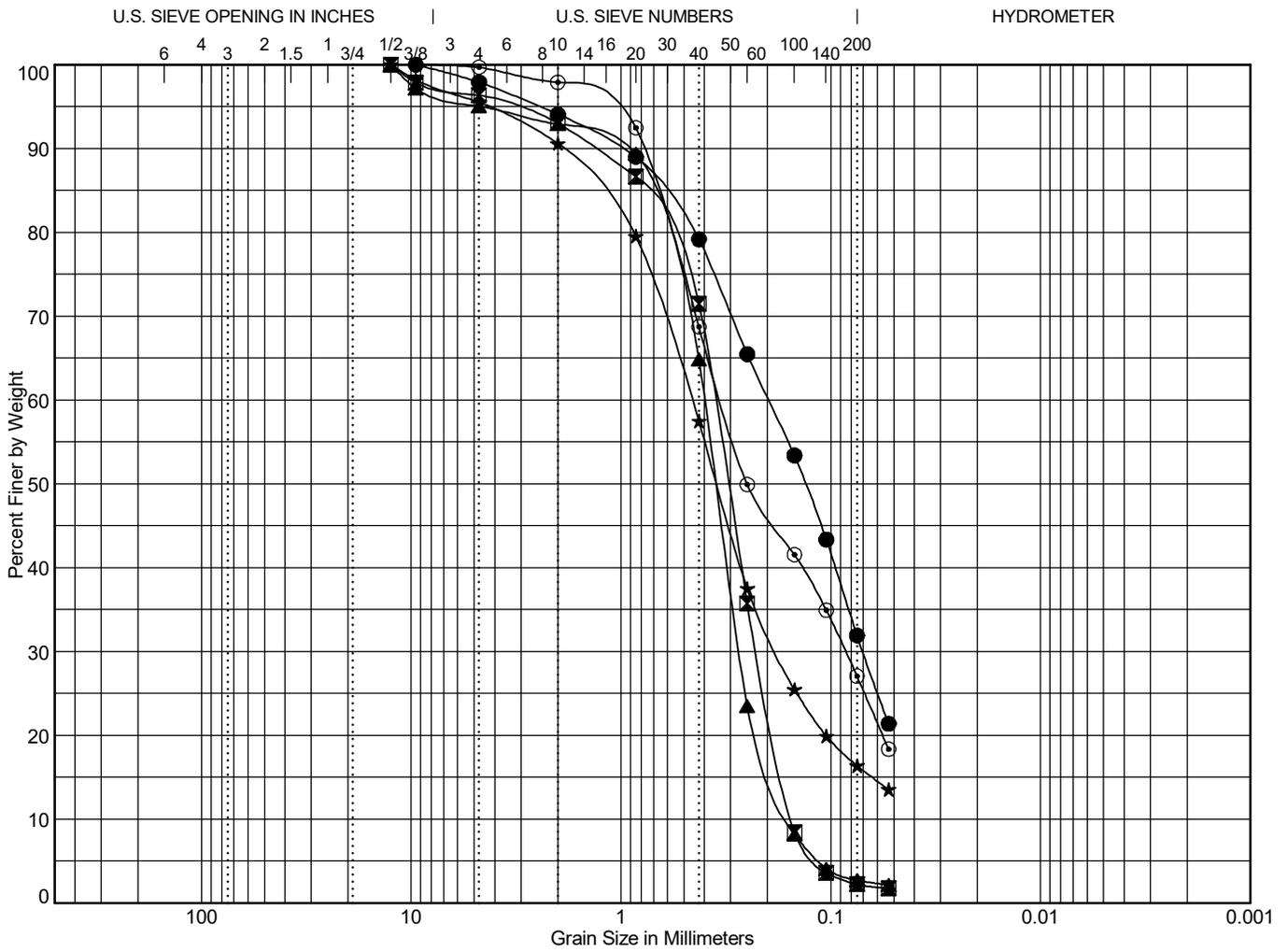
- Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
 2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
 3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.



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Business Park
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Log of Pilot Infiltration Tests

Figure
13



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C _c	C _u
●	TP-1 2.0	Very silty SAND, trace gravel (SM)					
☒	TP-2 2.0	POORLY GRADED SAND (SP)				0.91	2.34
▲	TP-2 5.0	POORLY GRADED SAND (SP)				1.17	2.52
★	TP-3 0.4	Silty SAND, trace gravel (SM)					
◎	TP-4 1.5	Silty SAND, trace gravel (SM)					

Point	Depth	D ₉₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	TP-1 2.0	1.006	0.198	0.132	0.07		0.0	2.1	3.8	14.9	47.3	31.9
☒	TP-2 2.0	1.332	0.358	0.309	0.224	0.153	0.0	3.6	3.3	21.5	69.3	2.2
▲	TP-2 5.0	0.985	0.399	0.351	0.272	0.158	0.0	4.9	2.1	28.0	62.1	2.7
★	TP-3 0.4	1.907	0.46	0.348	0.181		0.0	4.5	4.9	33.1	41.1	16.4
◎	TP-4 1.5	0.791	0.332	0.251	0.085		0.0	0.3	1.8	29.2	41.7	27.1

$$C_c = D_{30}^2 / (D_{60} * D_{10})$$

$$C_u = D_{60} / D_{10}$$

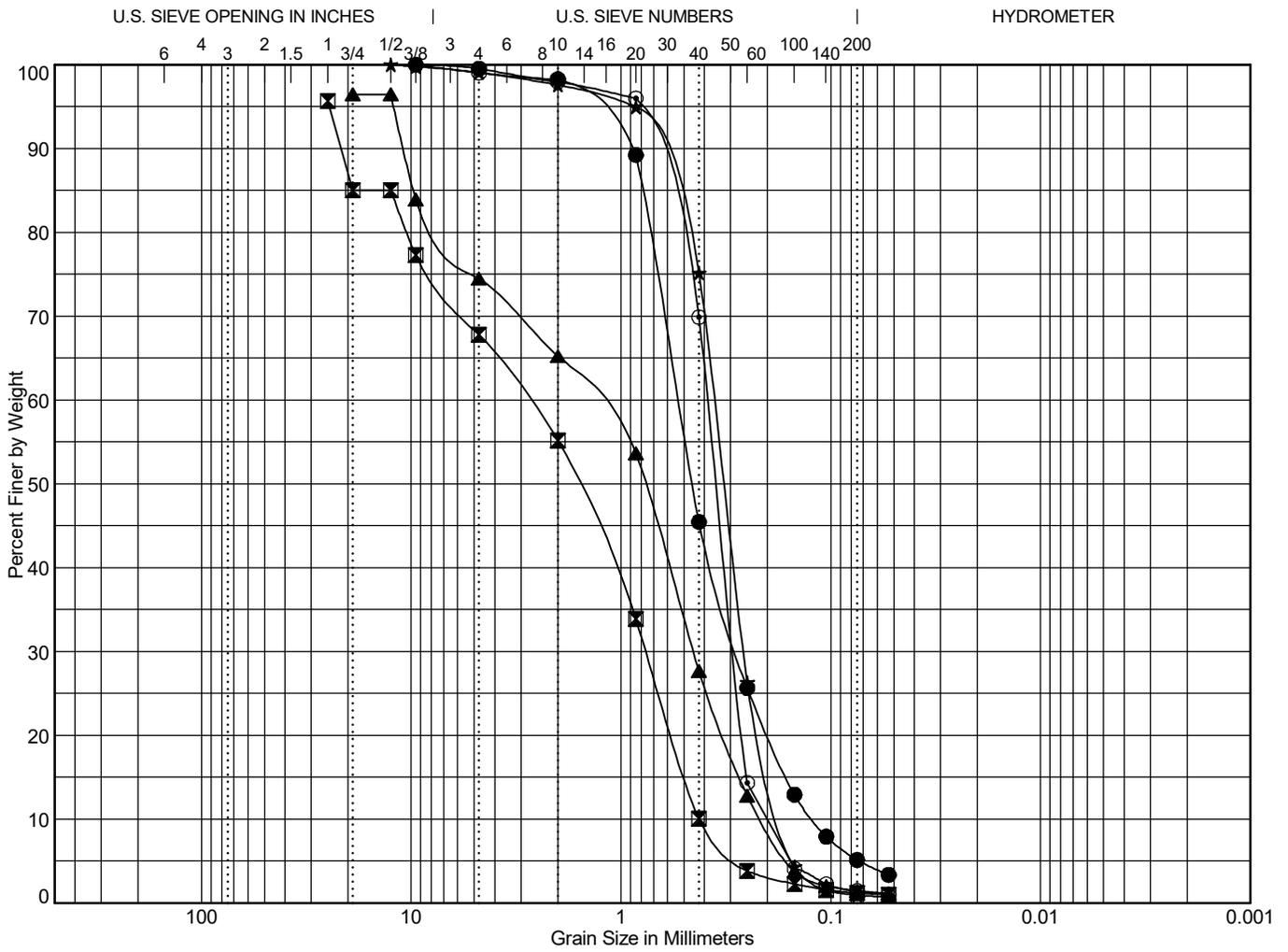
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW



