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

October 31, 2022

Washington State Department of Enterprise Services
Division of Engineering & Architectural Services
206 General Administration Building
Olympia, Washington 98504-1012

Attention: Dennis Flynn

Subject: Supplemental Groundwater Information Addendum #1
Pierce College Puyallup – Northwest Parking Lot Additions
Puyallup, Washington
File No. 21342-003-00

INTRODUCTION

This addendum presents additional groundwater monitoring information collected for the Pierce College Puyallup – Parking Lot Additions project in Puyallup, Washington, and is intended to supplement our Geotechnical Engineering Services Report for the same project, dated January 31, 2022 (Geotechnical Report). Our services have been provided in general accordance with our Additional Service Agreement #1 for this project dated December 22, 2021 and our Signed Agreement No. 2020-546 C dated March 16, 2022. Reference to this study should include review and full inclusion of our January 31, 2022 Geotechnical Report. This addendum and our report should be provided and reviewed together for all our geotechnical information, conclusions, and recommendations presented by us on this project.

The City of Puyallup (City) requested, and in general accordance with the Washington State Department of Ecology's 2014 Stormwater Management Manual for Western Washington (SWMMWW), that groundwater monitoring data be collected during the wet season (defined by City as December 21 through April 1) in the vicinity of the former proposed detention pond to be located near the future northwest parking lot. We facilitated drilling and installation of a groundwater monitoring well (MW-1) at the site on January 3, 2022. MW-1 was placed in the vicinity of the former proposed stormwater detention system. The location of the well is shown on the Site Plan, Figure 1. We understand that due to site constraints and other factors, the northwest stormwater facility design was changed to an underground detention pipe system. The underground system will be located beneath the western portion of the proposed northwest parking lot. The bottom of the facility is planned to be between about Elevation 506.5 and 507 feet. As part of the system change, the parking lot layout was elongated toward the west to northwest.

In the following sections, we discuss the subsurface conditions encountered during drilling, present the groundwater monitoring data collected, and provide additional conclusions and recommendations for design of the northwest stormwater facility.

SUBSURFACE CONDITIONS

During drilling for MW-1, we advanced through about 12 inches of forest duff and/or organic-rich soil at the surface. Underlying the forest duff, we encountered what we interpret to be glacial till. The upper approximate 4½ feet was weathered and generally consisted of medium dense silty sand. Beneath the weathered zone, soil generally consisted of dense to very dense silty sand with gravel, very dense gravel with silt and sand, and very stiff to hard silt with varying sand content. A more detailed description of our interpretation of geologic and subsurface conditions at the project site and additional exploration logs are provided in our Geotechnical Report. Our exploration and laboratory testing program and summary exploration log for this study is included in Appendix A.

We encountered groundwater at about 21 feet below ground surface (bgs) during drilling. After constructing the monitoring well, we measured groundwater at about 9¾ feet bgs. Based on subsurface soil conditions (soil lithology and soil moisture conditions), followed by the subsequent rise in groundwater level (approximate 11-foot rise after well construction), it is our opinion that artesian groundwater conditions are present in the vicinity of MW-1. It should be noted that our other geotechnical studies in the project vicinity on campus have documented near surface perched groundwater seepage, but it was not interpreted to be a regional groundwater table at the depths noted or an artesian condition.

GROUNDWATER MONITORING

We installed a pressure transducer data logger within MW-1 to record groundwater levels at regular time intervals. The data logger was programmed to collect a groundwater reading once a day at 12:00 between January 4 and May 18, 2022. Groundwater data collected was compiled and correlated to an elevation versus date presented in the Groundwater Hydrograph, Figure 2.

The maximum and average groundwater elevations are presented in Table 1 below.

TABLE 1. GROUNDWATER ELEVATION SUMMARY

Date and Time of Maximum Elevation	Approx. Maximum Elevation (feet, NAVD88[1])	Approx. Average Elevation (feet, NAVD88[1])
1/17/22 12:00	506.0	504.5

Notes:

[1] The North American Vertical Datum 1988.

