Geotechnical Engineering Services

East Parking Lot Expansion
South Hill Business and Technology Center
Puyallup, Washington

for
Benaroya Company LLC

February 28, 2022

GeoEngineers
Earth Science + Technology

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GeoEngineers

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Puyallup, Washington

File No. 4565-064-06

February 28, 2022

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GEOENGINEERS

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APPENDICES

1.0 INTRODUCTION AND PROJECT DESCRIPTION

This report presents the results of GeoEngineers, Inc.'s (GeoEngineers) geotechnical engineering services for the proposed East Parking Lot project at the South Hill Business and Technology Center in Puyallup, Washington. We previously provided geotechnical engineering services and infiltration testing for the proposed parking lot in 2014. We understand the size of the proposed parking area has increased to include the wooded area to the east, extending roughly 500 square feet.

The project location is shown on the attached Vicinity Map, Figure 1. The purpose of this study was to complete additional infiltration testing for potential low impact development (LID) drainage features, complete explorations to evaluate subsurface conditions in the undeveloped wooded area, and to provide geotechnical recommendations for support of the parking lot expansion. Our geotechnical engineering services were completed in general accordance with the confirming agreement executed on March 30, 2020. We submitted a draft report on February 5, 2021. This final report incorporates a revised site plan.

2.0 FIELD EXPLORATIONS AND LABORATORY TESTING

2.1. Field Explorations

Subsurface soil and groundwater conditions were evaluated by excavating 11 test pits (TP-1-20 through TP-5-20 and PIT-1-20 through PIT-6-20) and advancing three borings (MW-1-20, MW-2-20 and B-3) at the approximate locations shown on the attached Site Plan, Figure 2. The test pits were completed to depths ranging from 7½ to 10 feet below the ground surface (bgs). The borings were advanced to depths between 11.5 and 26.5 feet bgs.

Pilot infiltration tests (PITs) were completed in six of the test pits (PIT-1-20 through PIT-6-20) at a depth of 4 feet. Two of the borings (MW-1-20 and MW-2-20) were completed as monitoring wells. A detailed description of the field exploration and testing program and logs of the explorations are presented in Appendix A, Field Explorations. The results of the PITs are also presented in the main text of this report.

2.2. Laboratory Testing

Soil samples obtained from the explorations were transported to GeoEngineers' Redmond, Washington geotechnical laboratory and evaluated to confirm or modify field classifications, as well as to evaluate engineering and index properties of the soil. Selected samples were tested for the determination of moisture content, grain size distribution, percent fines and organic content. Select soil samples were also sent to an outside laboratory for cation exchange capacity (CEC) analysis. A description of the laboratory testing and the test results are presented in Appendix B, Laboratory Testing.

3.0 GEOLOGY

We reviewed available geologic maps, including the geologic map of the Tacoma quadrangle (Schuster et al. 2015). The project area is located on a glaciated upland west and south of a major glacial trough, now occupied by the Puyallup River.

Surficial soils mapped in the project vicinity generally consist of geologic units deposited during the Vashon stade of the Fraser glaciation and include Vashon Till (Got), Recessional outwash (Qgo) and ice-contact deposits (Qgo_i).

Vashon till generally consists of a non-sorted, non-stratified mixture of clay, silt, sand and gravel with larger constituents up to the size of cobbles and boulders. The till is very dense and relatively impermeable but can contain localized zones of interbedded stratified sand and gravel.

Recessional outwash and ice-contact deposits typically consist of stratified outwash sand with some gravel, and some areas of silt and clay. The sediments were deposited by meltwater from the stagnating and receding Vashon glacier and are typically loose to medium dense.

Subsurface soils encountered in our explorations are consistent with the geologic mapping. In general, we encountered a variable thickness of fill overlying recessional outwash/ice contact deposits. Glacial till was encountered at depth in the borings below a depth of approximately 20 to 25 feet bgs.

4.0 SITE CONDITIONS

4.1. Surface Conditions

The South Hill Business and Technology Center is located north of 39th Avenue SE, east of Bradley Lake and west of Pierce College in Puyallup, Washington. College Way borders the site to the north. The East Parking Lot expansion area is located in the east-central portion of the Business and Technology Center campus. The southwest portion of the parking lot expansion area consists of a gravel parking/yard area located adjacent to the existing south building as shown in Figure 2. The existing gravel area is relatively level with existing ground surface elevations ranging from Elevation 486 feet in the west and Elevation 491 feet in the east (elevations in this report refer to the North American Vertical Datum of 1988 [NAVD 88]). The north and east portions of the proposed parking lot expansion area consist of an undeveloped wooded area that slopes upward to the east to approximately Elevation 520 feet. This area contains fir and cedar trees with a dense understory of blackberry vines.

4.2. Subsurface Soil Conditions

Soils encountered in the explorations are generally consistent with the mapped geologic units. Soils encountered in the explorations on the western portion generally consist of fill overlying complex layering of recessional outwash/ice contact deposits. The near-surface deposits generally consist of medium dense silty sand with variable gravel content. Cobbles were observed within the deposits in PIT-3-20 and PIT-6-20. The silty sand was encountered below the infiltration subgrade in the southwestern explorations, which resulted in limited to no infiltration as described in a subsequent section.

Subsurface soils encountered in PIT-5-20 and PIT-6-20 excavated in the eastern undeveloped area contained layers of cleaner sand and gravel that extended to the full depth of the test pits. Moderate to high infiltration rates were obtained in these explorations as discussed in Section 5.4.

The borings were advanced up to a depth of 26.5 feet below the existing ground surface and encountered dense to very dense silty sand with gravel below a depth of 20 to 25 feet (interpreted as glacial till). Shallow monitoring wells were installed in the borings to monitor groundwater conditions.

Vashon till consists of dense to very dense silty sand with gravel, cobbles, and occasional boulders.

4.3. Groundwater Conditions

Groundwater seepage was observed in test pits TP-4-20 and TP-5-20 located in the southeast corner of the site at depths of 6 and 8½ feet, respectively. Groundwater seepage was also observed in PIT-3-20 and PIT-4-20 at depths of 2 and 3¾ feet, respectively, prior to PIT testing. A summary of groundwater observations in all explorations is provided in Table 1. Groundwater levels should be expected to fluctuate seasonally and following significant rain events.

TABLE 1. GROUNDWATER OBSERVATIONS AND MEASUREMENTS

Exploration	Observed Seepage Depth[1] (During Excavation/Drilling) (feet)	Observed Seepage Depth Following PIT Test[2] (feet)	Measured Groundwater Depth (feet), Date
TP-1-20	Not Encountered	-	-
TP-2-20	Not Encountered	-	-
TP-3-20	Not Encountered	-	-
TP-4-20	6	-	-
TP-5-20	8½	-	-
PIT-1-20	Not Encountered	Not Encountered	-
PIT-2-20	Not Encountered	Not Encountered	-
PIT-3-20	2	Not Encountered	-
PIT-4-20	3½	Not Encountered	-
PIT-5-20	Not Encountered	Not Encountered	-
PIT-6-20	Not Encountered	6	-
MW-1	15	-	15.30, 12/18/20
MW-1			10.61, 5/7/21
MW-2	13	-	8.55, 12/18/20
MW-2			5.61, 5/7/21

Notes:

[1] Groundwater levels observed during excavation/drilling should be considered approximate due to the limited time the exploration is left open.

[2] Although seepage was not observed following the PIT test, PIT-1-20 through PIT-3-20 had zero infiltration as discussed in Section 5.4.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary of Geotechnical Considerations

We conclude that the planned improvements can be successfully completed from a geotechnical perspective, provided the considerations and recommendations presented in this report are incorporated into the project. A summary of the primary geotechnical considerations is provided below. The summary is presented for introductory purposes only and should be used in conjunction with the complete recommendations presented in this report.

- The surficial silty sand soils contain a high percentage of fines (that portion passing the U.S. No. 200 sieve) and are therefore susceptible to disturbance when wet. Care should be taken to avoid allowing these soils to become saturated and disturbed. We recommend earthwork be completed in the dry season, if practical, to reduce subgrade stabilization measures and import/export quantities.
- Based on our understanding of subsurface conditions at the site and our experience, we recommend a minimum pavement section consisting of 3 inches of asphalt concrete overlying 6 inches of crushed surfacing base course (CSBC) for drive aisles and light-duty service vehicles. A minimum pavement section consisting of 2 inches of asphalt concrete overlying 4 inches of CSBC is appropriate for areas restricted to automobile parking. A granular subbase is also recommended to provide pavement drainage and a stable subgrade for pavement support. Subbase material should consist of a minimum 6-inch thickness of gravel borrow as described in Section 5.3 "Pavement Considerations." This minimum thickness assumes construction occurs during dry weather and the subgrade can be compacted to at least 95 percent of the maximum dry density (MDD) prior to placement. Additional thickness will be required where loose, wet soils are encountered.
- We anticipate that portions of the on-site soils may be suitable for reuse as fill during dry weather only. Imported structural fill will be necessary during wet weather and when the existing soils are too wet to achieve compaction. We recommend the suitability of the exposed soils be evaluated during construction when they are exposed and a contingency be planned to use imported structural fill. Structural fill recommendations are described in Section 5.2.3. "Structural Fill Materials."
- We understand that stormwater infiltration drainage features are being considered for the site. We also understand that the infiltration facilities will be designed in accordance with the Washington State Department of Ecology Stormwater Management Manual of Western Washington (SMMWW) (Ecology 2019). Testing results of PITs completed in the southwest portion of the site resulted in no infiltration. Infiltration rates obtained in PITs completed in the undeveloped area range from 0.2 to 5.7 (corrected), with the greatest infiltration at PIT-5-20 and PIT-6-20. Groundwater was measured more than 5.6 feet below the existing ground surface in the monitoring wells installed within the undeveloped area.

These and other geotechnical considerations and recommendations are discussed further in the following sections of this report.

5.2. Earthwork

5.2.1. Earthwork Considerations

We anticipate site development and earthwork activities will include clearing and stripping vegetated areas; demolition of existing hardscaping or site facilities, as needed; site grading; establishing subgrades for drive aisles and parking areas; installation of utilities; installation of infiltration facilities; and placing and compacting fill and backfill materials. We expect site grading and earthwork can be accomplished with conventional earthmoving equipment. Cobbles were observed in the test pits and boulders are also common in glacial deposits. The contractor should be prepared to handle/remove cobbles and boulders.

Existing surfaces within proposed development areas should be cleared and stripped of all vegetation and organics prior to site development. Minimum stripping depths at the site will likely be on the order of 2 to 10 inches. Greater stripping depths should be anticipated to remove localized root systems of shrubs and trees within the undeveloped area. Voids caused by removal of stumps and/or root systems should be backfilled with compacted structural fill.

Based on our explorations, we anticipate soils exposed after stripping will have a high fines content and thus be susceptible to disturbance when wet. Care should be taken to avoid allowing these soils to become saturated and disturbed. We provide recommendations for subgrade protection in Section 5.2.3.3.

5.2.2. Subgrade Preparation

Prior to placing new fill, subbase or base course materials, larger subgrade areas should be proof-rolled to locate areas of loose, soft or pumping soils. Smaller subgrade areas should be evaluated by probing. Proof-rolling can be completed using a piece of heavy tire-mounted equipment or a loaded dump truck.

Where soft or pumping soils are observed, the subgrade soils should be recompacted or overexcavated and replaced. The depth of overexcavation should be determined by GeoEngineers based on the exposed conditions during construction. It may be possible to limit excavation depths by placing a geotextile for separation or soil stabilization on the subgrade (Washington State Department of Transportation [WSDOT] Standard Specification 9-33.2). We recommend using the specified woven fabric for soil stabilization (Table 3 of 9-33.2). The geotextile should be pulled taut and placed such that there are no folds or wrinkles. Adjacent geotextile panels should be overlapped a minimum of 1.5 feet. The first loose lift of fill placed over the geotextile should be a minimum of 12 inches thick and spread uniformly with a dozer. Equipment should not be routed directly on the geotextile or when there is less than 12 inches of cover. The geotextile will provide additional support by bridging over the soft material, and will help reduce fines contamination into the structural fill. The need for geotextile fabric and overexcavation should be evaluated based on observed conditions and depth of disturbance during construction.

GeoEngineers should monitor subgrade preparation operations to help determine the depth of removal of soft or pumping soils, and to evaluate whether subgrade disturbance or progressive deterioration is occurring. Subgrade disturbance or deterioration could occur if the subgrade is wet and cannot be dried. If the subgrade deteriorates during proof-rolling or compaction, it may become necessary to modify the proof-rolling or compaction criteria or methods.