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Grain Size Test Data

Figure
14



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C _c	C _u
●	TP-5 2.0	Slightly silty SAND, trace gravel (SP/SM)				1.21	4.41
☒	TP-5 5.3	POORLY GRADED SAND with GRAVEL (SP)				0.49	6.59
▲	TP-6 5.5	POORLY GRADED SAND with GRAVEL (SP)				0.71	6.37
★	TP-6 7.0	POORLY GRADED SAND (SP)				1.10	2.12
◎	TP-8 2.3	POORLY GRADED SAND (SP)				1.09	1.93

Point	Depth	D ₉₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	TP-5 2.0	0.913	0.535	0.457	0.281	0.121	0.0	0.5	1.2	52.8	40.3	5.2
☒	TP-5 5.3	21.601	2.786	1.624	0.759	0.423	10.6	17.3	12.6	45.1	8.8	1.2
▲	TP-6 5.5	10.845	1.357	0.771	0.452	0.213	0.0	22.0	9.2	37.6	26.3	1.4
★	TP-6 7.0	0.714	0.36	0.323	0.26	0.17	0.0	0.9	1.5	22.4	74.2	0.9
◎	TP-8 2.3	0.725	0.387	0.351	0.29	0.201	0.0	1.0	1.1	28.1	68.4	1.5

$$C_c = D_{30}^2 / (D_{60} * D_{10})$$

$$C_u = D_{60} / D_{10}$$

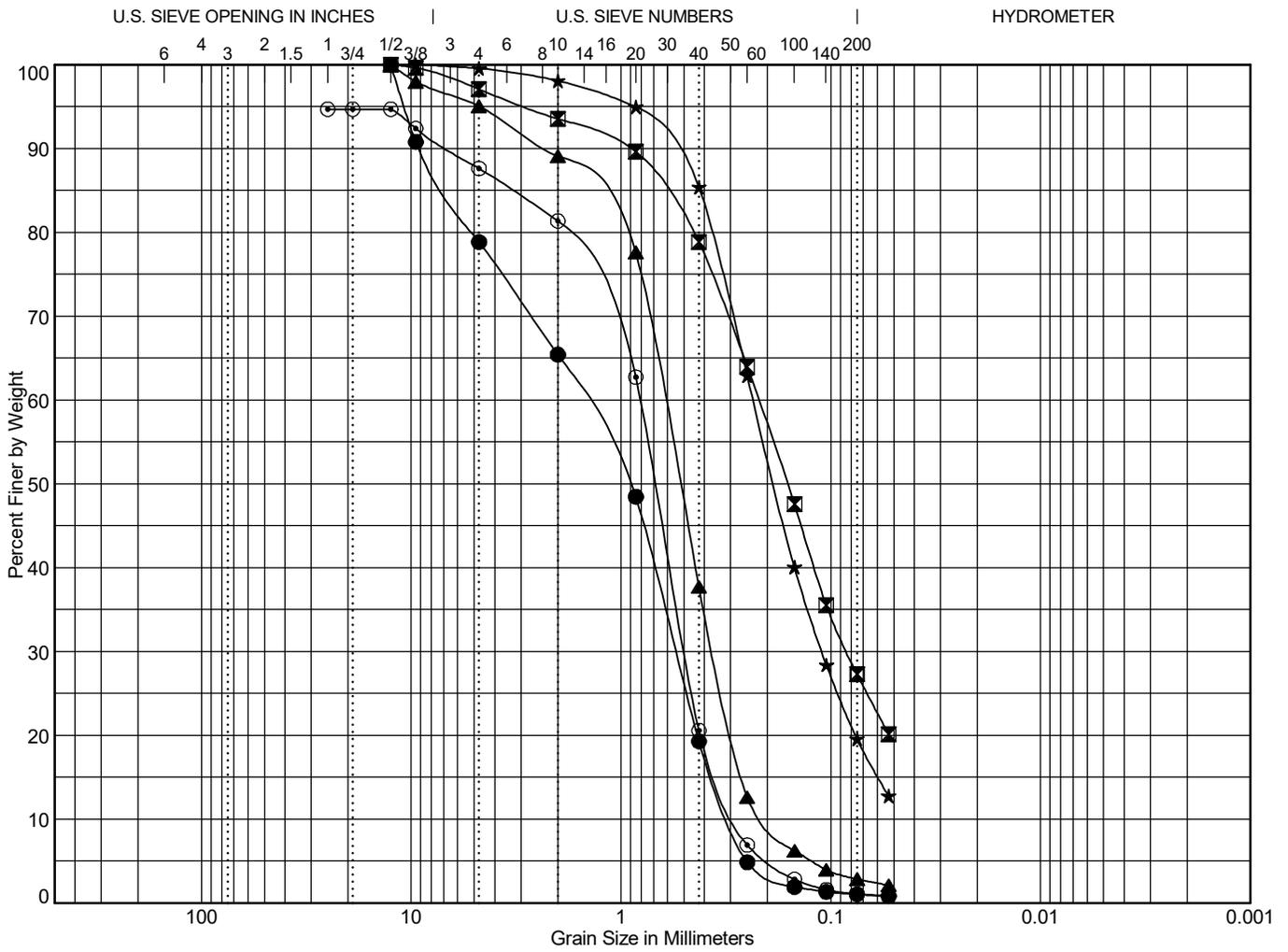
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW



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Grain Size Test Data

Figure
15



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C _c	C _u
●	TP-8 5.0	POORLY GRADED SAND with GRAVEL (SP)				0.65	5.04
☒	TP-10 1.5	Silty SAND, trace gravel (SM)					
▲	TP-10 2.8	POORLY GRADED SAND (SP)				1.03	3.10
★	TP-11 2.0	Silty SAND, trace gravel (SM)					
◎	TP-11 5.5	POORLY GRADED SAND (SP)				1.08	2.88

Point	Depth	D ₉₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	TP-8 5.0	9.065	1.521	0.918	0.548	0.302	0.0	21.1	13.4	46.1	18.2	1.1
☒	TP-10 1.5	0.918	0.22	0.161	0.084		0.0	2.9	3.5	14.7	51.6	27.3
▲	TP-10 2.8	2.282	0.626	0.526	0.361	0.202	0.0	4.9	6.0	51.4	34.9	2.9
★	TP-11 2.0	0.593	0.234	0.187	0.11		0.0	0.4	1.5	12.7	65.8	19.6
◎	TP-11 5.5	6.71	0.813	0.689	0.496	0.282	0.0	7.1	6.3	60.8	19.5	1.0