CONCLUSIONS AND RECOMMENDATION

Design Considerations

- We recommend that Elevation 506 feet be considered the limiting elevation for the bottom of the stormwater system for storage considerations.
- Buoyancy effects should be considered as a part of the detention system design. As such, we suggest that an initial and assumed groundwater elevation of 508 feet (NAVD88) be considered as a target groundwater elevation for buoyancy calculation checks. This is somewhat conservative. If

it is found that buoyancy effects at this groundwater elevation is a concern, we should be contacted and provided an opportunity to review and assist with the design.

- Total soil unit weight (above groundwater) may be considered to be 125 pounds per cubic foot (pcf).
- Effective soil unit weight (below groundwater) may be considered to be 62.6 pcf.
- Follow detention pipe system manufacturer recommendations for mitigating buoyancy effects.

Construction Considerations

Based on proposed design elevations, expect to encounter water below about Elevation 506 feet during excavation and construction. This will occur from either near surface seepage and/or artesian conditions, as described above. Artesian conditions may temporarily cause the base of the excavation to "float" and/or become unstable and/or disturbed. We expect that artesian conditions should subside shortly after excavation and just be wet. If the excavation takes place in mid- to late-summer, we expect the upward artesian seepage to be less prominent and the basal soils could potentially be dryer and less difficult to manage.

Subgrade stabilization below the bottom of the stormwater system may be necessary during construction. As such, we recommend budgeting and planning for at least 12 inches of subgrade over-excavation and replacement with quarry spalls (Washington State Department of Transportation [WSDOT] Standard Specification 9-13.1(5)), aside from any design base materials already in the project plans and specifications. Ultimately, base and subgrade conditions will have to be observed during excavation to determine if this, or other means of stabilization, are necessary.

LIMITATIONS

We have prepared this letter for the exclusive use of the Washington State Department of Enterprise Services (DES) and their authorized agents for the Pierce College Puyallup – Parking Lot Additions project located in Puyallup, Washington.

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

Except for described and modified herein, the conclusions and recommendations and limitations presented in our January 31, 2022 Geotechnical Report remain unchanged and still apply to this project. Please refer to Appendix A titled "Report Limitations and Guidelines for Use" in our Geotechnical Report for additional information pertaining to use of this letter.

We trust that this letter meets your needs. If you have any questions regarding this letter, please contact us.

Sincerely,
GeoEngineers, Inc.