5.2.3. Structural Fill Materials

Materials placed to support pavement is classified as structural fill for the purpose of this report. Structural fill material quality varies depending upon its use, as described below:

1. As a minimum, structural fill placed beneath pavement and to backfill utility trenches should meet the criteria for common borrow, WSDOT 9-03.14(3). Common borrow will be suitable for use as structural fill during dry weather conditions only and should be conditioned to within 2 percent of its optimum

moisture content. If structural fill is placed during wet weather, the structural fill should consist of gravel borrow, WSDOT 9-03.14(1) with the added restriction that the material passing the U.S. No. 200 sieve should be limited to 5 percent.

2. Structural fill placed as subbase below the CSBC should consist of gravel borrow. Gravel borrow should conform to WSDOT 9-03.14(1) with the added restriction that the material passing the U.S. No. 200 sieve should be limited to 5 percent.
3. Structural fill placed as CSBC should conform to WSDOT 9-03.9(3) with the exception that it contain less than 5 percent passing the U.S. No. 200 sieve.

5.2.3.1. On-site Soils

The soils observed in the explorations generally contain a high percentage of fines (silt and clay) and are moisture-sensitive. Some of the on-site soils may meet the criteria for common borrow and may be suitable for use during dry weather construction only, provided the soil has a moisture content near optimum. Fine-grained soils (silt and clay), or soils with wood or other debris do not meet the criteria for common borrow and should not be used.

5.2.3.2. Fill Placement and Compaction Criteria

Structural fill should be mechanically compacted to a firm and non-yielding condition. Structural fill should be placed in loose lifts not exceeding 1 foot in thickness. Each lift should be conditioned to the proper moisture content and compacted to the specified density before placing subsequent lifts. Structural fill should be compacted to the following criteria:

1. Structural fill beneath new pavement and storm drainage structures should be compacted to 90 percent of the MDD (ASTM International [ASTM] D 1557), except that the upper 2 feet of fill below final subgrade should be compacted to 95 percent of the MDD (ASTM D 1557).
2. Structural fill placed as CSBC below pavements should be compacted to 95 percent of the MDD (ASTM D 1557).

As discussed previously, we recommend that a representative of GeoEngineers be present during proof-rolling and/or probing of the exposed subgrade and pavement subgrade soils, and during placement of structural fill. GeoEngineers will evaluate the adequacy of the subgrade soils and identify areas needing further work, providing remediation recommendations as necessary. GeoEngineers will also perform in-place moisture-density tests of structural fill to evaluate whether the work is being done in accordance with the compaction specifications, and advise on any modifications to procedure that may be appropriate for the prevailing conditions.

5.2.3.3. Weather Considerations

The majority of surficial on-site soils generally contain a high percentage of fines (silt and clay) and are moisture-sensitive. When the moisture content of these soils is more than a few percent above the optimum moisture content, these soils become muddy and unstable, operation of equipment on these soils will be difficult, and it will be difficult or impossible to meet required compaction criteria. Disturbance of near-surface soils should be expected if earthwork is completed during periods of wet weather. The contractor will need to take precautions to protect the subgrade during periods of wet weather.

The wet weather season in western Washington generally begins in October and continues through May; however, periods of wet weather may occur during any month of the year. The optimum earthwork period for these types of soils is typically June through September. If wet weather earthwork is unavoidable, we recommend the following:

- The ground surface in and around the work area should be sloped so that surface water is directed away from the work area. The ground surface should be graded such that areas of ponded water do not develop. The contractor should take measures to prevent surface water from collecting in excavations and trenches. Measures should be implemented to remove surface water from the work area.
- Erosion control techniques should be implemented to prevent sediment from leaving the site.
- Earthwork activities should not take place during periods of heavy precipitation.
- Slopes with exposed soils should be covered with plastic sheeting.
- The contractor should take necessary measures to prevent on-site soils and soils to be used as fill from becoming wet or unstable. These measures may include the use of plastic sheeting, sumps with pumps, and grading. The site soils should not be left uncompacted and exposed to moisture. Sealing the surficial soils by rolling with a smooth-drum roller prior to periods of precipitation will help reduce the extent that these soils become wet or unstable.
- Construction activities should be scheduled so that the length of time that soils are left exposed to moisture is reduced to the extent practical.

5.3. Pavement Considerations

5.3.1. Subgrade Preparation

Pavement subgrade areas should be prepared as recommended in Section 5.2.2. "Subgrade Preparation." If construction occurs during the wet season, we estimate up to 18 inches of subbase overlying a geotextile may be required to provide a stabilized subgrade where grading occurs in the undeveloped area. Subbase fill should consist of gravel borrow as previously discussed. The subbase can be reduced to 6 inches if construction occurs during the dry season and the subgrade can be compacted to a minimum of 95 percent of the MDD. Isolated areas of thicker subbase may be required during the dry season where the existing soils are loose or wet and cannot be compacted. The required excavation thickness will depend on the moisture content of the subgrade soils at the time of construction and should be evaluated at that time.

If soft or pumping soils are observed within the prepared subgrade, subgrade soils should be recompacted or overexcavated and replaced. A woven geotextile could also be considered to limit overexcavation. Recommended overexcavation, geotextile and geotextile placement methods are provided in Section 5.2.2 "Subgrade Preparation."

5.3.2. Pavement Design

We recommend the following pavement design sections based on our understanding of subsurface conditions at the site, discussions with the design team, and our previous experience in the area.

TABLE 2. DESIGN PAVEMENT SECTIONS

Design Section	Asphalt Surfacing Thickness[1] (inches)	Crushed Surfacing Base Course[2] (inches)	Wet Weather Subbase Gravel Borrow[3] (inches)	Dry Weather Subbase Gravel Borrow[3] (inches)
Light-Duty Service Vehicles and Drive Aisles	3	6	12 to 18	6
Automobile Parking	2	4	12 to 18	6

Notes:

[1] Asphalt surfacing should consist of ½-inch HMA in accordance with WSDOT Specifications Sections 5-04 and 9-03.

[2] CSBC should meet WSDOT Specification 9-03.9(3) with the exception that it contain less than 5 percent passing the U.S. No. 200 sieve.

[3] The above pavement recommendations assume subgrade preparation to obtain CBR of approximately 15. If site preparation occurs during the wet season, a thick subbase is recommended for subgrade stabilization (12- to 18-inch layer of gravel borrow overlying a woven geotextile). The subbase can be reduced to 6 inches during dry weather provided the subgrade can be compacted to a minimum of 95 percent of the MDD. Gravel borrow should meet WSDOT Standard Specification 9-03.14(1) with the exception it contain less than 5 percent passing the U.S. No. 200 sieve.

5.4. Infiltration Considerations

We understand that stormwater infiltration drainage features are being considered for the site. Initial saturated hydraulic conductivity (Ksat) values were determined for site soils using in-situ PITs, as described below. We understand that infiltration features will be approximately 4 feet below grade.

5.4.1. Pilot Infiltration Tests

Six small-scale PITs were conducted in test pits PIT-1-20 through PIT-6-20 within the footprint of the proposed parking lot expansion area at the locations shown in Figure 2. The PITs were completed in general accordance with the guidelines provided in the SMMWW.

For all six PITs, a graduated yard stick was driven into the floor of each test pit as a visual reference for monitoring water levels during testing. A piezoelectric pressure transducer was secured to the bottom of the yard stick to provide accurate water level records in 5-second intervals throughout the duration of the tests. Full water-level records recorded for each test are plotted on Figures 3, 5, 7, 8, 10, and 12.

Detailed descriptions of the PIT "pre-soak" and testing phases are described in Appendix A. The plots of apparent PIT Infiltration rate for successive stages of each test (Figures 4, 6, 9, 11, and 13) provide a visual confirmation of subgrade saturation as infiltration rates decline to asymptotic steady-state values toward the end of the pre-soaking period when the water depth is maintained between 12 to 14 inches. The measured infiltration rates determined during the testing phase are assumed to approximate the saturated (vertical) hydraulic conductivity of the test pit subgrade.

5.4.2. Design Infiltration Rates

Three correction factors are applied to $K_{sat\ initial}$ to calculate the design saturated hydraulic conductivity ($K_{sat\ design}$) as required by the SMMWW. The correction factors consider the site variability and number of locations tested (CF_v), the testing method (CF_t), and the degree of influent control to prevent siltation and bio buildup (CF_m). CF_t accounts for uncertainties in the testing methods and is equal to 0.5 for small-scale PITs. CF_m accounts for the clogging effect of suspended material in stormwater, which will cause the soil's initial infiltration rate to gradually decline. The maintenance schedule calls for removing sediment when the Best Management Practices (BMP) is infiltrating at only 90 percent of its design capacity, so CF_m is equal to 0.9. CF_v can vary between 0.33 to 1.0 based on the variability of the soils on the site. CF_v was set to 0.8 for the three PITs located in the undeveloped area of the site (PIT-4-20 to PIT-6-20 in Table 3 below).

The design saturated hydraulic conductivity is calculated by:

$$K_{sat\ design} = K_{sat\ initial}\ x\ CF_v\ x\ CF_t\ x\ CF_m$$

Additional details of the infiltration testing is included in Appendix A. All correction factors and hydraulic conductivities are shown in Table A-1 and Table 3.

TABLE 3. INFILTRATION RATES FROM PILOT INFILTRATION TESTING

PIT	$K_{sat\ initial}$ (inches per hour)	CF_v[1]	CF_t[2]	CF_m[3]	$K_{sat\ design}$ (inches per hour)
PIT-1-20	0	-	-	-	0
PIT-2-20	0	-	-	-	0
PIT-3-20	NA	-	-	-	NA4
PIT-4-20	0.5	0.8	0.5	0.9	0.2
PIT-5-20	8.0	0.8	0.5	0.9	2.9
PIT-6-20	15.9	0.8	0.5	0.9	5.7

Notes:

[1] Site variability and number of locations tested. CF_v = 0.33 to 1.0

[2] Test method. CF_t = 0.5 for small-scale PITs

[3] Degree of influent control to prevent siltation and bio-buildup. CF_m = 0.9

[4] NA, PIT-3-20 could not be analyzed due to groundwater seepage entering the test pit excavation during testing

5.5. Drainage Considerations

We anticipate shallow groundwater seepage may enter construction excavations depending on the time of year and weather conditions. We anticipate localized dewatering can be adequately handled by pumping from sumps within the bottom of excavations augmented with gravel-lined trenches. The excavation for the sump and the drainage trenches should be backfilled with clean gravel or crushed rock to reduce the amount of sediment in the water pumped from the sump (i.e., to serve as a filter). If seepage is not intercepted and removed from excavations, it will be difficult to place and compact structural fill and may result in destabilized cut slopes.

All paved and landscaped areas should be graded so that surface drainage is directed away from the building to appropriate catch basins.

6.0 RECOMMENDED ADDITIONAL GEOTECHNICAL SERVICES

GeoEngineers should be retained to review the project plans and specifications when complete to confirm that our design recommendations have been implemented as intended. Care must be taken during construction to protect the infiltration surface below the parking areas by avoiding surface compaction from vehicle traffic or excavation equipment, avoiding flooding of the area, and preventing the run-on and ponding of silt laden stormwater from adjacent areas of the site.

During construction, GeoEngineers should observe stripping and grading, observe installation of subsurface drainage measures, evaluate the suitability of infiltration subgrades and other appurtenant structures, and provide a summary letter of our construction observation services. The purposes of GeoEngineers construction phase services are to confirm the subsurface conditions are consistent with those observed in the explorations and other reasons described in Appendix C, Report Limitations and Guidelines for Use.

7.0 LIMITATIONS

We have prepared this report for the exclusive use of the Benaroya Company LLC and other project team members for the East Parking Lot Expansion project at the South Hill Business and Technology Center in Puyallup, Washington. The data should be provided to prospective contractors for their bidding or estimating purposes, but our report and interpretations should not be construed as a warranty of the subsurface conditions.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix C for additional information pertaining to use of this report.

8.0 REFERENCES

American Association of State Highway and Transportation Officials (AASHTO), AASHTO Guide for Design of Pavement Structures, 1993.