$$C_c = D_{30}^2 / (D_{60} * D_{10})$$

$$C_u = D_{60} / D_{10}$$

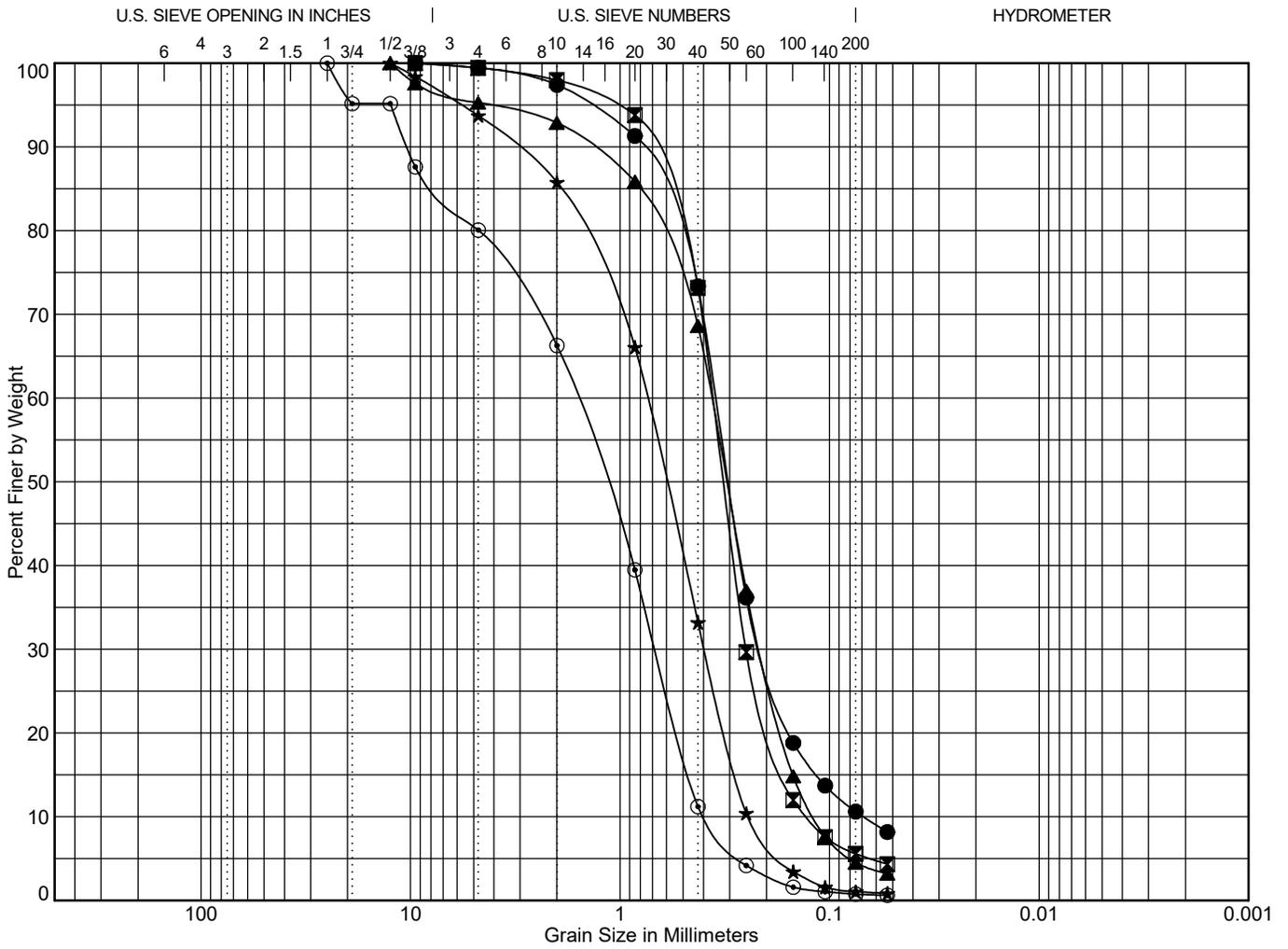
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW



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Arlington, WA 98223

Grain Size Test Data

Figure
16



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C _c	C _u
●	PIT-1 0.5	Slightly silty SAND, trace gravel (SP/SM)				1.79	5.10
☒	PIT-1 1.5	Slightly silty SAND, trace gravel (SP/SM)				1.37	2.84
▲	PIT-1 2.7	POORLY GRADED SAND (SP)				1.04	3.12
★	PIT-1 4.0	POORLY GRADED SAND (SP)				0.86	3.08
◎	PIT-1 5.5	POORLY GRADED SAND with GRAVEL (SP)				0.71	4.22

Point	Depth	D ₉₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	PIT-1 0.5	0.808	0.351	0.305	0.208	0.069	0.0	0.6	2.0	24.0	62.8	10.6
☒	PIT-1 1.5	0.748	0.362	0.32	0.251	0.127	0.0	0.6	1.5	24.8	67.6	5.6
▲	PIT-1 2.7	1.409	0.368	0.311	0.212	0.118	0.0	4.7	2.4	24.3	64.1	4.5
★	PIT-1 4.0	3.165	0.748	0.606	0.395	0.242	0.0	6.3	8.0	52.6	32.1	1.0
◎	PIT-1 5.5	10.363	1.637	1.189	0.674	0.388	4.8	15.1	13.8	55.1	10.5	0.8

$$C_c = D_{30}^2 / (D_{60} * D_{10})$$

$$C_u = D_{60} / D_{10}$$

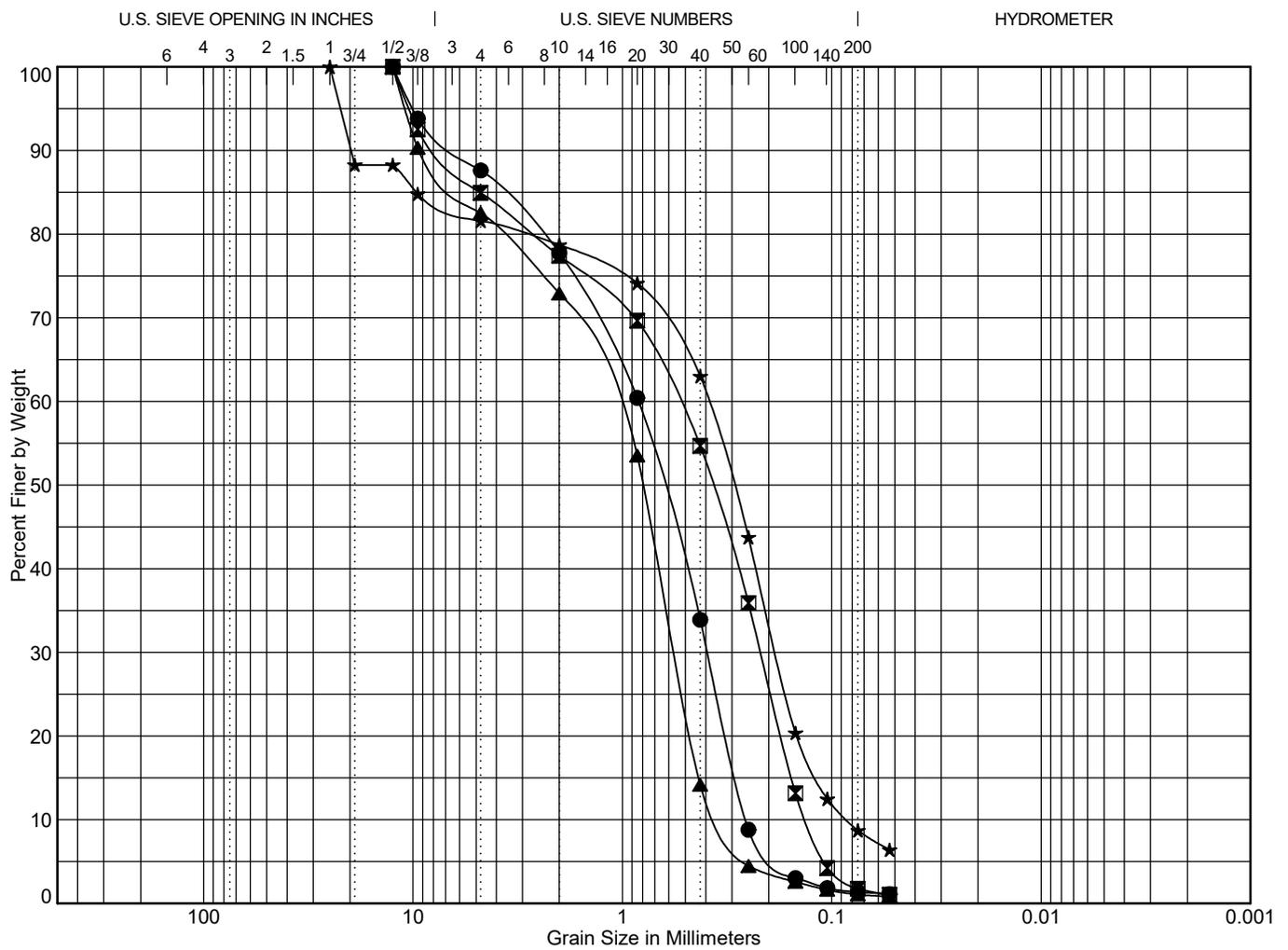
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW



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Grain Size Test Data

Figure
17



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C _c	C _u
●	PIT-2 5.0	POORLY GRADED SAND (SP)				0.71	3.28
☒	PIT-2 5.8	POORLY GRADED SAND with GRAVEL (SP)				0.67	4.13
▲	PIT-3 4.3	POORLY GRADED SAND with GRAVEL (SP)				0.82	3.34
★	PIT-3 5.3	Slightly silty, gravelly SAND (SP/SM)				1.03	4.65