10/31/22

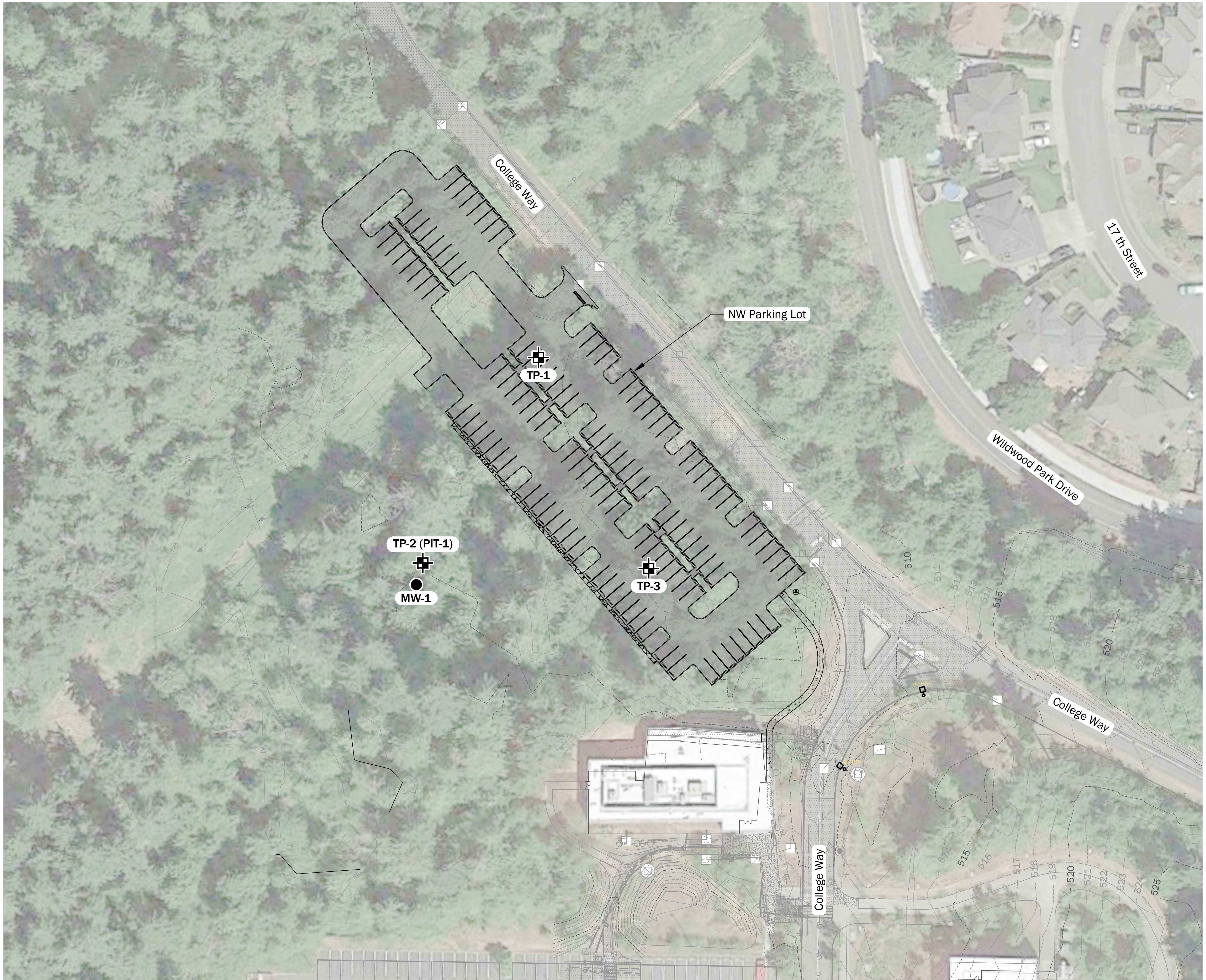
Christopher R. Newton, PE
Geotechnical Engineer

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

CRN:DJT:leh

Attachments:
Figure 1. Site Plan
Figure 2. Groundwater Hydrograph
Appendix A. Subsurface Explorations and Laboratory Testing
  Figure A-1 – Key to Exploration Logs
  Figure A-2 – Log of Monitoring Well
  Figures A-3 and A-4 – Sieve Analysis Results

1 copy submitted electronically



Legend

MW-1 ● Monitoring Well by GeoEngineers, Inc., 2022

TP-1 Test Pit by GeoEngineers, Inc., 2021

Notes:

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

Data Source: Background from AHBL, Inc., received on 10/06/2022.
Aerial from Google Earth Pro dated 08/14/2020.