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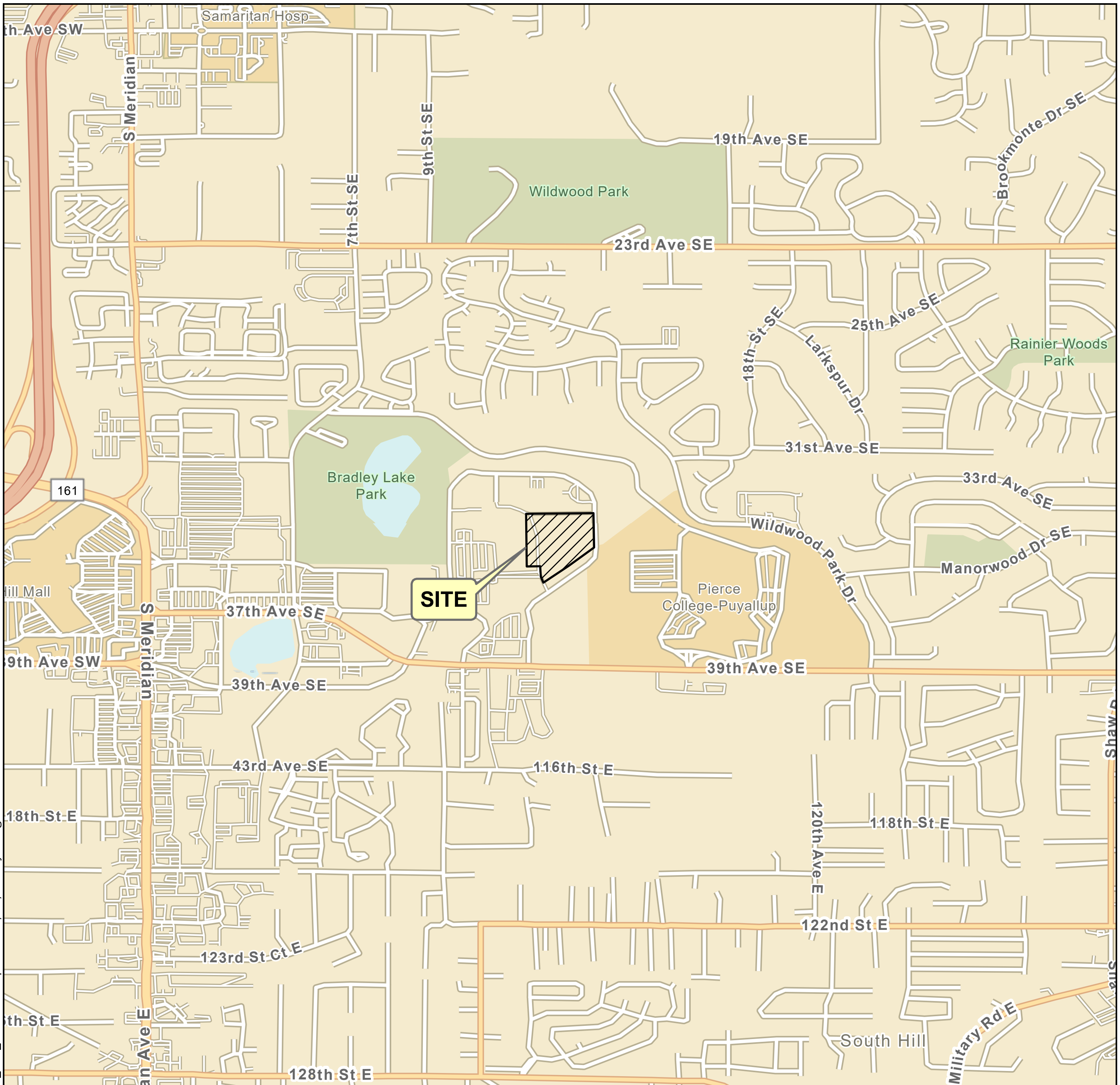
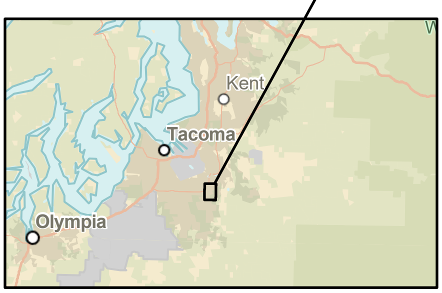
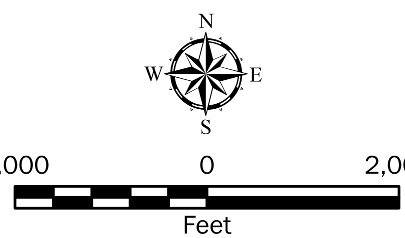
Washington State Department of Transportation, WSDOT Pavement Policy, June 2015.

FIGURES







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: ESRI

Projection: NAD 1983 StatePlane Washington South FIPS 4602 Feet

Vicinity Map

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

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Figure 1

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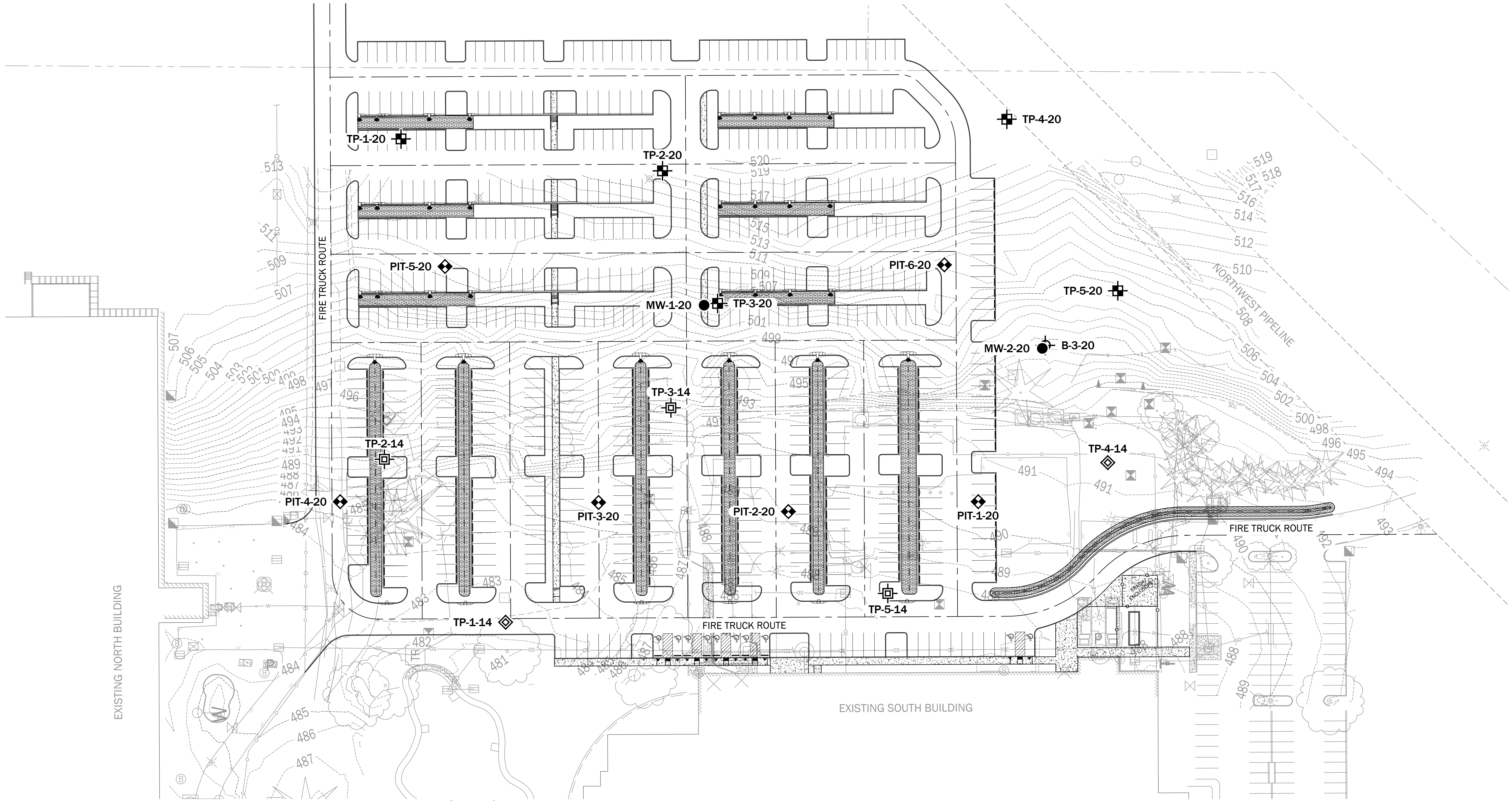

Legend

MW-1-20	Monitoring Well by GeoEngineers, Inc., 2020
B-3-20	Boring by GeoEngineers, Inc., 2020
TP-1-20	Test Pit by GeoEngineers, Inc., 2020
PIT-1-20	Pilot Infiltration Test by GeoEngineers, Inc., 2020
TP-2-14	Test Pit by GeoEngineers, Inc., 2014
TP-1-14	Pilot Infiltration Test by GeoEngineers, Inc., 2014
	Potential Infiltration Facilities

Notes:

1. The locations of all features shown are approximate.
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Data Source: Base CAD file from Parametrix received on 2/16/2022.

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

Site Plan

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

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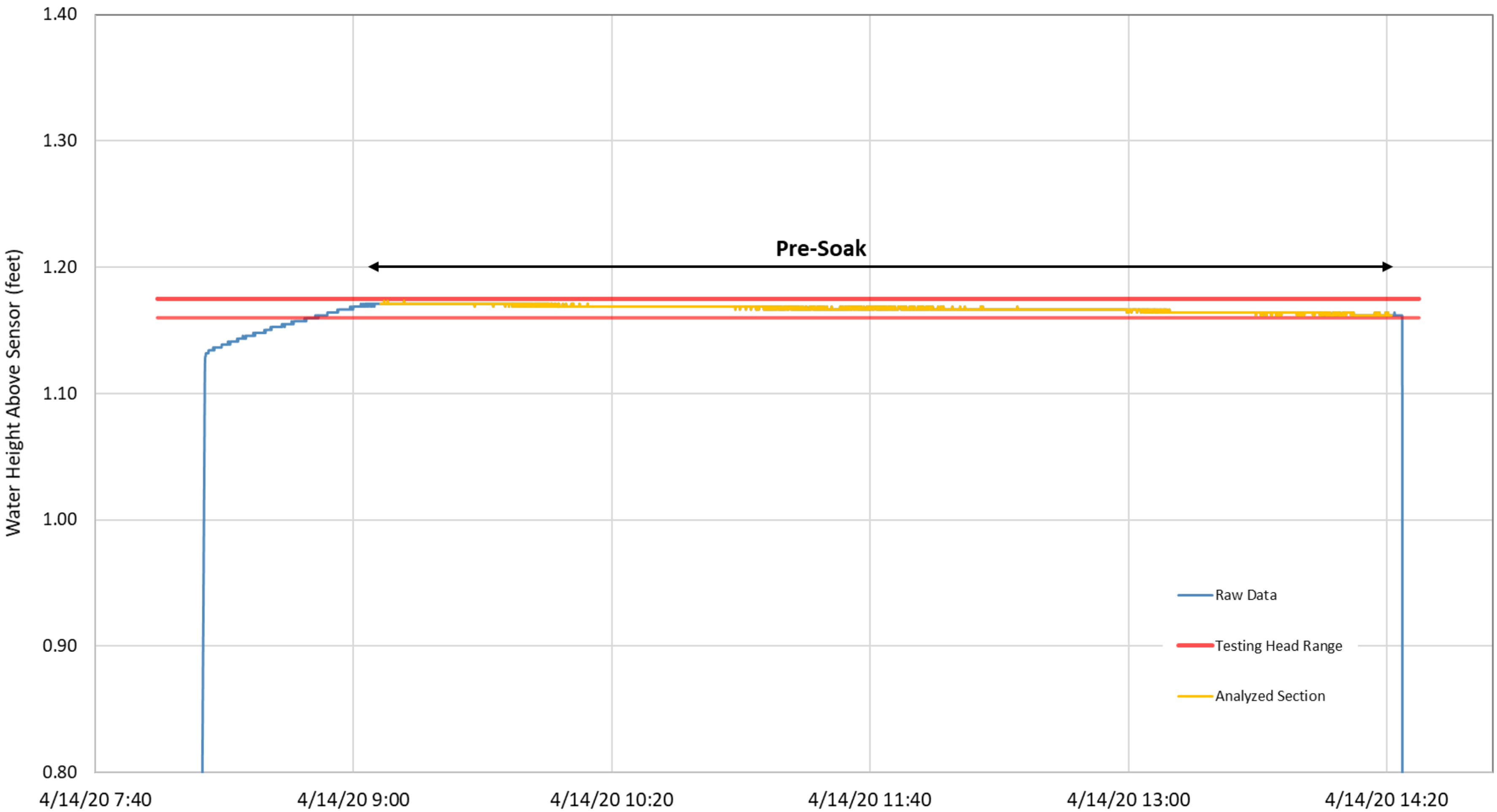
Figure 2