Point	Depth	D ₉₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	PIT-2 5.0	6.201	0.841	0.647	0.391	0.256	0.0	12.4	9.9	43.9	32.5	1.4
☒	PIT-2 5.8	7.538	0.544	0.372	0.219	0.132	0.0	15.1	7.5	22.7	52.9	1.8
▲	PIT-3 4.3	9.241	1.131	0.799	0.562	0.338	0.0	17.5	9.6	58.7	13.1	1.1
★	PIT-3 5.3	19.782	0.391	0.297	0.184	0.084	11.7	6.7	2.9	15.7	54.3	8.7

$$C_c = D_{30}^2 / (D_{60} * D_{10})$$

$$C_u = D_{60} / D_{10}$$

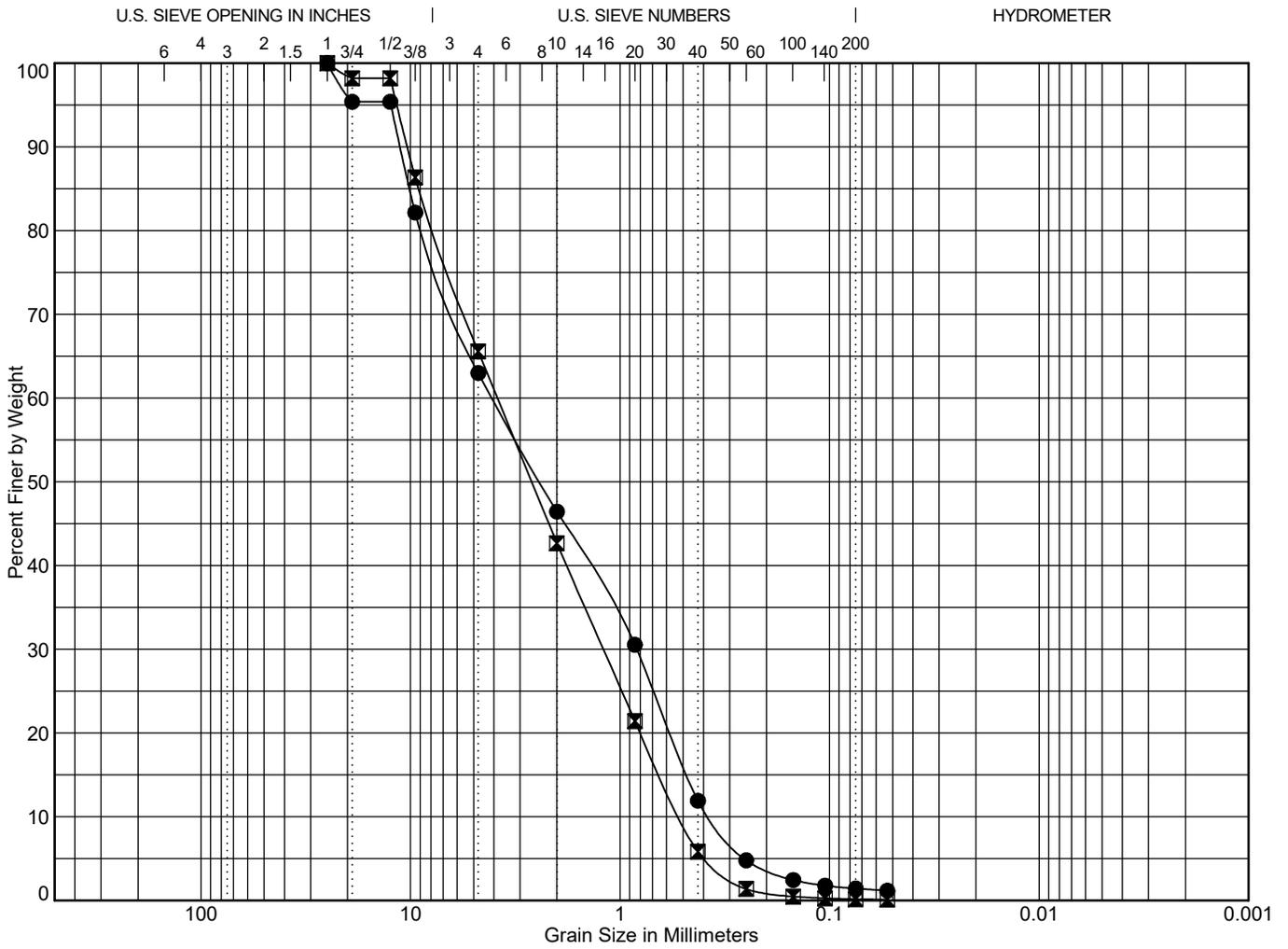
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW



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Arlington, WA 98223

Grain Size Test Data

Figure
18



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C _c	C _u
●	PIT-4 6.3	POORLY GRADED SAND with GRAVEL (SP)				0.46	11.01
■	PIT-4 7.0	POORLY GRADED SAND with GRAVEL (SP)				0.73	7.52

Point	Depth	D ₉₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	PIT-4 6.3	11.179	4.063	2.41	0.833	0.369	4.6	32.4	16.6	34.5	10.5	1.4
■	PIT-4 7.0	10.337	3.847	2.638	1.201	0.512	1.8	32.6	22.9	36.9	5.7	0.2

$$C_c = D_{30}^2 / (D_{60} * D_{10})$$

$$C_u = D_{60} / D_{10}$$

To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW



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Grain Size Test Data

Figure
19



2545 W Falls Avenue
 Kennewick, WA 99336
 509.783.7450
 www.nwag.com
 lab@nwag.com

PAP-Accredited



GeoTest Services Inc.
 741 Marine Drive
 Bellingham, WA 98225

Report: 51638-1-1
Date: May 27, 2020
Project No: 20-0458
Project Name: Arlington Airport Business
 Park

Sample ID	pH	Organic Matter	Cation Exchange Capacity
TP-1 @ 0.5'	6.9	2.89%	8.8 meq/100g
TP-3 @ 2.2'	6.1	2.93%	6.9 meq/100g
TP-4 @ 0.5'	6.0	5.07%	10.9 meq/100g
TP-4 @ 1.5'	6.1	1.94%	5.3 meq/100g
TP-7 @ 2.0'	6.1	1.56%	3.1 meq/100g
TP-8 @ 1.25'	6.0	2.43%	6.0 meq/100g
TP-10 @ 0.5'	5.6	5.19%	10.4 meq/100g
Method	SM 4500-H⁺ B	ASTM D2974	EPA 9081



**Northwest Agricultural
Consultants**

2545 W Falls Avenue
Kennewick, WA 99336
509.783.7450
www.nwag.com
lab@nwag.com

PAP-Accredited



GeoTest Services Inc.
741 Marine Drive
Bellingham, WA 98225

Report: 51782-1-1
Date: June 15, 2020
Project No: 20-0458
Project Name: Arlington Airport Business
Park

Sample ID	pH	Organic Matter	Cation Exchange Capacity
PIT-2 @ 0.5'	5.8	7.04%	13.2 meq/100g
PIT-2 @ 1.75'	6.1	2.08%	5.4 meq/100g
PIT-3 @ 1.4'	6.0	3.87%	9.1 meq/100g
PIT-3 @ 2.7'	6.4	1.33%	3.6 meq/100g
Method	SM 4500-H⁺ B	ASTM D2974	EPA 9081



REPORT LIMITATIONS AND GUIDELINES FOR ITS USE¹

Subsurface issues may cause construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help:

Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

At GeoTest our geotechnical engineers and geologists structure their services to meet specific needs of our clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of an owner, a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineer who prepared it. And no one – not even you – should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

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

GeoTest's geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the clients goals, objectives, and risk management preferences; the general nature of the structure involved its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless GeoTest, who conducted the study specifically states otherwise, do not rely on a geotechnical engineering report that was:

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



Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed, for example, from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed construction,
- alterations in drainage designs; or
- composition of the design team; the passage of time; man-made alterations and construction whether on or adjacent to the site; or by natural alterations and events, such as floods, earthquakes or groundwater fluctuations; or project ownership.

Always inform GeoTest's geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. Do not rely on the findings and conclusions of this report, whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact GeoTest before applying the report to determine if it is still relevant. A minor amount of additional testing or analysis will help determine if the report remains applicable.

Most Geotechnical and Geologic Findings are Professional Opinions

Our site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoTest's engineers and geologists review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in your report. Retaining GeoTest who developed this report to provide construction observation is the most effective method of managing the risks associated with anticipated or unanticipated conditions.



A Report's Recommendations are Not Final

Do not over-rely on the construction recommendations included in this report. Those recommendations are not final, because geotechnical engineers or geologists develop them principally from judgment and opinion. GeoTest's geotechnical engineers or geologists can finalize their recommendations only by observing actual subsurface conditions revealed during construction. GeoTest cannot assume responsibility or liability for the report's recommendations if our firm does not perform the construction observation.