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

N W E S

80 0 80

Feet

Site Plan

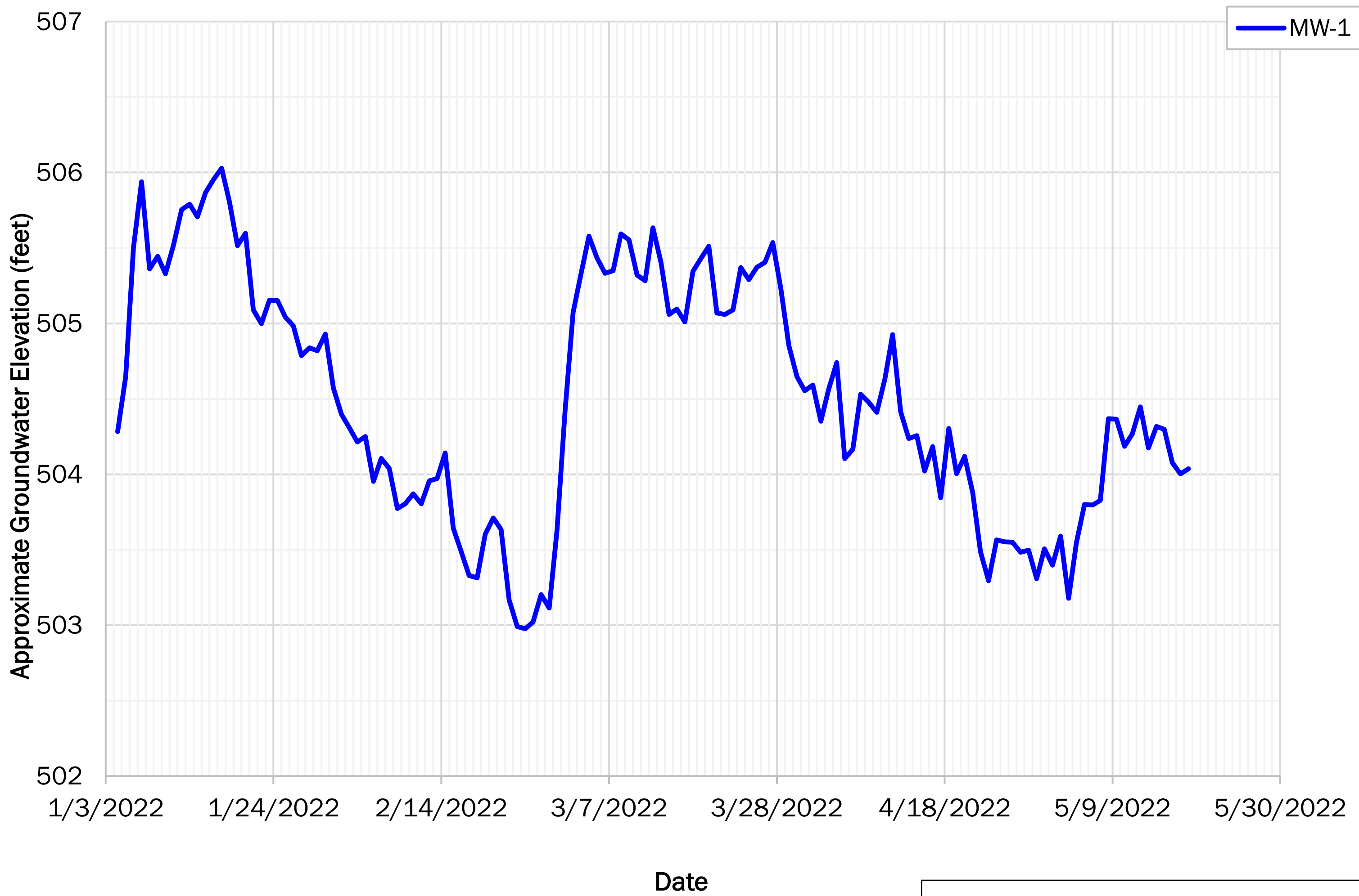
Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

GEOENGINEERS

Figure 1

P:\21\2134200 3\CAD\00\Addendum Report\2134200300_F01_Site Plan.dwg TAB:F01 Date Exported: 11/01/22 - 16:29 by mfadhl

Groundwater Hydrograph



Note:

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

Groundwater Hydrograph	
Pierce College Puyallup - Parking Lot Additions Puyallup, Washington	
GeoEngineers	Figure 2

APPENDIX A
Subsurface Explorations and Laboratory Testing

APPENDIX A
SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

Subsurface Explorations

Subsurface conditions were explored by advancing one hollow-stem auger boring on January 3, 2022. Subsurface exploratory services were provided by Holocene Drilling, Inc. under subcontract to GeoEngineers, Inc. The boring was advanced to a nominal depth of about 25¼ feet below surrounding site grade. A groundwater monitoring well was installed with a pressure transducer at this boring.