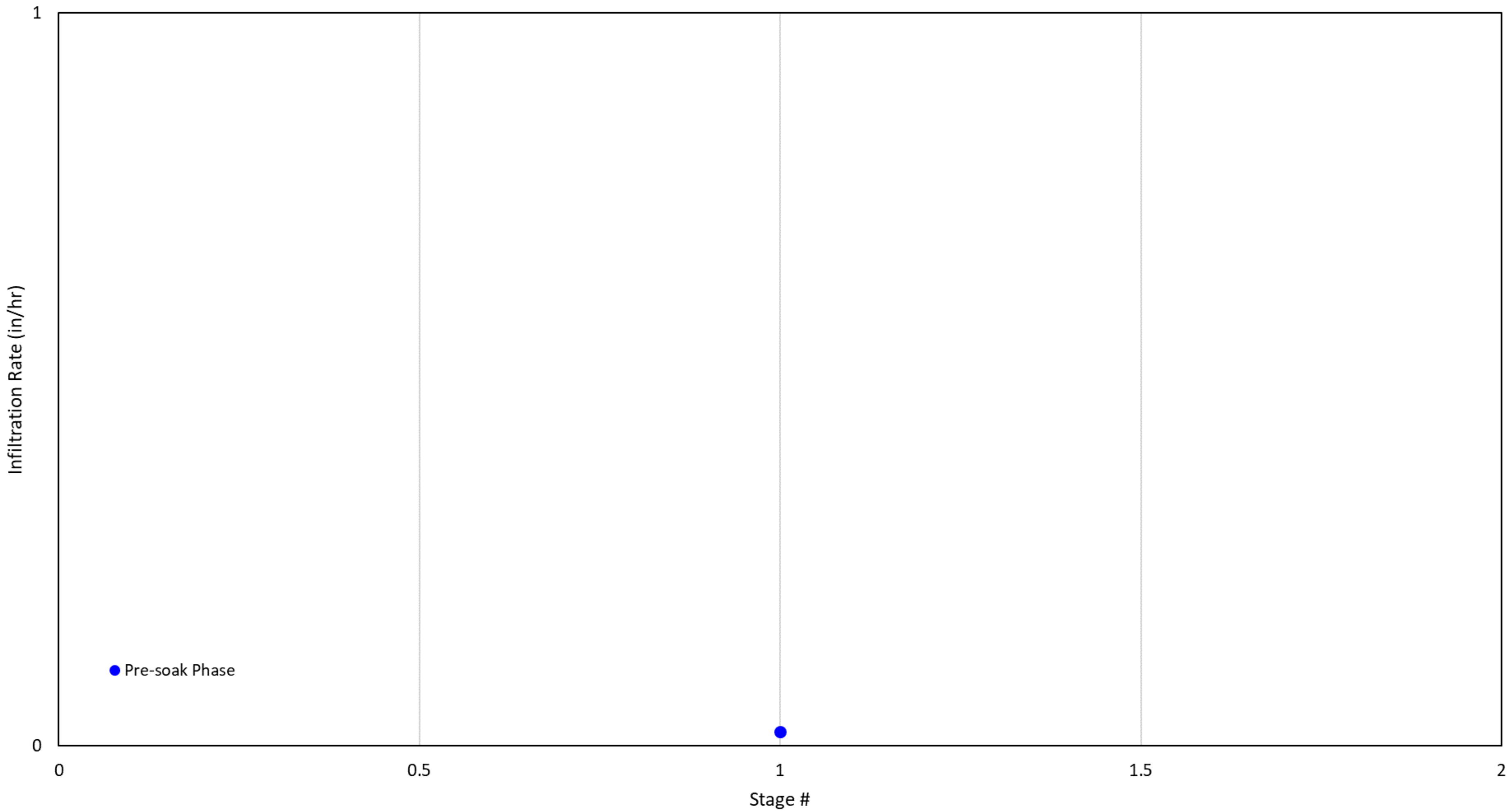
P:\4\4565064\CAD\06\GeoTech\456506406_F02_Site Plan.dwg TAB:F02 Date Exported: 02/18/22 - 4:38 by syi



Notes:

1. PIT-1-20 was started on April 14, 2020.
2. PIT-1-20 was aborted due to lack of infiltration on April 14,2020.
3. The testing phase head range was analyzed during the pre-soak period.

PIT-1-20 Hydrograph	
Benaroya Co South Hill Business & Technology Center Puyallup, Washington	
GeoEngineers	Figure 3



Notes:

1. The pre-soak period is intended to saturate the soil and is not taken to be the long-term infiltration rate.
2. The estimated field measured infiltration rate is 0.02 inches per hour based on the geometric mean of the pre-soak phase.

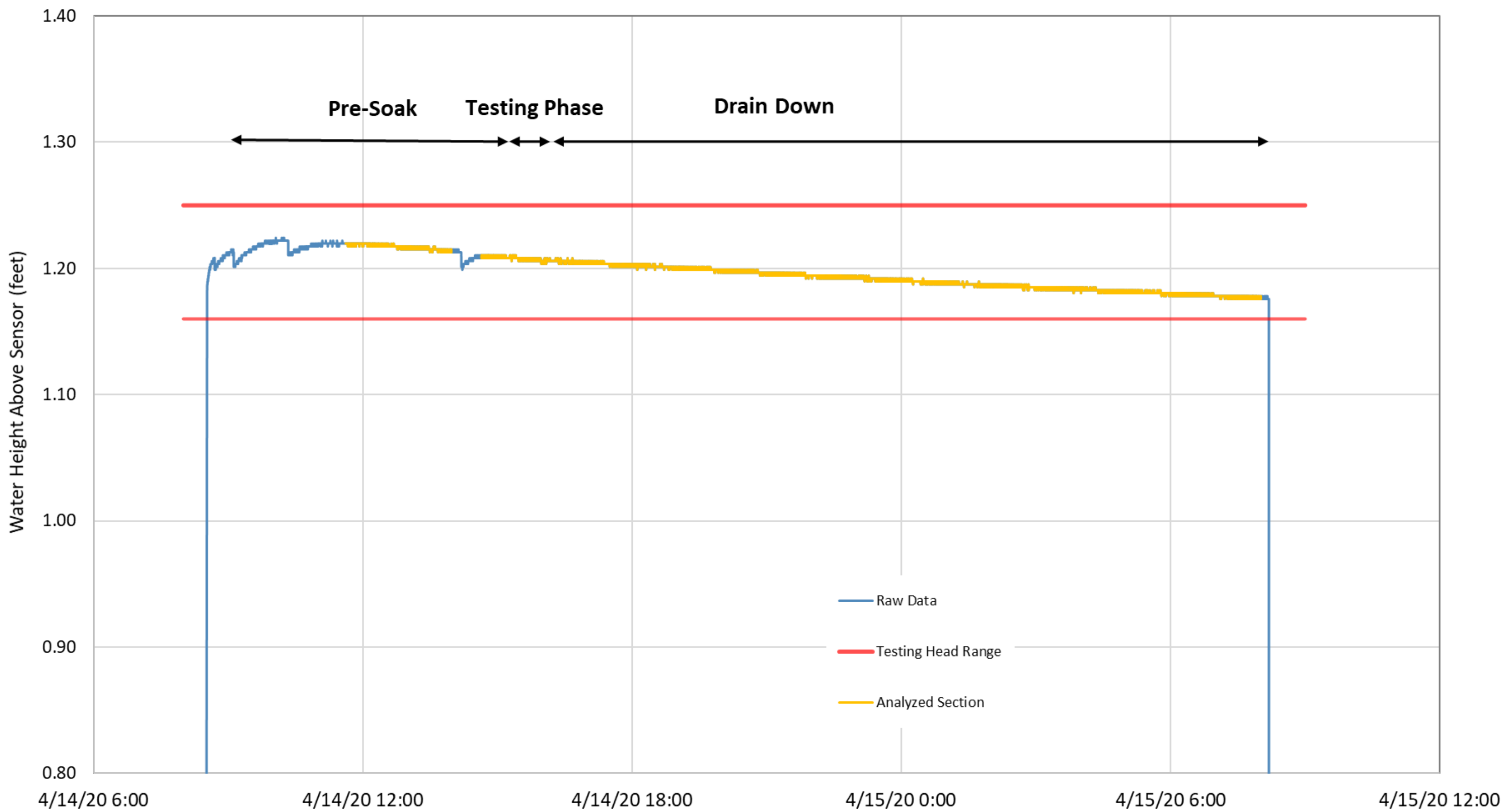
PIT-1-20 Infiltration Rates

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

GeoEngineers

Figure 4

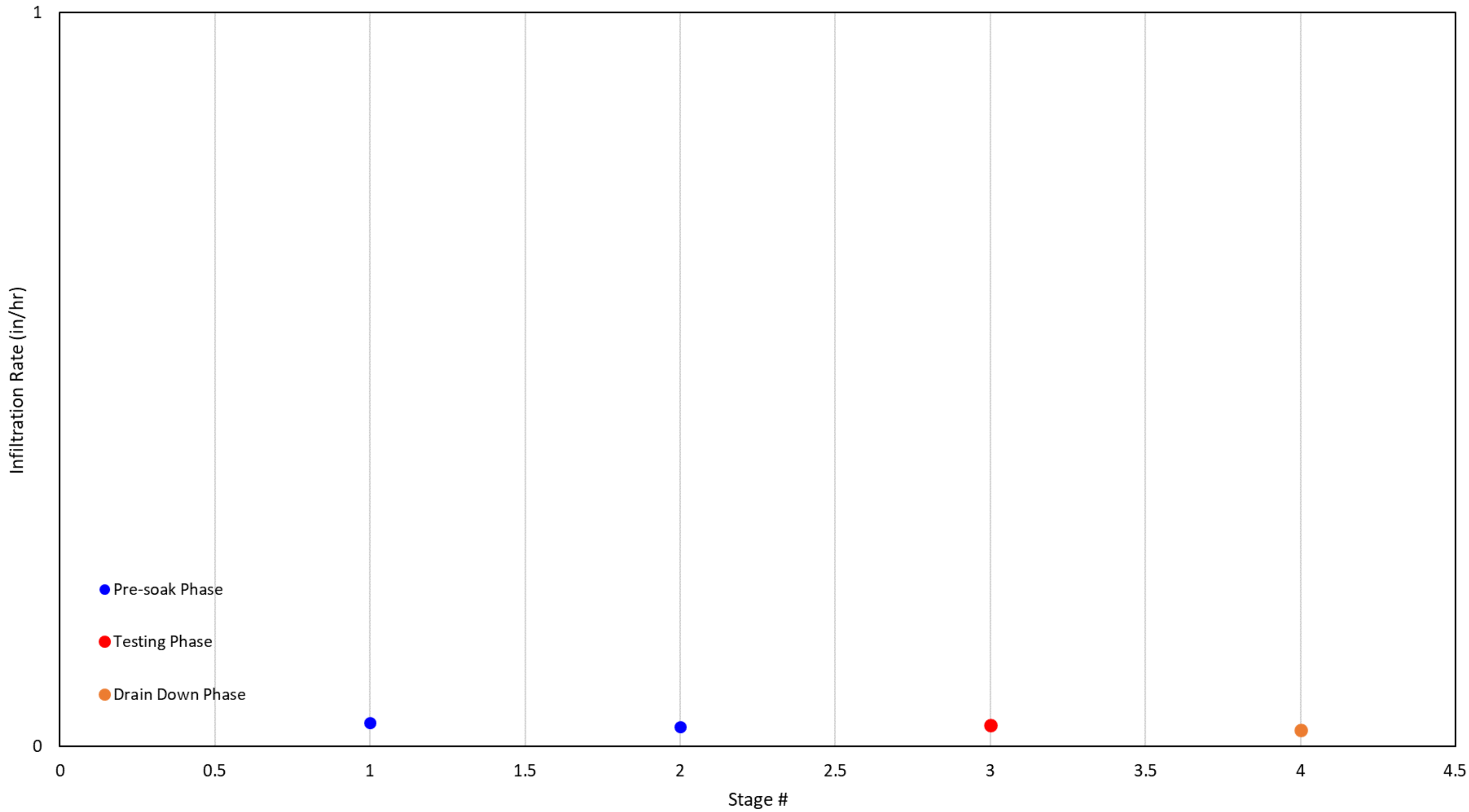
04565-064-06 Date Exported: 4/22/20



Notes:

1. PIT-2-20 was started on April 14, 2020 and completed on April 15, 2020.
2. After approximately 7 hours the PIT was allowed to drain until the next morning.
3. The testing phase head range was analyzed during the testing period.