A Geotechnical Engineering or Geologic Report may be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. Lower that risk by having GeoTest confer with appropriate members of the design team after submitting the report. Also, we suggest retaining GeoTest to review pertinent elements of the design teams plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having GeoTest participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do not Redraw the Exploration Logs

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

Give Contractors a Complete Report and Guidance

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



In addition, it is recommended that a contingency for unanticipated conditions be included in your project budget and schedule.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering or geology is far less exact than other engineering disciplines. This lack of understanding can create unrealistic expectations that can lead to disappointments, claims, and disputes. To help reduce risk, GeoTest includes an explanatory limitations section in our reports. Read these provisions closely. Ask questions and we encourage our clients or their representative to contact our office if you are unclear as to how these provisions apply to your project.

Environmental Concerns Are Not Covered in this Geotechnical or Geologic Report

The equipment, techniques, and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated containments, etc. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. Do not rely on environmental report prepared for some one else.

Obtain Professional Assistance to Deal with Biological Pollutants

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts biological pollutants from growing on indoor surfaces. Biological pollutants includes but is not limited to molds, fungi, spores, bacteria and viruses. To be effective, all such strategies should be devised for the express purpose of prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional biological pollutant prevention consultant. Because just a small amount of water or moisture can lead to the development of severe biological infestations, a number of prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of this study, the geotechnical engineer or geologist in charge of this project is not a biological pollutant prevention consultant; none of the services performed in connection with this geotechnical engineering or geological study were designed or conducted for the purpose of preventing biological infestations.

Appendix C

Operation and Maintenance

The following maintenance standards are as described in [Volume V, Section 4.6.6, Table 5.3](#) of the SWMMWW.

Table V-4.5.2(2)			
Maintenance Standards - Infiltration			
Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Poisonous/Noxious Vegetation	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Contaminants and Pollution	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Rodent Holes	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.

		(A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Piping	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway	Rock Missing	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

Table V-4.5.2(18)			
Maintenance Standards - Catchbasin Inserts			
Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert.
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Media Insert Use Beyond Normal Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.

Appendix D

Infiltration Trench Drainage Calculations

WWHM2012
PROJECT REPORT

General Model Information

Project Name: SCA ACCESS RD
Site Name:
Site Address:
City:
Report Date: 8/17/2020
Gage: Everett
Data Start: 1948/10/01
Data End: 2009/09/30
Timestep: 15 Minute
Precip Scale: 1.200
Version Date: 2019/09/13
Version: 4.2.17

POC Thresholds

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

Landuse Basin Data

Predeveloped Land Use

South Basin

Bypass:	No
GroundWater:	No
Pervious Land Use A B, Forest, Flat	acre 0.72
Pervious Total	0.72
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.72

Element Flows To:		
Surface	Interflow	Groundwater

Mitigated Land Use

South Basin

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
ROADS FLAT	0.72
Impervious Total	0.72
Basin Total	0.72

Element Flows To:		
Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	1300.00 ft.
Bottom Width:	2.00 ft.
Trench bottom slope 1:	0.001 To 1
Trench Left side slope 0:	0.001 To 1
Trench right side slope 2:	0.001 To 1
Material thickness of first layer:	2
Pour Space of material for first layer:	0.33
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:	6
Infiltration safety factor:	1
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	138.975
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	138.975
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	2 ft.
Riser Diameter:	12 in.
Element Flows To:	
Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

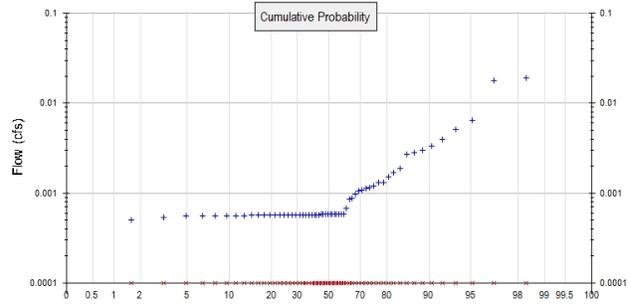
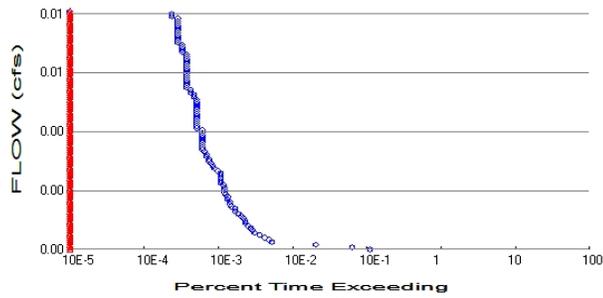
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.059	0.000	0.000	0.000
0.0222	0.059	0.000	0.000	0.361
0.0444	0.059	0.000	0.000	0.361
0.0667	0.059	0.001	0.000	0.361
0.0889	0.059	0.001	0.000	0.361
0.1111	0.059	0.002	0.000	0.361
0.1333	0.059	0.002	0.000	0.361
0.1556	0.059	0.003	0.000	0.361
0.1778	0.059	0.003	0.000	0.361
0.2000	0.059	0.003	0.000	0.361
0.2222	0.059	0.004	0.000	0.361
0.2444	0.059	0.004	0.000	0.361
0.2667	0.059	0.005	0.000	0.361
0.2889	0.059	0.005	0.000	0.361
0.3111	0.059	0.006	0.000	0.361
0.3333	0.059	0.006	0.000	0.361
0.3556	0.059	0.007	0.000	0.361
0.3778	0.059	0.007	0.000	0.361
0.4000	0.059	0.007	0.000	0.361
0.4222	0.059	0.008	0.000	0.361
0.4444	0.059	0.008	0.000	0.361
0.4667	0.059	0.009	0.000	0.361
0.4889	0.059	0.009	0.000	0.361

0.5111	0.059	0.010	0.000	0.361
0.5333	0.059	0.010	0.000	0.361
0.5556	0.059	0.010	0.000	0.361
0.5778	0.059	0.011	0.000	0.361
0.6000	0.059	0.011	0.000	0.361
0.6222	0.059	0.012	0.000	0.361
0.6444	0.059	0.012	0.000	0.361
0.6667	0.059	0.013	0.000	0.361
0.6889	0.059	0.013	0.000	0.361
0.7111	0.059	0.014	0.000	0.361
0.7333	0.059	0.014	0.000	0.361
0.7556	0.059	0.014	0.000	0.361
0.7778	0.059	0.015	0.000	0.361
0.8000	0.059	0.015	0.000	0.361
0.8222	0.059	0.016	0.000	0.361
0.8444	0.059	0.016	0.000	0.361
0.8667	0.059	0.017	0.000	0.361
0.8889	0.059	0.017	0.000	0.361
0.9111	0.059	0.018	0.000	0.361
0.9333	0.059	0.018	0.000	0.361
0.9556	0.059	0.018	0.000	0.361
0.9778	0.059	0.019	0.000	0.361
1.0000	0.059	0.019	0.000	0.361
1.0222	0.059	0.020	0.000	0.361
1.0444	0.059	0.020	0.000	0.361
1.0667	0.059	0.021	0.000	0.361
1.0889	0.059	0.021	0.000	0.361
1.1111	0.059	0.021	0.000	0.361
1.1333	0.059	0.022	0.000	0.361
1.1556	0.059	0.022	0.000	0.361
1.1778	0.059	0.023	0.000	0.361
1.2000	0.059	0.023	0.000	0.361
1.2222	0.059	0.024	0.000	0.361
1.2444	0.059	0.024	0.000	0.361
1.2667	0.059	0.025	0.000	0.361
1.2889	0.059	0.025	0.000	0.361
1.3111	0.059	0.025	0.000	0.361
1.3333	0.059	0.026	0.000	0.361
1.3556	0.059	0.026	0.000	0.361
1.3778	0.059	0.027	0.000	0.361
1.4000	0.059	0.027	0.000	0.361
1.4222	0.059	0.028	0.000	0.361
1.4444	0.059	0.028	0.000	0.361
1.4667	0.059	0.028	0.000	0.361
1.4889	0.059	0.029	0.000	0.361
1.5111	0.059	0.029	0.000	0.361
1.5333	0.059	0.030	0.000	0.361
1.5556	0.059	0.030	0.000	0.361
1.5778	0.059	0.031	0.000	0.361
1.6000	0.059	0.031	0.000	0.361
1.6222	0.059	0.032	0.000	0.361
1.6444	0.059	0.032	0.000	0.361
1.6667	0.059	0.032	0.000	0.361
1.6889	0.059	0.033	0.000	0.361
1.7111	0.059	0.033	0.000	0.361
1.7333	0.059	0.034	0.000	0.361
1.7556	0.059	0.034	0.000	0.361
1.7778	0.059	0.035	0.000	0.361