The boring was located in the field using an electronic tablet equipped with a global positioning system (GPS) software application. The exploration coordinates were approximated using publicly available aerial imagery and coordinate software. The exploration location is included on the Site Plan, Figure 1. The location and elevation of the exploration should be considered approximate.

Our field representative collected samples, classified the soils, maintained a detailed log of the exploration, and observed groundwater conditions. The samples were obtained with a standard split spoon sampler in general accordance with ASTM International (ASTM) D 1586. Field blow counts are presented on the logs. The soils were classified visually in general accordance with the system described in Figure A-1, which includes a key to the exploration logs. A summary log of the exploration is included as Figure A-2.

Laboratory Testing

Soil samples obtained from the boring were transported to GeoEngineers laboratory. Representative soil samples were selected for laboratory tests to evaluate the pertinent geotechnical engineering characteristics of the site soils and to confirm our field classification.

Our testing program consisted of the following:

- Five – Particle-size distribution analyses (sieve analyses (SA))
- One – Moisture content determination (MC)

Tests were performed in general accordance with test methods of ASTM or other applicable procedures. The following sections provide a general description of the tests performed.

Sieve Analysis

Particle-size analyses were completed on selected samples in general accordance with ASTM Test Method C 136. This test method determines quantitatively the distribution of particle sizes in soils. Typically, the distribution of particle sizes larger than 75 micrometers (μm) is determined by sieving. The results of the tests were used to verify field soil classifications and determine pertinent engineering characteristics. Figures A-3 and A-4 present the results of our sieve analyses.

Moisture Content

The moisture content of a selected sample was determined in general accordance with ASTM Test Method D 2216. The test results are used to aid in soil classification and correlation with other pertinent engineering soil properties. The test results are shown on the exploration log at the respective sample depth.

SOIL CLASSIFICATION CHART

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

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

ADDITIONAL MATERIAL SYMBOLS

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

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel / Dames & Moore (D&M)
- Standard Penetration Test (SPT)
- Shelby tube
- Piston
- Direct-Push
- Bulk or grab
- Continuous Coring

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

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

"WOH" indicates sampler pushed using the weight of the hammer.

Groundwater Contact

Measured groundwater level in exploration, well, or piezometer

Measured free product in well or piezometer

Graphic Log Contact

Distinct contact between soil strata

Approximate contact between soil strata

Material Description Contact

Contact between geologic units

Contact between soil of the same geologic unit

Laboratory / Field Tests

%F	Percent fines
%G	Percent gravel
AL	Atterberg limits
CA	Chemical analysis
CP	Laboratory compaction test
CS	Consolidation test
DD	Dry density
DS	Direct shear
HA	Hydrometer analysis
MC	Moisture content
MD	Moisture content and dry density
Mohs	Mohs hardness scale
OC	Organic content
PM	Permeability or hydraulic conductivity
PI	Plasticity index
PL	Point lead test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
UU	Unconsolidated undrained triaxial compression
VS	Vane shear

Sheen Classification

NS	No Visible Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen

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

Key to Exploration Logs

GeoEngineers

Figure A-1

Drilled	Start 1/3/2022	End 1/3/2022
Total Depth (ft)	25.25	
Logged By	OA	
Checked By	CRN	
Driller	Holocene Drilling, Inc.	
Drilling Method	Hollow-stem Auger	
Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	
Drilling Equipment	Diedrich D-50 Turbo (track-mounted)	
Surface Elevation (ft) / Vertical Datum	514.55 / NAVD88	
Top of Casing Elevation (ft)	518.29	
Easting (X) / Northing (Y)	1198829 / 671013	
Horizontal Datum	WA State Plane South NAD83 (feet)	