PIT-2-20 Hydrograph	
Benaroya Co South Hill Business & Technology Center Puyallup, Washington	
GeoEngineers	Figure 5



Notes:

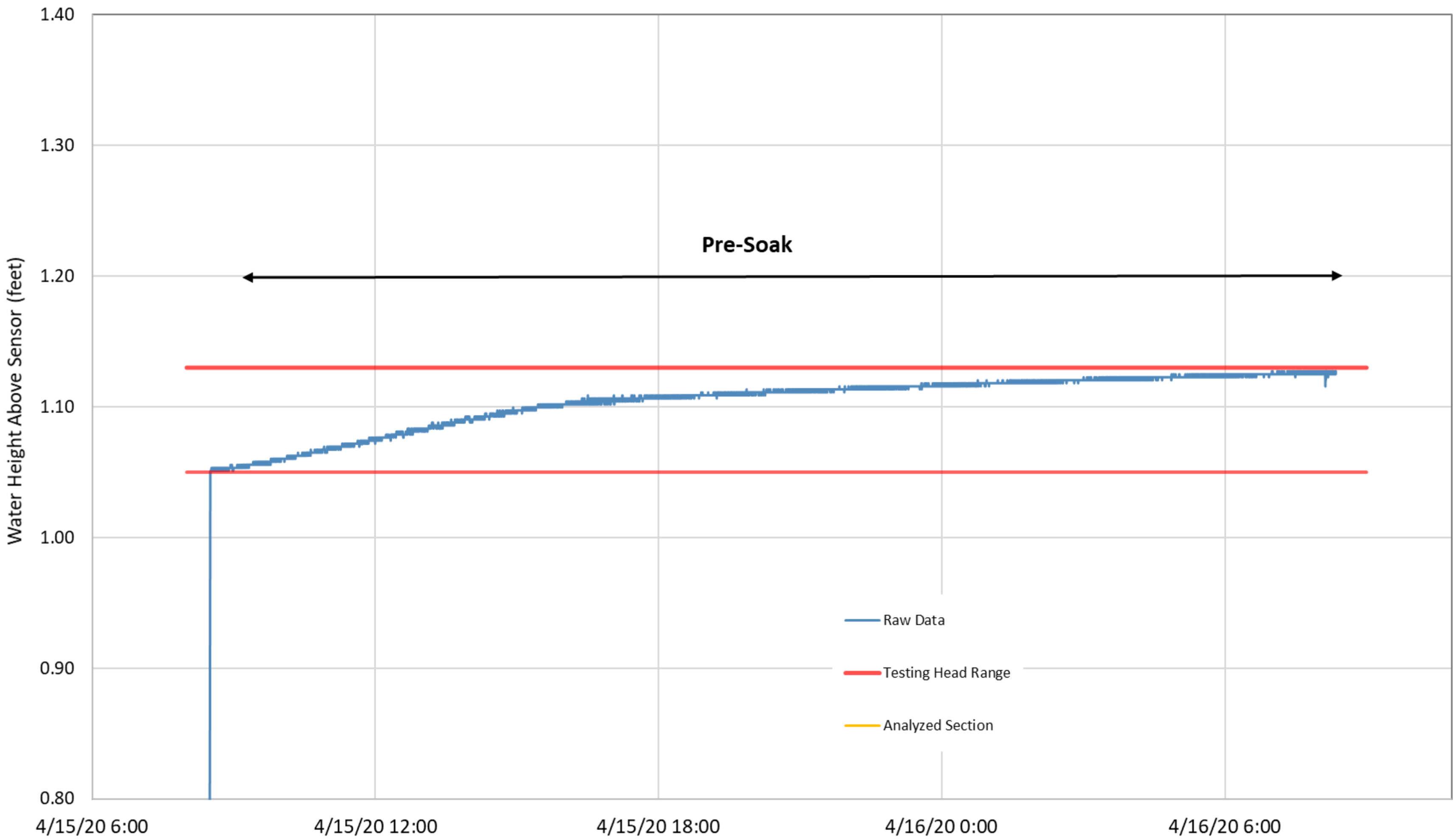
1. The pre-soak period is intended to saturate the soil and is not taken to be the long-term infiltration rate.
2. The estimated field measured infiltration rate is 0.03 inches per hour based on the geometric mean of the testing phase.

PIT-2-20 Infiltration Rates

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

GeoEngineers

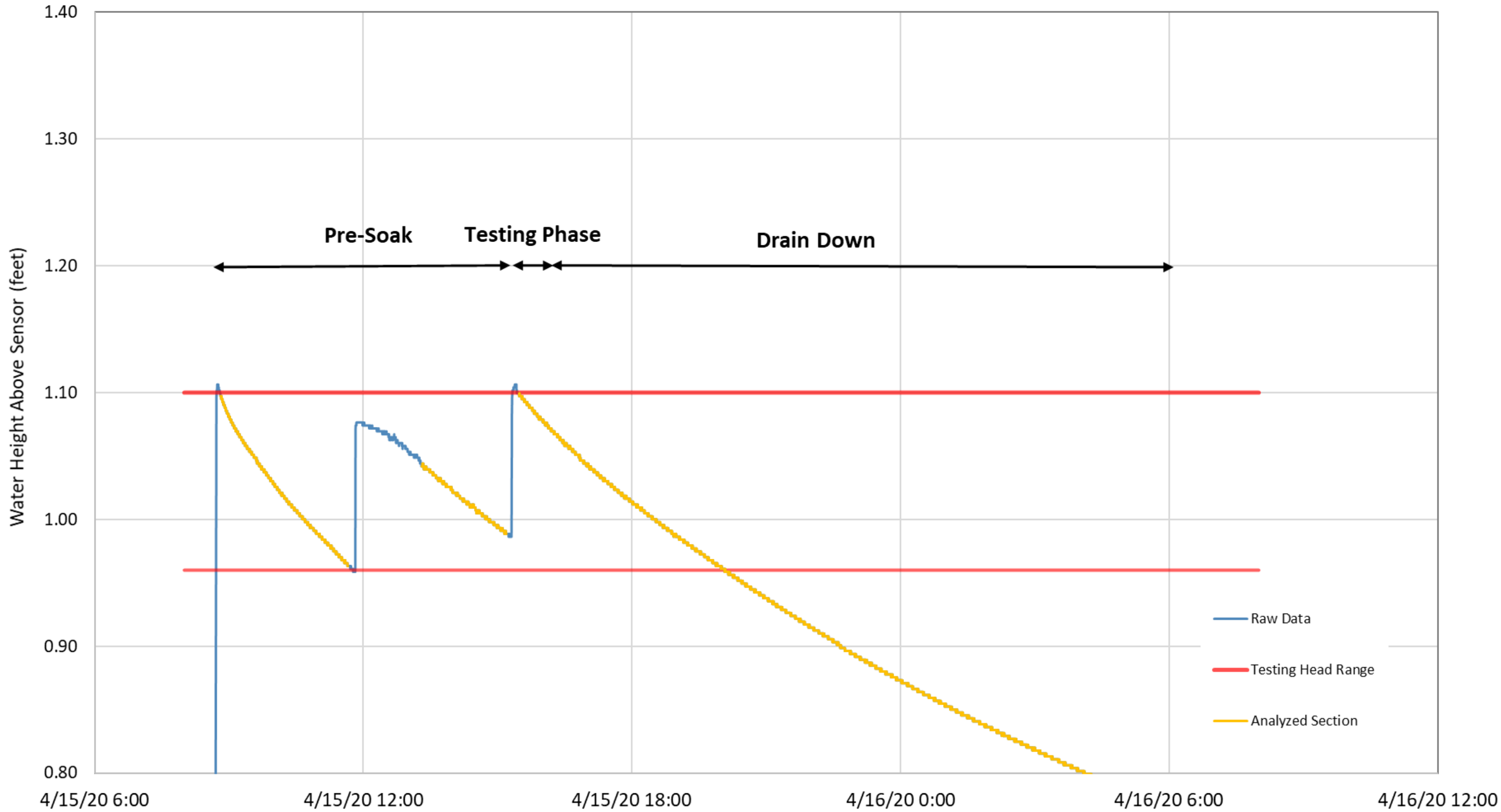
Figure 6



Notes:

1. PIT-3-20 was started on April 15, 2020 and completed on April 16, 2020.
2. After approximately 7 hours the PIT was allowed to drain until the next morning.
3. The water level rose during the duration of the pre-soak, testing and drain down periods, due to high groundwater level near the PIT.

PIT-3-20 Hydrograph	
Benaroya Co South Hill Business & Technology Center Puyallup, Washington	
GeoEngineers	Figure 7



Notes:

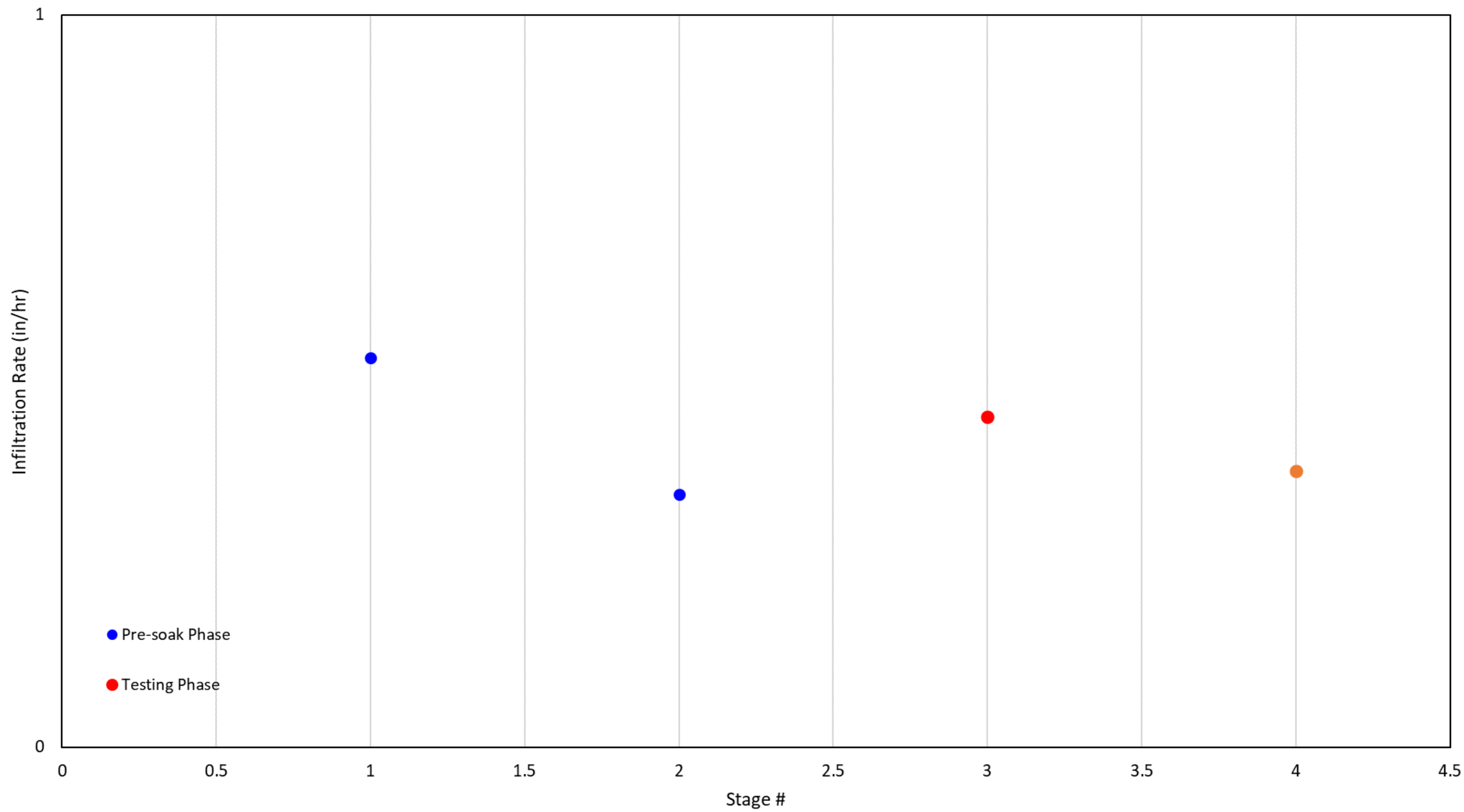
1. PIT-4-20 was started on April 15, 2020 and completed on April 16, 2020.
2. After approximately 7 hours the PIT was allowed to drain until the next morning.
3. The testing phase head range was analyzed during the testing period.