1.8000	0.059	0.035	0.000	0.361
1.8222	0.059	0.035	0.000	0.361
1.8444	0.059	0.036	0.000	0.361
1.8667	0.059	0.036	0.000	0.361
1.8889	0.059	0.037	0.000	0.361
1.9111	0.059	0.037	0.000	0.361
1.9333	0.059	0.038	0.000	0.361
1.9556	0.059	0.038	0.000	0.361
1.9778	0.059	0.039	0.000	0.361
2.0000	0.059	0.039	0.000	0.361

Analysis Results

POC 1



+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area: 0.72
 Total Impervious Area: 0

Mitigated Landuse Totals for POC #1

Total Pervious Area: 0
 Total Impervious Area: 0.72

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.000826
5 year	0.001792
10 year	0.002875
25 year	0.005022
50 year	0.00742
100 year	0.010763

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	0.001	0.000
1950	0.002	0.000
1951	0.001	0.000
1952	0.001	0.000
1953	0.001	0.000
1954	0.004	0.000
1955	0.003	0.000
1956	0.001	0.000
1957	0.001	0.000
1958	0.001	0.000

1959	0.001	0.000
1960	0.001	0.000
1961	0.003	0.000
1962	0.001	0.000
1963	0.001	0.000
1964	0.002	0.000
1965	0.001	0.000
1966	0.001	0.000
1967	0.001	0.000
1968	0.001	0.000
1969	0.001	0.000
1970	0.001	0.000
1971	0.003	0.000
1972	0.001	0.000
1973	0.001	0.000
1974	0.002	0.000
1975	0.001	0.000
1976	0.001	0.000
1977	0.001	0.000
1978	0.001	0.000
1979	0.001	0.000
1980	0.001	0.000
1981	0.001	0.000
1982	0.001	0.000
1983	0.001	0.000
1984	0.001	0.000
1985	0.001	0.000
1986	0.005	0.000
1987	0.003	0.000
1988	0.001	0.000
1989	0.001	0.000
1990	0.001	0.000
1991	0.001	0.000
1992	0.001	0.000
1993	0.001	0.000
1994	0.001	0.000
1995	0.001	0.000
1996	0.007	0.000
1997	0.018	0.000
1998	0.001	0.000
1999	0.001	0.000
2000	0.001	0.000
2001	0.001	0.000
2002	0.001	0.000
2003	0.000	0.000
2004	0.001	0.000
2005	0.001	0.000
2006	0.019	0.000
2007	0.001	0.000
2008	0.001	0.000
2009	0.001	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0192	0.0000
2	0.0178	0.0000
3	0.0065	0.0000

4	0.0051	0.0000
5	0.0040	0.0000
6	0.0033	0.0000
7	0.0030	0.0000
8	0.0028	0.0000
9	0.0027	0.0000
10	0.0019	0.0000
11	0.0017	0.0000
12	0.0015	0.0000
13	0.0013	0.0000
14	0.0013	0.0000
15	0.0012	0.0000
16	0.0012	0.0000
17	0.0011	0.0000
18	0.0011	0.0000
19	0.0011	0.0000
20	0.0010	0.0000
21	0.0009	0.0000
22	0.0009	0.0000
23	0.0007	0.0000
24	0.0006	0.0000
25	0.0006	0.0000
26	0.0006	0.0000
27	0.0006	0.0000
28	0.0006	0.0000
29	0.0006	0.0000
30	0.0006	0.0000
31	0.0006	0.0000
32	0.0006	0.0000
33	0.0006	0.0000
34	0.0006	0.0000
35	0.0006	0.0000
36	0.0006	0.0000
37	0.0006	0.0000
38	0.0006	0.0000
39	0.0006	0.0000
40	0.0006	0.0000
41	0.0006	0.0000
42	0.0006	0.0000
43	0.0006	0.0000
44	0.0006	0.0000
45	0.0006	0.0000
46	0.0006	0.0000
47	0.0006	0.0000
48	0.0006	0.0000
49	0.0006	0.0000
50	0.0006	0.0000
51	0.0006	0.0000
52	0.0006	0.0000
53	0.0006	0.0000
54	0.0006	0.0000
55	0.0006	0.0000
56	0.0006	0.0000
57	0.0006	0.0000
58	0.0006	0.0000
59	0.0005	0.0000
60	0.0005	0.0000
61	0.0004	0.0000

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0004	2357	0	0	Pass
0.0005	1343	0	0	Pass
0.0006	443	0	0	Pass
0.0006	112	0	0	Pass
0.0007	103	0	0	Pass
0.0008	89	0	0	Pass
0.0008	77	0	0	Pass
0.0009	66	0	0	Pass
0.0010	61	0	0	Pass
0.0011	58	0	0	Pass
0.0011	54	0	0	Pass
0.0012	50	0	0	Pass
0.0013	49	0	0	Pass
0.0013	47	0	0	Pass
0.0014	43	0	0	Pass
0.0015	40	0	0	Pass
0.0015	36	0	0	Pass
0.0016	36	0	0	Pass
0.0017	32	0	0	Pass
0.0018	31	0	0	Pass
0.0018	31	0	0	Pass
0.0019	29	0	0	Pass
0.0020	29	0	0	Pass
0.0020	27	0	0	Pass
0.0021	26	0	0	Pass
0.0022	26	0	0	Pass
0.0023	26	0	0	Pass
0.0023	25	0	0	Pass
0.0024	23	0	0	Pass
0.0025	23	0	0	Pass
0.0025	23	0	0	Pass
0.0026	23	0	0	Pass
0.0027	23	0	0	Pass
0.0027	21	0	0	Pass
0.0028	19	0	0	Pass
0.0029	18	0	0	Pass
0.0030	17	0	0	Pass
0.0030	16	0	0	Pass
0.0031	16	0	0	Pass
0.0032	15	0	0	Pass
0.0032	15	0	0	Pass
0.0033	14	0	0	Pass
0.0034	13	0	0	Pass
0.0035	13	0	0	Pass
0.0035	13	0	0	Pass
0.0036	13	0	0	Pass
0.0037	13	0	0	Pass
0.0037	13	0	0	Pass
0.0038	13	0	0	Pass
0.0039	13	0	0	Pass
0.0040	13	0	0	Pass
0.0040	11	0	0	Pass
0.0041	11	0	0	Pass

0.0042	11	0	0	Pass
0.0042	11	0	0	Pass
0.0043	11	0	0	Pass
0.0044	11	0	0	Pass
0.0044	11	0	0	Pass
0.0045	11	0	0	Pass
0.0046	11	0	0	Pass
0.0047	11	0	0	Pass
0.0047	11	0	0	Pass
0.0048	11	0	0	Pass
0.0049	11	0	0	Pass
0.0049	10	0	0	Pass
0.0050	10	0	0	Pass
0.0051	9	0	0	Pass
0.0052	9	0	0	Pass
0.0052	8	0	0	Pass
0.0053	8	0	0	Pass
0.0054	8	0	0	Pass
0.0054	8	0	0	Pass
0.0055	8	0	0	Pass
0.0056	8	0	0	Pass
0.0057	8	0	0	Pass
0.0057	8	0	0	Pass
0.0058	8	0	0	Pass
0.0059	8	0	0	Pass
0.0059	8	0	0	Pass
0.0060	8	0	0	Pass
0.0061	8	0	0	Pass
0.0061	8	0	0	Pass
0.0062	8	0	0	Pass
0.0063	7	0	0	Pass
0.0064	7	0	0	Pass
0.0064	7	0	0	Pass
0.0065	7	0	0	Pass
0.0066	6	0	0	Pass
0.0066	6	0	0	Pass
0.0067	6	0	0	Pass
0.0068	6	0	0	Pass
0.0069	6	0	0	Pass
0.0069	6	0	0	Pass
0.0070	6	0	0	Pass
0.0071	6	0	0	Pass
0.0071	6	0	0	Pass
0.0072	6	0	0	Pass
0.0073	6	0	0	Pass
0.0073	5	0	0	Pass
0.0074	5	0	0	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	<input type="checkbox"/>	126.47			<input type="checkbox"/>	100.00			
Total Volume Infiltrated		126.47	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