DOE Well I.D.: BNP-056
A 2-in well was installed on 1/3/2022 to a depth of 25 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
1/3/2022	9.75	504.80

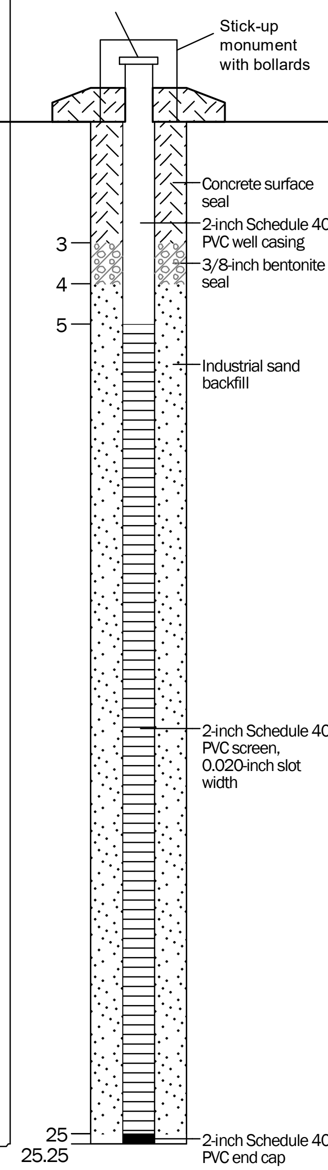
Notes: Groundwater observed at approximately 21 feet below ground surface during drilling

FIELD DATA / MATERIAL DESCRIPTION

Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Group Classification	Material Description	Moisture Content (%)	Fines Content (%)
0				Duff	Forest duff		
	16	26	1 MC	SM	Gray with moderate oxidation staining silty fine to medium sand with occasional gravel (medium dense, moist) (weathered glacial till)	20	
5	10	42	2	SM	Gray silty fine sand with gravel (dense, moist) (glacial till)		
	8	78/9"	3 SA		Grades to very dense, includes approximate 1-inch thick layer of wet, fine to medium sand	12	43
10	17	85/11"	4 SA	ML	Gray silt with sand (hard, moist)	17	71
15	12	22	5 SA	ML	Gray sandy silt and includes approximate 1-inch-thick layer of wet, fine to medium sand (very stiff, near wet)	19	51
20	6	50/6"	6 SA	SM	Gray silty fine sand with gravel (very dense, wet)	15	34
25	3	50/3"	7 SA	GW-GM	Gray fine to coarse gravel with silt and sand (very dense, wet)	8	8