PIT-4-20 Hydrograph

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

GeoEngineers

Figure 8



Notes:

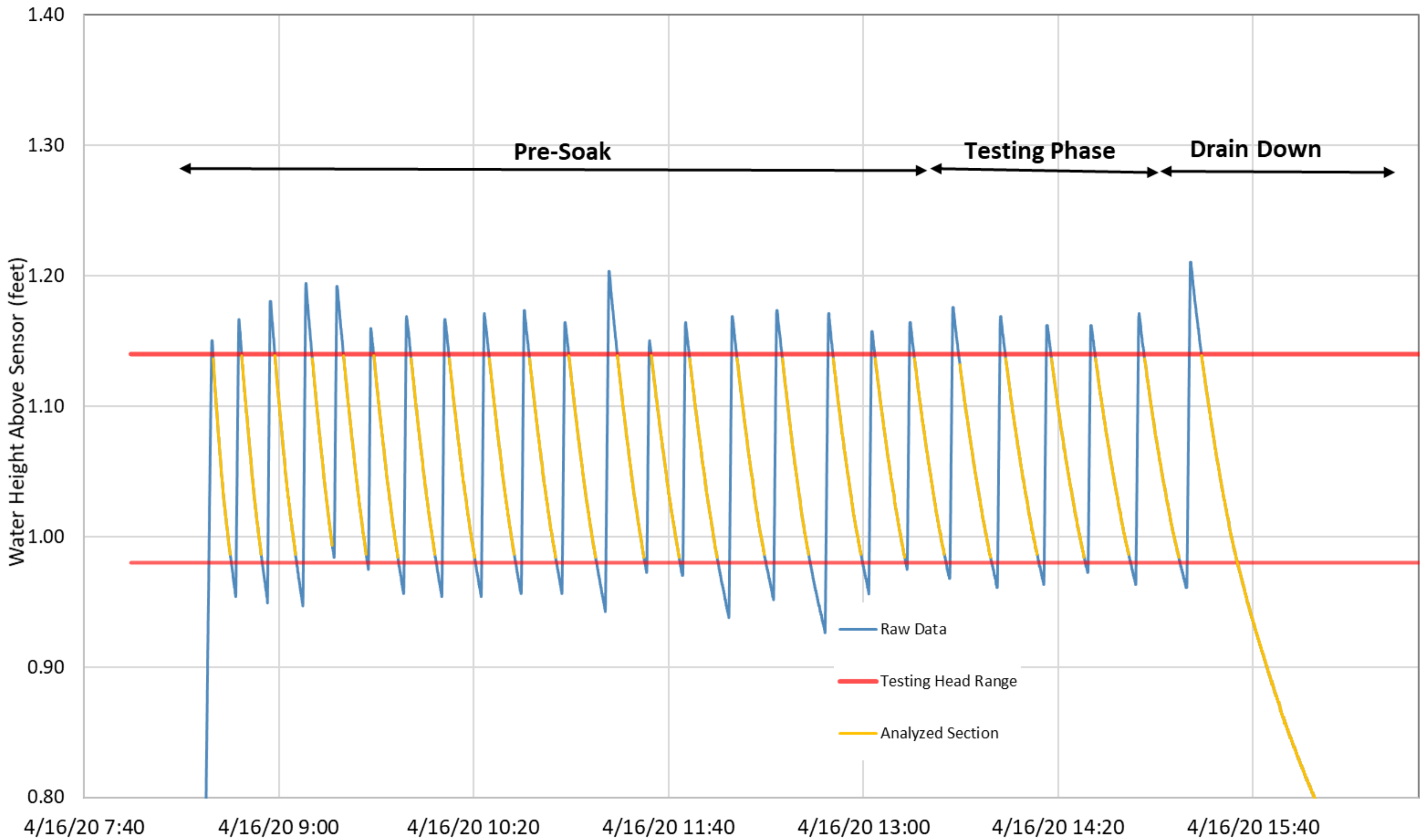
1. The pre-soak period is intended to saturate the soil and is not taken to be the long-term infiltration rate.
2. The estimated field measured infiltration rate is 0.45 inches per hour based on the geometric mean of the testing phase.

PIT-4-20 Infiltration Rates

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

GeoEngineers

Figure 9



Notes:

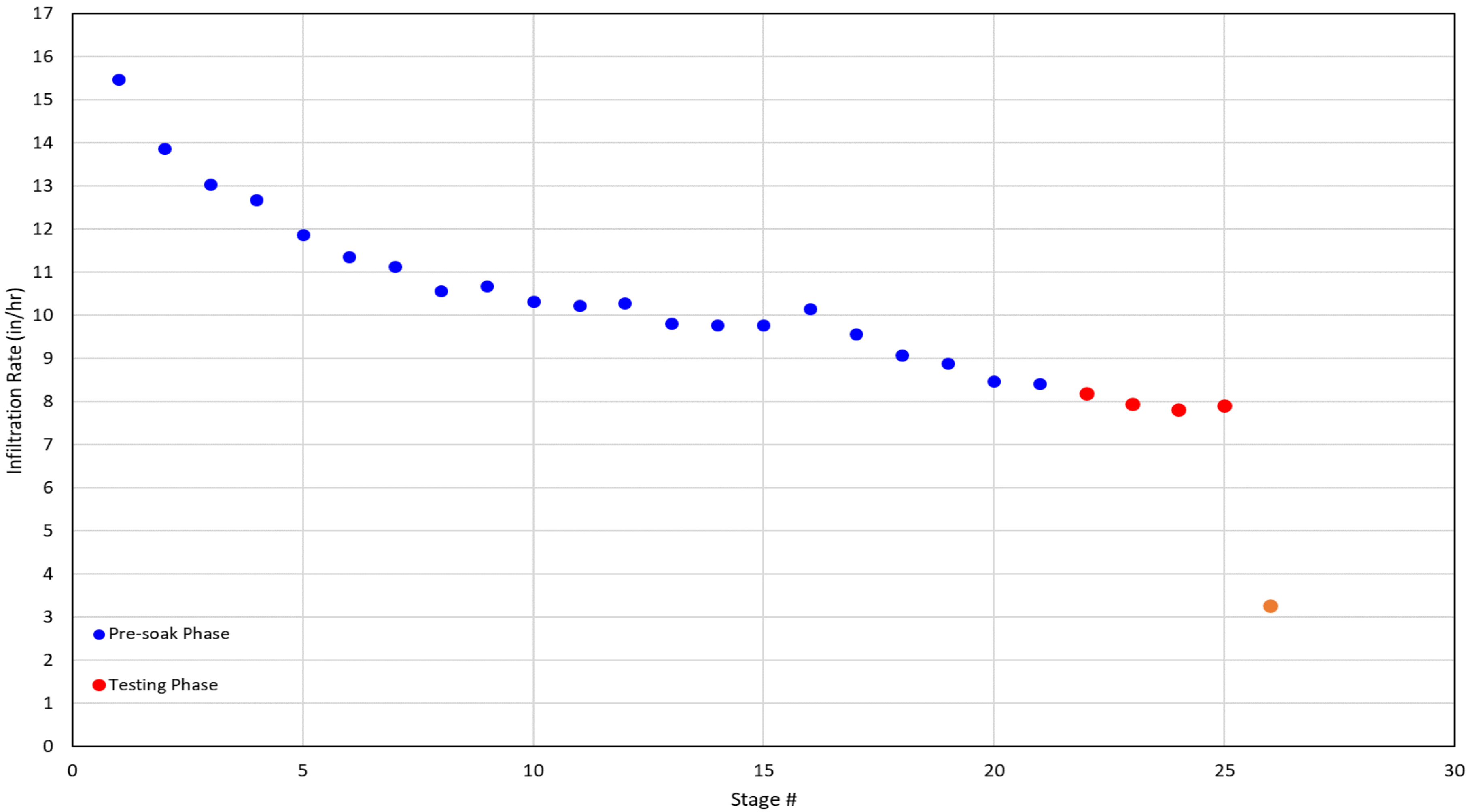
1. PIT-5-20 was completed on April 16, 2020.
2. After approximately 7 hours the PIT was allowed to drain completely.
3. The testing phase head range was analyzed during the testing period.

PIT-5-20 Hydrograph

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

GeoEngineers

Figure 10



Notes:

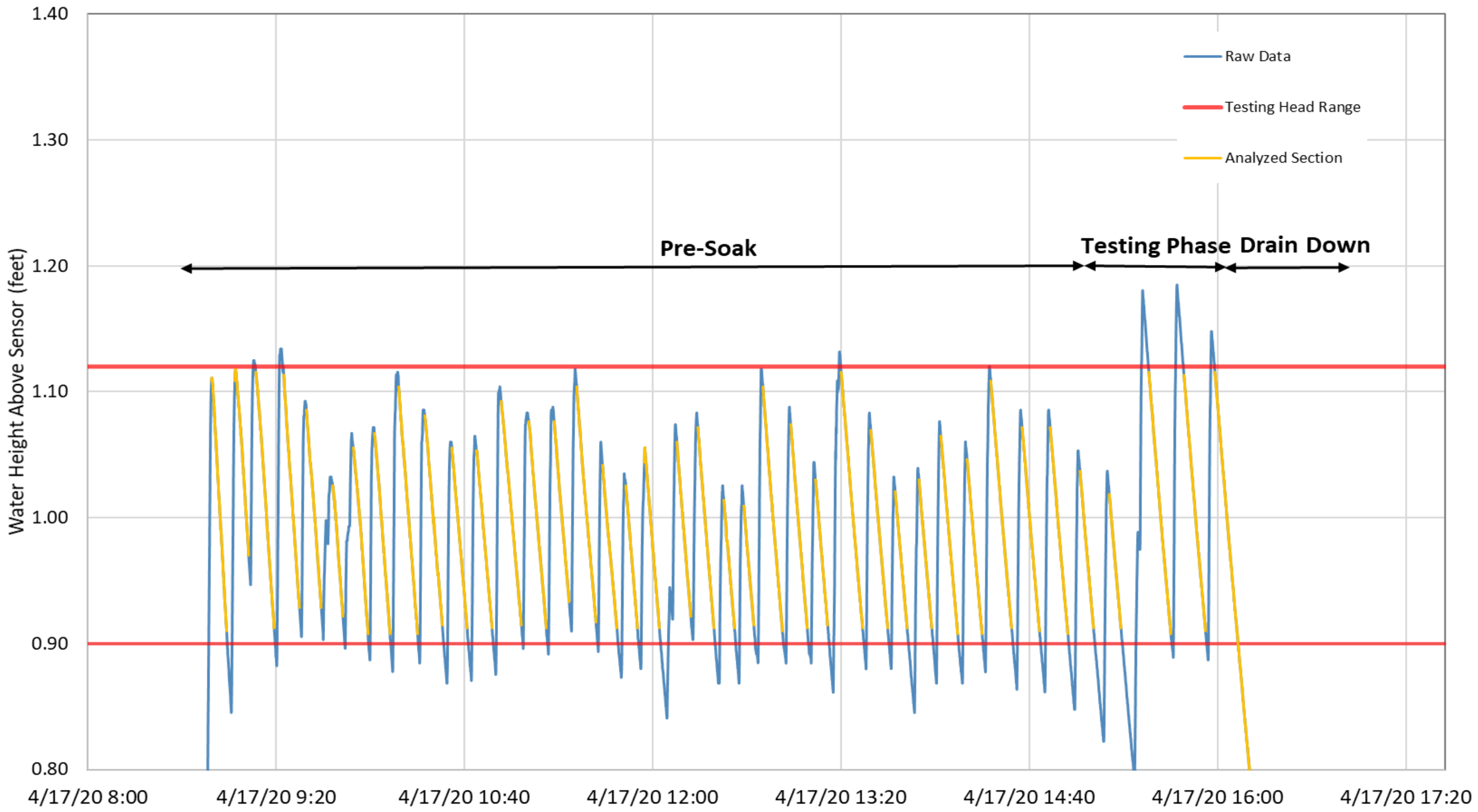
1. The pre-soak period is intended to saturate the soil and is not taken to be the long-term infiltration rate.
2. The estimated field measured infiltration rate is 7.97 inches per hour based on the geometric mean of the testing phase.