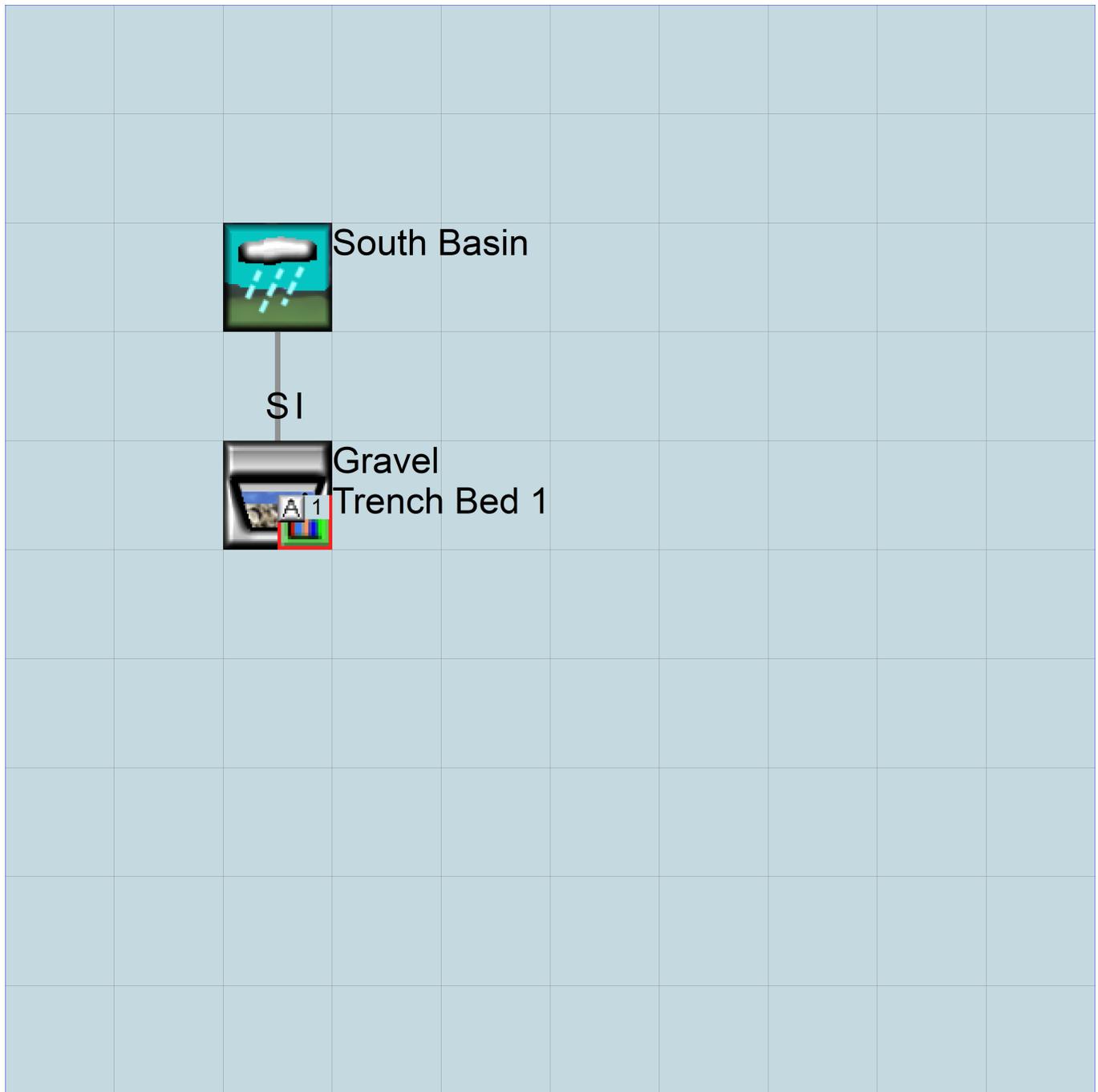
No IMPLND changes have been made.

Appendix
Predeveloped Schematic



South Basin
0.72ac

Mitigated Schematic



Predeveloped UCI File

RUN

GLOBAL

```
WVHM4 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      SCA ACCESS RD.wdm
MESSU    25      PreSCA ACCESS RD.MES
          27      PreSCA ACCESS RD.L61
          28      PreSCA ACCESS RD.L62
          30      POCSCA ACCESS RD1.dat
```

END FILES

OPN SEQUENCE

```
INGRP          INDELT 00:15
  PERLND        1
  COPY          501
  DISPLY        1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INFO1

```
# - #<-----Title----->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
1      South Basin          MAX          1    2    30    9
```

END DISPLY-INFO1

END DISPLY

COPY

TIMESERIES

```
# - # NPT NMN ***
1      1    1
501    1    1
```

END TIMESERIES

END COPY

GENER

OPCODE

```
#      # OPCD ***
```

END OPCODE

PARM

```
#      #          K ***
```

END PARM

END GENER

PERLND

GEN-INFO

```
<PLS ><-----Name----->NBLKS  Unit-systems  Printer ***
# - #          User  t-series  Engl Metr ***
          in  out          ***
1      A/B, Forest, Flat  1    1    1    1    27    0
```

END GEN-INFO

*** Section PWATER***

ACTIVITY

```
<PLS > ***** Active Sections *****
# - # ATMP SNOW PWAT  SED  PST  PWG  PQAL MSTL PEST NITR PHOS TRAC ***
1      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 *****
1      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 ***
1 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 LRSUR SLSUR KVARY AGWRC
1 0 5 2 400 0.05 0.3 0.996
END PWAT-PARM2

PWAT-PARM3
<PLS > PWATER input info: Part 3 ***
# - # ***PETMAX PETMIN INFEXP INFILD DEEPFR BASETP AGWETP
1 0 0 2 2 0 0 0
END PWAT-PARM3

PWAT-PARM4
<PLS > PWATER input info: Part 4 ***
# - # CEPSC UZSN NSUR INTFW IRC LZETP ***
1 0.2 0.5 0.35 0 0.7 0.7
END PWAT-PARM4

PWAT-STATE1
<PLS > *** Initial conditions at start of simulation
ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
# - # *** CEPS SURS UZS IFWS LZS AGWS GWVS
1 0 0 0 0 3 1 0
END PWAT-STATE1

END PERLND

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

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

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

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

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

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

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

```

END IMPLND

SCHEMATIC

<-Source->	<Name> #	<--Area-->	<-factor-->	<-Target->	MBLK	***
South Basin***					Tbl#	***
PERLND	1	0.72		COPY 501	12	
PERLND	1	0.72		COPY 501	13	

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

NETWORK

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

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

END NETWORK

RCHRES

GEN-INFO

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

END GEN-INFO

*** Section RCHRES***

ACTIVITY

<PLS > ***** Active Sections *****

#	-	#	HYFG	ADFG	CNFG	HTFG	SDFG	GQFG	OXFG	NUFG	PKFG	PHFG	***
#	-	#	HYFG	ADFG	CNFG	HTFG	SDFG	GQFG	OXFG	NUFG	PKFG	PHFG	***

END ACTIVITY

PRINT-INFO

<PLS > ***** Print-flags ***** PIVL PYR

#	-	#	HYDR	ADCA	CONS	HEAT	SED	GQL	OXRX	NUTR	PLNK	PHCB	PIVL	PYR	*****
#	-	#	HYDR	ADCA	CONS	HEAT	SED	GQL	OXRX	NUTR	PLNK	PHCB	PIVL	PYR	*****

END PRINT-INFO

HYDR-PARM1

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

END HYDR-PARM1

HYDR-PARM2

#	-	#	FTABNO	LEN	DELTH	STCOR	KS	DB50	***
<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	***

END HYDR-PARM2

HYDR-INIT

RCHRES	Initial	conditions	for each	HYDR	section	***
# - #	***	VOL	Initial	value	of COLIND	Initial
	***	ac-ft	for each	possible	exit	for each

<-----><-----> <-----><-----><-----><-----> *** <-----><-----><-----><-----><----->

END HYDR-INIT

END RCHRES

SPEC-ACTIONS

END SPEC-ACTIONS

FTABLES

END FTABLES

EXT SOURCES

<-Volume->	<Member>	SsysSgap	<--Mult-->	Tran	<-Target vols>	<-Grp>	<-Member->	***
<Name>	#	<Name> #	tem	strg	<-factor-->strg	<Name> #	#	<Name> #
WDM	2	PREC	ENGL	1.2	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***
COPY  501 OUTPUT MEAN  1 1      48.4      WDM  501 FLOW      ENGL      REPL
END EXT TARGETS
```

MASS-LINK

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

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

END MASS-LINK

END RUN

Mitigated UCI File

RUN

GLOBAL

```
WVHM4 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    SCA ACCESS RD.wdm
MESSU    25    MitsCA ACCESS RD.MES
          27    MitsCA ACCESS RD.L61
          28    MitsCA ACCESS RD.L62
          30    POCSCA ACCESS RD1.dat
```

END FILES

OPN SEQUENCE

```
INGRP          INDELT 00:15
  IMPLND        1
  RCHRES        1
  COPY          1
  COPY         501
  DISPLY        1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

```
# - #<-----Title----->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
1   1   Gravel Trench Bed 1          MAX          1   2   30   9
```

END DISPLY-INF01

END DISPLY

COPY

TIMESERIES