Elevation (feet): 510, 505, 500, 495, 490

WELL LOG

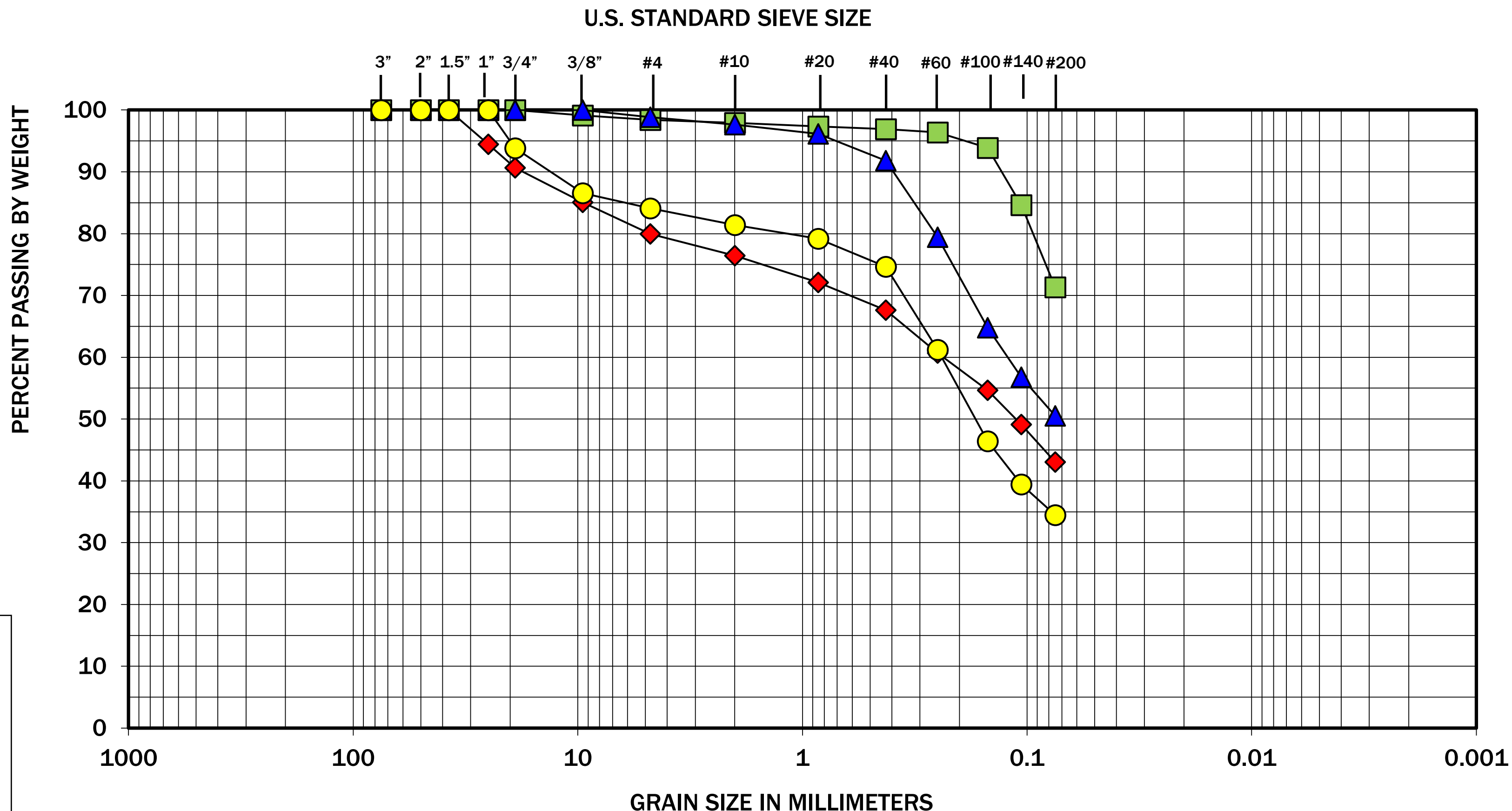


Note: See Figure A-1 for explanation of symbols.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Aerial Imagery.

Log of Monitoring Well MW-1

GeoEngineers

Project: Pierce College Puyallup - Parking Lot Additions
Project Location: Puyallup, Washington
Project Number: 21342-003-00



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆ (red diamond)	MW-1	7.5	12	Silty sand with gravel (SM)
■ (green square)	MW-1	10	17	Silt with sand (ML)
▲ (blue triangle)	MW-1	15	19	Sandy silt (ML)
● (yellow circle)	MW-1	20	15	Silty sand with gravel (SM)

AASHTO ACCREDITED

Note: This report may not be reproduced, except in full, without written approval of GeoEngineers, Inc. Test results are applicable only to the specific sample on which they were performed, and should not be interpreted as representative of any other samples obtained at other times, depths or locations, or generated by separate operations or processes.