PIT-5-20 Infiltration Rates

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

GeoEngineers

Figure 11



Notes:

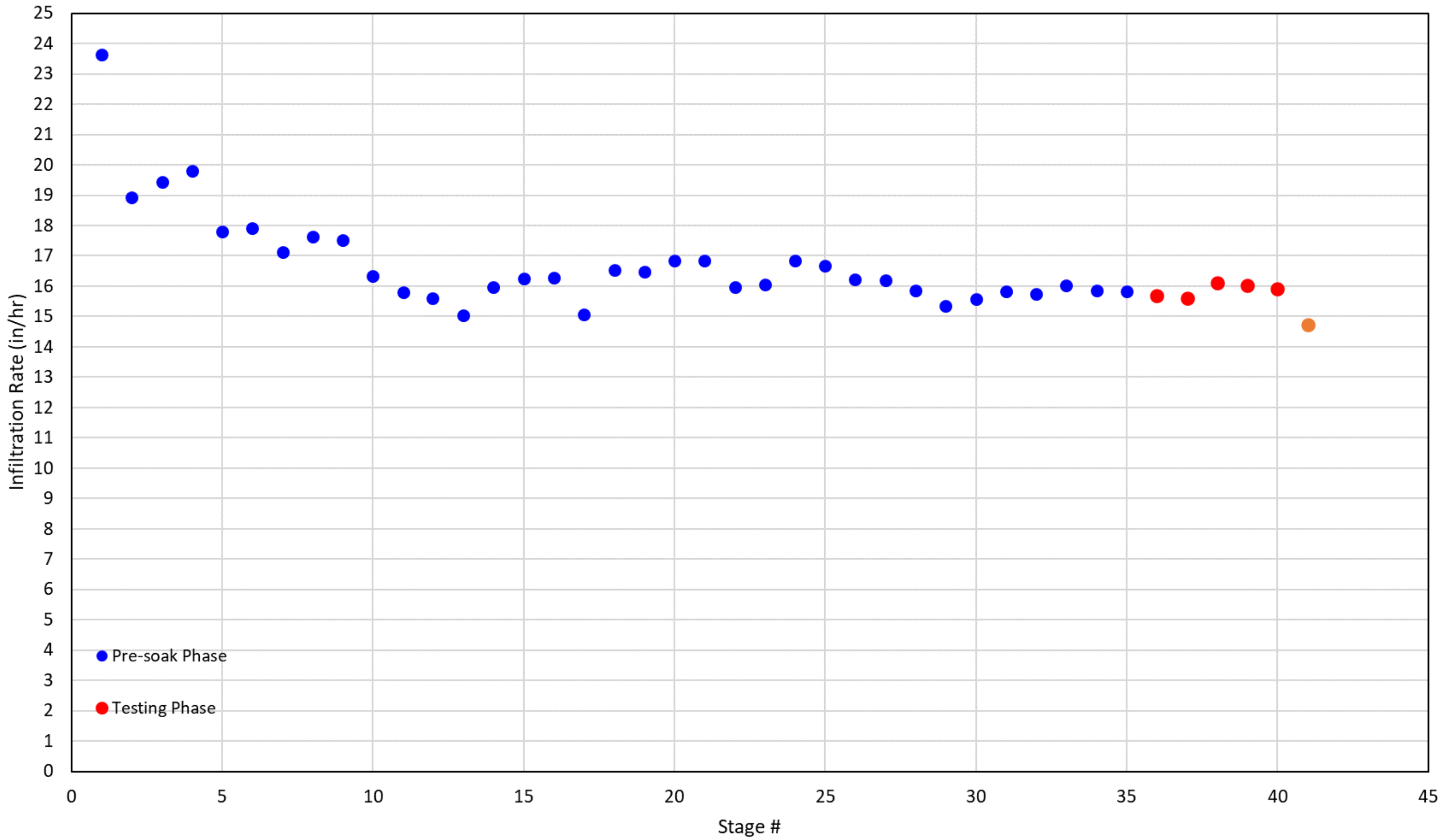
1. PIT-6-20 was completed on April 17, 2020.
2. After approximately 7 hours the PIT was allowed to drain completely.
3. The testing phase head range was analyzed during the testing period.

PIT-6-20 Hydrograph

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

GeoEngineers

Figure 12



Notes:

1. The pre-soak period is intended to saturate the soil and is not taken to be the long-term infiltration rate.
2. The estimated field measured infiltration rate is 15.86 inches per hour based on the geometric mean of the testing phase.

PIT-6-20 Infiltration Rates	
Benaroya Co South Hill Business & Technology Center Puyallup, Washington	
GeoEngineers	**Figure 13**

APPENDICES

APPENDIX A
Field Explorations

APPENDIX A
FIELD EXPLORATIONS

Subsurface soil and groundwater conditions were evaluated by excavating 11 test pits/PITs (TP-1-20 through TP-5-20 and PIT-1-20 through PIT-6-20), and three borings in which two were completed as monitoring wells at the approximate locations shown on Figure 2. The test pits were completed by Kelly's Excavating between April 13 and 17, 2020. The borings/monitoring wells were drilled on July 8, 2020 to monitor groundwater levels during the winter season. In addition, we conducted small-scale pilot infiltration tests (PITs) in test pits PIT-1-20 through PIT-6-20. Locations of the explorations were determined in the field by using a global positioning system (GPS) enabled tablet.

Test Pits

The test pits and PITs were excavated using a Takeuchi TB 138 mini excavator to depths ranging from 7½ to 10 feet below ground surface (bgs). The test pits were continuously observed by a geologist from our firm who examined and classified the soils encountered, obtained representative soil samples and maintained a detailed log of each test pit. Density was estimated from difficulty of digging, difficulty of sample collection using a hand-held trowel and probe rod penetration. In addition, pertinent information including soil sample depths, stratigraphy and groundwater seepage were recorded.

The soils encountered during excavation were visually classified in general accordance with the Unified Soil Classification System (USCS) and ASTM International (ASTM) D 2488 summarized in Figure A-1. The logs of the test pits and PITs are presented in Figures A-2 through A-12. The logs are based on our interpretation of the field and laboratory data and indicate the various soils encountered. They also indicate the approximate depths at which the soils or their characteristics change; although the change may be gradual. If the change occurred between sampling locations, the depth was inferred.

Representative soil samples were obtained from the test pits, logged, sealed in plastic bags and transported to our laboratory. The field classifications were further evaluated in our laboratory.

The test pits were backfilled with the excavated soils and compacted to the extent practical with the bucket of the excavator. The fill was not compacted to the requirements of structural fill.

Monitoring Wells

Hollow-stem auger borings were completed at two locations for the purpose of installing monitoring wells for recording seasonal groundwater fluctuations. The explorations were continuously monitored by geotechnical engineer from our firm who examined and classified the soils encountered, obtained representative soil samples, observed groundwater conditions and prepared a detailed boring log of each exploration. The logs are based on our interpretation of the field and laboratory data and indicate the various types of soils encountered. The logs also indicate the depths at which these soils or their characteristics change, although the change may actually be gradual. If the change occurred between samples, it was interpreted.

Soils encountered in the explorations were visually classified in general accordance with the classification system described above and in Figure A-1. Observations of groundwater conditions were made during exploration, and these observations represent a short-term condition and may or may not be representative of the long-term groundwater conditions at the site.

Samples from the drilled borings were obtained using a standard penetration test (SPT) sampler driven into the soil with a 140-pound hammer. The number of blows required to drive the sampler the last 12 inches or other indicated distances are recorded on the boring log for the SPT samples. The logs of the borings are presented in Figures A-13 through A-15. The exploration logs are based on our interpretation of the field and laboratory data and indicate the various types of soils encountered. They also indicate the depths at which these soils or their characteristics change; although, the change might actually be gradual.

Observations of groundwater conditions were made during drilling and are included on the boring logs. These observations represent a short-term condition and may or may not be representative of the long-term groundwater conditions at the site. Groundwater conditions observed during drilling should be considered approximate.

Monitoring wells (2-inch-diameter) were installed to allow measurement of groundwater levels following drilling. The wells should be decommissioned by a licensed well driller in accordance with Chapter 173-160 of the Washington Administrative Code (WAC) when they are no longer needed for data collection. Alternatively, the wells could be kept intact for use during project bidding and then be decommissioned under the construction contract.

Pilot Infiltration Testing

Six small-scale PITs were conducted in test pits PIT1-20 through PIT-6-20 within the footprint of the proposed parking lot expansion area. Figure 2 shows the approximate locations of the test pits where the small-scale PITs were performed. The PITs were completed in general accordance with the guidelines provided in the Washington State Department of Ecology Stormwater Management Manual for Western Washington (SMMWW).

Methodology

For all six PITs, a graduated yard stick was driven into the floor of each test pit as a visual reference for monitoring water levels during testing. A piezoelectric pressure transducer was secured to the bottom of the yard stick to provide accurate water level records in 5-second intervals throughout the duration of the tests. Full water-level records recorded for each test are plotted on Figures 3, 5, 7, 8, 10, and 12.

The first phase of a PIT is the “pre-soak” in which the test pit is filled and a water depth of at least 12 inches is maintained for approximately 6 hours. During pre-soak, water is added as necessary to keep the water depth in the test pit between approximately 12 and 14 inches. The pre-soak stage is intended to fully saturate the soil below the test pit. Water must be added more frequently to test pits exhibiting higher rates of infiltration.

The second phase performed was the “testing phase” in which the water depth in the test pit is kept at a depth of 6 to 12 inches, comparable with proposed operational conditions for the planned infiltration facility, for one hour. Infiltration rates are dependent on the water depth in the pit because the hydraulic head of the water column ‘pushes’ water into the ground. For this reason, the testing stage requires a constant, or near-constant water depth. Ideally, water is added to the pit at a rate that would maintain the water depth for a period of one hour with water inflow volume measurements taken every 15 to 30 minutes.

During the testing phase, the water level is allowed to decline over a small, 1- to 2-inch interval. The infiltration rate is calculated by finding the slope of each stage over the same head range, which provides much greater accuracy than attempting to measure inflow volumes.

The third phase performed was the "drain-down" in which the PITs are left undisturbed until the water drains completely. The drain-down period shows how infiltration changes over a continuous range of declining water depths.

The plots of apparent PIT Infiltration rate for successive stages of each test (Figures 4, 6, 9, 11, and 13) provide a visual confirmation of subgrade saturation as infiltration rates decline to asymptotic steady-state values toward the end of the pre-soaking period when the water depth is maintained between 12 to 14 inches. The measured infiltration rates determined during the testing phase are assumed to approximate the saturated (vertical) hydraulic conductivity of the test pit subgrade.

Test Descriptions

Each of the test pits were initially excavated with a backhoe to approximately 4 feet long by 4 feet wide and 4 feet deep with the sidewalls kept as vertical as possible. Water for infiltration was provided by Kelly's Excavating using a 2,400-gallon water truck. PITs were conducted at a depth of 4 feet in each test pit.

- PIT-1-20 was conducted on April 13, 2020. The soil at the initial bottom (test elevation) of PIT-1-20 generally consisted of medium dense, gray-brown silty fine sand with occasional gravel. Groundwater seepage was not observed while excavating. After 6 hours of the pre-soak, the water level had not dropped (no infiltration), and the test was aborted. The transducer was removed, the remaining water was bailed out of the test pit using the bucket of the backhoe. The test pit was over excavated to a depth of 7½ feet. No groundwater seepage was observed after the PIT. The entire transducer record was analyzed and indicated zero infiltration.
- PIT-2-20 was conducted on April 15, 2020. The soil at the initial bottom of the PIT generally consisted of medium dense, gray-brown fine to medium sand with silt and occasional gravel. Groundwater seepage was not observed while excavating. After six hours of the pre-soak, the water level had not dropped (no infiltration) and the test pit was left overnight to drain. On the morning of April 15, 2020, the transducer was removed, the remaining water was bailed out of the test pit using the bucket of the backhoe, and the test pit was over excavated to a depth of 9 feet bgs. No groundwater seepage was observed after the PIT. The entire transducer record was analyzed and indicated zero infiltration.
- PIT-3-20 was excavated on April 14, 2020 and covered with plywood for testing the following day. The soil at the initial bottom of the PIT generally consisted of medium dense, blue-gray silty fine sand. Slight groundwater seepage was observed at a depth of 2 feet bgs while excavating. On the morning of April 15, 2020, prior to starting the PIT, there was approximately 3 inches of standing water in the bottom of the pit. After six hours of the pre-soak, the water level had not dropped (no infiltration) and the test pit was left overnight to drain. On the morning of April 16, 2020, the water level in the pit was higher than the night before, indicating groundwater seepage into the PIT, resulting in a negative infiltration rate. The transducer was removed, the remaining water was bailed out of the test pit using the bucket of the backhoe, and the test pit was overexcavated to a depth of 7½ feet bgs. PIT-3-20 was determined to have an effective infiltration rate of 0 inches per hour.
- PIT-4-20 was excavated on April 14, 2020 and covered with plywood for testing the following day. The soil at the initial bottom of the PIT generally consisted of fine sand with silt. Slight groundwater seepage

was observed at a depth of 3¾ feet bgs while excavating. On the morning of April 15, 2020, prior to starting the PIT, there was approximately 6 inches of standing water in the bottom of the pit. The pre-soak required two refills during approximately 6 hours to maintain a water depth of at least 12 inches. The testing phase had 1 stage that was analyzed (Figure 8). The testing phase head-change stage was calculated to determine a measured infiltration rate ($K_{sat\ initial}$) of 0.5 inches per hour in PIT-4-20 (Figure 9). After approximately 7 hours of testing, the test pit was allowed to drain for an additional hour. After infiltration testing was completed, the test pit was overexcavated to a depth of 10 feet bgs. Groundwater seepage was not observed after the PIT.