```
# - # NPT NMN ***
1   1   1   1
501 1   1   1
```

END TIMESERIES

END COPY

GENER

OPCODE

```
#   # OPCD ***
```

END OPCODE

PARM

```
#   #           K ***
```

END PARM

END GENER

PERLND

GEN-INFO

```
<PLS ><-----Name----->NBLKS  Unit-systems  Printer ***
# - #                               User  t-series  Engl Metr ***
                               in  out          ***
```

END GEN-INFO

*** Section PWATER***

ACTIVITY

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

END ACTIVITY

PRINT-INFO

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

END PRINT-INFO

PWAT-PARM1

```

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

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

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

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

END PERLND

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

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

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

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

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

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

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

```

END IMPLND

SCHEMATIC

<-Source->	<--Area-->	<-Target->	MBLK	***
<Name> #	<-factor->	<Name> #	Tbl#	***
South Basin***				
IMPLND 1	0.72	RCHRES 1	5	

*****Routing*****

IMPLND 1	0.72	COPY 1	15
RCHRES 1	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-007	2	1 1	28 0 1	

END GEN-INFO

*** Section RCHRES***

ACTIVITY

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

END ACTIVITY

PRINT-INFO

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

END PRINT-INFO

HYDR-PARM1

RCHRES	Flags for each HYDR Section	***	ODGTFG for each	FUNCT for each	***
# - #	VC A1 A2 A3	ODFVFG for each	*** possible exit	*** possible exit	possible exit
	FG FG FG FG	* * * * *	* * * * *	* * * * *	* * * * *
1	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	0.25	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

END HYDR-INIT

END RCHRES

SPEC-ACTIONS

END SPEC-ACTIONS

FTABLES

FTABLE

1

92 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.059688	0.000000	0.000000	0.000000		
0.022222	0.059689	0.000438	0.000000	0.361119		
0.044444	0.059690	0.000875	0.000000	0.361127		
0.066667	0.059692	0.001313	0.000000	0.361135		
0.088889	0.059693	0.001751	0.000000	0.361143		
0.111111	0.059694	0.002189	0.000000	0.361151		
0.133333	0.059696	0.002626	0.000000	0.361159		
0.155556	0.059697	0.003064	0.000000	0.361167		
0.177778	0.059698	0.003502	0.000000	0.361175		
0.200000	0.059700	0.003940	0.000000	0.361183		
0.222222	0.059701	0.004378	0.000000	0.361191		
0.244444	0.059702	0.004815	0.000000	0.361200		
0.266667	0.059704	0.005253	0.000000	0.361208		
0.288889	0.059705	0.005691	0.000000	0.361216		
0.311111	0.059706	0.006129	0.000000	0.361224		
0.333333	0.059708	0.006567	0.000000	0.361232		
0.355556	0.059709	0.007005	0.000000	0.361240		
0.377778	0.059710	0.007442	0.000000	0.361248		
0.400000	0.059712	0.007880	0.000000	0.361256		
0.422222	0.059713	0.008318	0.000000	0.361264		
0.444444	0.059714	0.008756	0.000000	0.361272		
0.466667	0.059716	0.009194	0.000000	0.361280		
0.488889	0.059717	0.009632	0.000000	0.361288		
0.511111	0.059718	0.010070	0.000000	0.361296		
0.533333	0.059720	0.010508	0.000000	0.361304		
0.555556	0.059721	0.010946	0.000000	0.361312		
0.577778	0.059722	0.011384	0.000000	0.361320		
0.600000	0.059724	0.011822	0.000000	0.361328		
0.622222	0.059725	0.012260	0.000000	0.361336		
0.644444	0.059726	0.012698	0.000000	0.361344		
0.666667	0.059728	0.013136	0.000000	0.361352		
0.688889	0.059729	0.013574	0.000000	0.361360		
0.711111	0.059730	0.014012	0.000000	0.361368		
0.733333	0.059732	0.014450	0.000000	0.361376		
0.755556	0.059733	0.014888	0.000000	0.361384		
0.777778	0.059734	0.015326	0.000000	0.361392		
0.800000	0.059736	0.015764	0.000000	0.361400		
0.822222	0.059737	0.016202	0.000000	0.361408		
0.844444	0.059738	0.016640	0.000000	0.361417		
0.866667	0.059740	0.017078	0.000000	0.361425		
0.888889	0.059741	0.017516	0.000000	0.361433		
0.911111	0.059742	0.017954	0.000000	0.361441		
0.933333	0.059744	0.018392	0.000000	0.361449		
0.955556	0.059745	0.018831	0.000000	0.361457		
0.977778	0.059746	0.019269	0.000000	0.361465		
1.000000	0.059748	0.019707	0.000000	0.361473		
1.022222	0.059749	0.020145	0.000000	0.361481		
1.044444	0.059750	0.020583	0.000000	0.361489		
1.066667	0.059752	0.021021	0.000000	0.361497		
1.088889	0.059753	0.021460	0.000000	0.361505		
1.111111	0.059754	0.021898	0.000000	0.361513		
1.133333	0.059756	0.022336	0.000000	0.361521		
1.155556	0.059757	0.022774	0.000000	0.361529		
1.177778	0.059758	0.023212	0.000000	0.361537		
1.200000	0.059760	0.023651	0.000000	0.361545		
1.222222	0.059761	0.024089	0.000000	0.361553		
1.244444	0.059762	0.024527	0.000000	0.361561		
1.266667	0.059764	0.024965	0.000000	0.361569		
1.288889	0.059765	0.025404	0.000000	0.361577		
1.311111	0.059766	0.025842	0.000000	0.361585		
1.333333	0.059767	0.026280	0.000000	0.361593		
1.355556	0.059769	0.026718	0.000000	0.361601		
1.377778	0.059770	0.027157	0.000000	0.361609		
1.400000	0.059771	0.027595	0.000000	0.361617		
1.422222	0.059773	0.028033	0.000000	0.361625		

1.444444	0.059774	0.028472	0.000000	0.361634
1.466667	0.059775	0.028910	0.000000	0.361642
1.488889	0.059777	0.029348	0.000000	0.361650
1.511111	0.059778	0.029787	0.000000	0.361658
1.533333	0.059779	0.030225	0.000000	0.361666
1.555556	0.059781	0.030664	0.000000	0.361674
1.577778	0.059782	0.031102	0.000000	0.361682
1.600000	0.059783	0.031540	0.000000	0.361690
1.622222	0.059785	0.031979	0.000000	0.361698
1.644444	0.059786	0.032417	0.000000	0.361706
1.666667	0.059787	0.032856	0.000000	0.361714
1.688889	0.059789	0.033294	0.000000	0.361722
1.711111	0.059790	0.033733	0.000000	0.361730
1.733333	0.059791	0.034171	0.000000	0.361738
1.755556	0.059793	0.034610	0.000000	0.361746
1.777778	0.059794	0.035048	0.000000	0.361754
1.800000	0.059795	0.035487	0.000000	0.361762
1.822222	0.059797	0.035925	0.000000	0.361770
1.844444	0.059798	0.036364	0.000000	0.361778
1.866667	0.059799	0.036802	0.000000	0.361786
1.888889	0.059801	0.037241	0.000000	0.361794
1.911111	0.059802	0.037679	0.000000	0.361802
1.933333	0.059803	0.038118	0.000000	0.361810
1.955556	0.059805	0.038556	0.000000	0.361818
1.977778	0.059806	0.038995	0.000000	0.361826
2.000000	0.059807	0.039433	0.000000	0.361834
2.022222	0.059809	0.040762	0.035147	0.361842

END FTABLE 1

END FTABLES

EXT SOURCES

<-Volume->	<Member>	SsysSgap	<--Mult-->	Tran	<-Target vols>	<-Grp>	<-Member->	***	
<Name>	#	<Name>	#	tem strg	<-factor-->	strg	<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	1006	FLOW	ENGL	REPL
RCHRES	1	HYDR	O	1	1	1	WDM	1007	FLOW	ENGL	REPL
RCHRES	1	HYDR	O	2	1	1	WDM	1008	FLOW	ENGL	REPL
RCHRES	1	HYDR	STAGE	1	1	1	WDM	1009	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

END EXT TARGETS

MASS-LINK

<Volume>	<-Grp>	<-Member->	<--Mult-->	<Target>	<-Grp>	<-Member->	***	
<Name>		<Name>	#	#	<-factor-->	<Name>	# #	***
MASS-LINK			5					
IMPLND	IWATER	SURO		0.083333		RCHRES	INFLOW	IVOL
END MASS-LINK			5					
MASS-LINK			15					
IMPLND	IWATER	SURO		0.083333		COPY	INPUT	MEAN
END MASS-LINK			15					
MASS-LINK			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

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