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

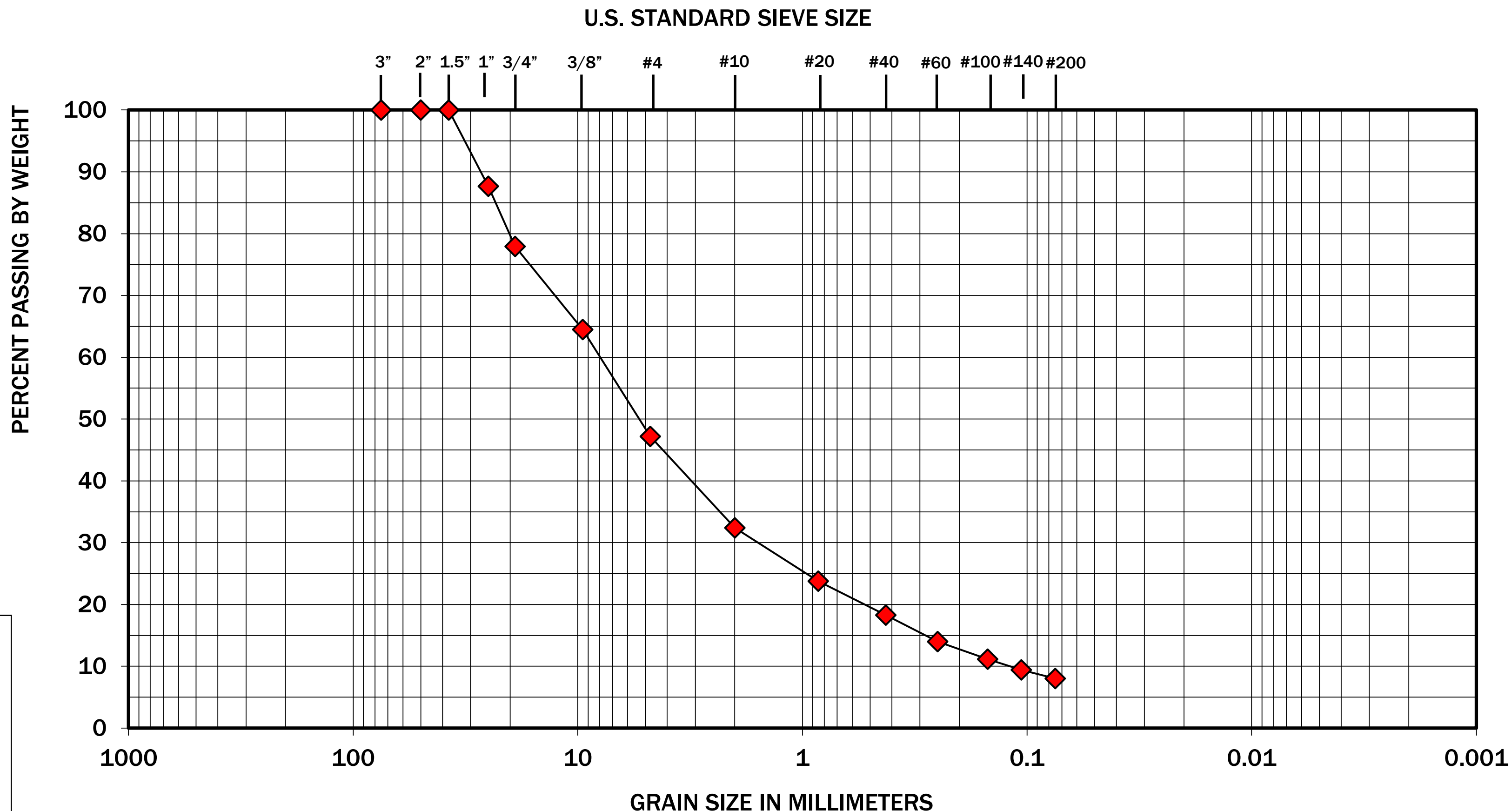
GeoEngineers

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

Sieve Analysis Results

Figure A-3

21342-003-00 Date Exported: 1/14/22



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring Number	Depth (feet)	Moisture (%)	Soil Description
◆	MW-1	25	8	Well-graded gravel with silt and sand (GW-GM)

AASHTO ACCREDITED

The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

GEOENGINEERS

Pierce College Puyallup - Parking Lot Additions
Puyallup, Washington

Sieve Analysis Results

Figure A-4