- PIT-5-20 was conducted on April 15, 2020. The soil at the initial bottom of the PIT generally consisted of medium dense, tan-brown silty fine sand with gravel. Groundwater seepage was not observed while excavating. The pre-soak required 18 refills during approximately 6 hours to maintain a water depth of at least 12 inches. The testing phase had five stages that were analyzed (Figure 10). The geometric mean of the testing phase head-change stages was calculated to determine a measured infiltration rate ($K_{sat\ initial}$) of 8.0 inches per hour in PIT-5-20 (Figure 11). After approximately 7 hours of testing, the test pit was allowed to drain completely. After infiltration testing was completed, the test pit was over-excavated to a depth of 10 feet bgs. Groundwater seepage was not observed after the PIT.
- PIT-6-20 was conducted on April 17, 2020. The soil at the bottom of the PIT generally consisted of medium dense, brown fine to coarse gravel. Groundwater seepage was not observed while excavating. The pre-soak required 35 refills during approximately 6 hours to maintain a water depth of at least 12 inches. The testing phase had four stages that were analyzed (Figure 12). The geometric mean of the testing phase head-change stages was calculated to determine a measured infiltration rate ($K_{sat\ initial}$) of 15.9 inches per hour in PIT-6-20 (Figure 13). After approximately 7 hours of testing, the test pit was allowed to drain completely. After infiltration the test pit was overexcavated to a depth of 8 feet bgs. Moderate groundwater seepage was observed at 6 feet bgs.

Design Infiltration Rates

Three correction factors are applied to $K_{sat\ initial}$ to calculate the design saturated hydraulic conductivity ($K_{sat\ design}$) as required by the SMMWW. The correction factors consider the site variability and number of locations tested (CF_v), the testing method (CF_t), and the degree of influent control to prevent siltation and bio buildup (CF_m). CF_t accounts for uncertainties in the testing methods and is equal to 0.5 for small-scale PITs. CF_m accounts for the clogging effect of suspended material in stormwater which will cause the soil's initial infiltration rate to gradually decline. The maintenance schedule calls for removing sediment when the BMP is infiltrating at only 90 percent of its design capacity, so CF_m is equal to 0.9. CF_v can vary between 0.33 to 1.0 based on the variability of the soils on the site. CF_v was set to 0.8 for the three PITs located in the undeveloped area of the site (PIT-4-20 to PIT-6-20 in Table A-1 below).

The design saturated hydraulic conductivity is calculated by:

$$K_{sat\ design} = K_{sat\ initial}\ x\ CF_v\ x\ CF_t\ x\ CF_m$$

All correction factors and hydraulic conductivities are shown in Table A-1.

TABLE A-1. INFILTRATION RATES FROM PILOT INFILTRATION TESTING

PIT	$K_{sat\ initial}$ (inches per hour)	CF_v[1]	CF_t[2]	CF_m[3]	$K_{sat\ design}$ (inches per hour)
PIT-1-20	0	-	-	-	0
PIT-2-20	0	-	-	-	0
PIT-3-20	NA	-	-	-	NA[4]
PIT-4-20	0.5	0.8	0.5	0.9	0.2
PIT-5-20	8.0	0.8	0.5	0.9	2.9
PIT-6-20	15.9	0.8	0.5	0.9	5.7

Notes:

[1] Site variability and number of locations tested. CF_v = 0.33 to 1.0

[2] Test method. CF_t = 0.5 for small-scale PITs

[3] Degree of influent control to prevent siltation and bio-buildup. CF_m = 0.9

[4] NA, PIT-3-20 could not be analyzed due to groundwater seepage entering the test pit excavation during testing

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

Sampler Symbol Descriptions

- 2.4-inch I.D. split barrel
- 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.

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

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 load test
PP	Pocket penetrometer
SA	Sieve analysis
TX	Triaxial compression
UC	Unconfined compression
VS	Vane shear

Sheen Classification

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

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

Key to Exploration Logs

GeoEngineers

Figure A-1

Date Excavated 4/15/2020	Total Depth (ft) 10	Logged By WCW Checked By DCO	Excavator Kelly's Excavating, Inc. Equipment Takeuchi TB 138	Groundwater not observed Caving not observed	

Surface Elevation (ft) 530 Vertical Datum NAVD88	Easting (X) 1198213 Northing (Y) 671135	Coordinate System WA State Plane South Horizontal Datum NAD83 (feet)

Elevation (feet)	Depth (feet)	Testing Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				Duff	1 inch forest duff			
		X	1 / MC		SM	Tan-brown silty fine to medium sand with occasional gravel (medium dense, moist)	14		
529	1								
528	2				SP-SM	Tan-brown fine sand with silt (medium dense, moist)			
		X	2						
527	3								
526	4								
		X	3 / SA				11	8	
525	5								
524	6								
					SP	Gray-brown fine sand (dense, moist)			
		X	4						
523	7								
522	8								
		X	5 / %F				18	5	
521	9								
520	10								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit TP-1-20

GEOENGINEERS

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Figure A-2
Sheet 1 of 1

Date Excavated	4/13/2020	Total Depth (ft)	10	Logged By	WCW	Excavator	Kelly's Excavating, Inc.	Groundwater not observed
				Checked By	DCO	Equipment	Takeuchi TB 138	Caving not observed

Surface Elevation (ft)	540	Easting (X)	1198187	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	670919	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
540	0				Duff	2 inches forest duff			
			1 MC		SM	Brown silty fine sand with occasional gravel and trace organic matter (roots) (loose to medium dense, moist)	11		
539	1								
					SP-SM	Brown fine to medium sand with silt (loose to medium dense, moist)			
538	2								
			2						
537	3								
536	4				SM	Tan-brown silty fine to medium sand (medium dense, moist)			
			3 SA				16	13	
535	5								
534	6								
			4						
533	7								
532	8								
531	9								
			5						
530	10								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit TP-2-20

GEOENGINEERS

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Date Excavated	4/13/2020	Total Depth (ft)	10	Logged By	WCW	Excavator	Kelly's Excavating, Inc.	Groundwater not observed
				Checked By	DCO	Equipment	Takeuchi TB 138	Caving not observed

Surface Elevation (ft)	530	Easting (X)	1198077	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	670873	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
530	0		Duff	3 inches forest duff			
		1 MC	SM	Red-brown silty fine to medium sand with occasional gravel and trace organic matter (roots) (loose to medium dense, moist)	16		
529	1						
528	2						
		2		Becomes brown			
527	3						
			SM	Gray-brown silty fine to medium sand with gravel (medium dense, moist)			
526	4						
		3 SA			9	13	
525	5						
524	6						
		4		Grades with less gravel			
523	7						
522	8						
			SP-SM	Gray-brown fine sand with silt (medium dense, moist)			
521	9						
		5					
520	10						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit TP-3-20

GeoEngineers

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Date Excavated	4/13/2020	Total Depth (ft)	9.5	Logged By WCW Checked By DCO	Excavator Kelly's Excavating, Inc. Equipment Takeuchi TB 138	See "Remarks" section for groundwater observed Caving not observed

Surface Elevation (ft)	530	Easting (X)	1198229	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	670635	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				Duff	3 inches forest duff			
529	1		1 MC		SM	Red-brown silty fine sand with occasional gravel and trace organic matter (roots) (loose to medium dense, moist)	22		
528	2				SM	Red-brown silty fine sand (loose to medium dense, moist)			
527	3		2						
526	4				SM	Brown silty fine sand (medium dense, moist to wet)			
525	5		3						
524	6				SM	Gray silty fine to medium sand with occasional gravel (medium dense, moist)			Slight groundwater seepage observed at 6 feet
523	7		4						
522	8								
521	9		5						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit TP-4-20

GeoEngineers

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Date Excavated	4/13/2020	Total Depth (ft)	9.5	Logged By WCW Checked By DCO	Excavator Kelly's Excavating, Inc. Equipment Takeuchi TB 138	See "Remarks" section for groundwater observed Caving not observed

Surface Elevation (ft) Vertical Datum	520 NAVD88	Easting (X) Northing (Y)	1198088 670543	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
520	0				Duff	4 inches forest duff			
					SM	Red-brown silty fine sand (loose to medium dense, moist)			
519	1	▯	1 / MC				10		
518	2				SP-SM	Tan fine sand with silt (loose to medium dense, moist)			
517	3	▯	2						
516	4								
515	5	▯	3 / SA		SM	Brown silty fine to coarse sand with gravel (medium dense, moist)	15	36	
514	6				GM	Brown silty fine to coarse gravel with sand (medium dense, moist)			
513	7	▯	4 / SA				13	33	
512	8				SM	Brown silty fine to coarse sand (medium dense, moist)			Slight groundwater seepage observed at approximately 8½ feet
511	9	▯	5						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit TP-5-20

GEOENGINEERS

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Date:2/5/21 Path:\\GEOENGINEERS.COM\WAN\PROJECTS\4\4565064\GINT\456506406.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI8_TESTPIT_1P_GEOTEC_%F

Date Excavated	4/13/2020	Total Depth (ft)	7.5	Logged By WCW Checked By DCO	Excavator Kelly's Excavating, Inc. Equipment Takeuchi TB 138
Groundwater not observed Caving not observed					

Surface Elevation (ft)	490	Easting (X)	1197914	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	670658	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				SM	Brown silty fine to medium sand (medium dense, moist)			
489	1		1 MC				10		
488	2		2		SM	Gray and brown silty fine sand with occasional gravel (medium dense, moist)			
487	3				SM	Gray-brown silty fine sand with gravel (medium dense, moist)			
486	4		3 SA				15	44	
485	5		4						
484	6								
483	7		5						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit PIT-1-20

GEOENGINEERS

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Date Excavated	4/15/2020	Total Depth (ft)	9	Logged By	WCW	Excavator	Kelly's Excavating, Inc.	Groundwater not observed
				Checked By	DCO	Equipment	Takeuchi TB 138	Caving not observed

Surface Elevation (ft)	490	Easting (X)	1197906	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	670815	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				SM	Gray-brown silty fine to coarse sand with gravel (medium dense, moist)			
489	1		1 MC				8		
	1.5				SP-SM	Gray-brown fine to medium sand with silt and occasional gravel (medium dense, moist)			
488	2								
487	3		2						
486	4		3						
	4.5				GP-GM	Gray-brown fine to coarse gravel with silt and sand (medium dense, moist)			
485	5		4 SA				8	7	
484	6		5						
	6				SM	Gray silty sand (medium dense, moist)			
	6.5		6		SM	Gray-brown silty fine to coarse sand with gravel (dense, moist)			
483	7								
482	8		7						
481	9								

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit PIT-2-20

GeoEngineers

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Figure A-8
Sheet 1 of 1

Date Excavated	4/14/2020	Total Depth (ft)	7.5	Logged By	WCW	Excavator	Kelly's Excavating, Inc.	See "Remarks" section for groundwater observed
				Checked By	DCO	Equipment	Takeuchi TB 138	Caving not observed

Surface Elevation (ft)	490	Easting (X)	1197913	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	670972	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				SM	Brown silty fine to coarse sand with gravel and cobbles (medium dense, moist)			
489	1	▯	1 / MC				15		
488	2								Light groundwater seepage observed at 2 feet
	2.5				SM	Blue-gray silty fine sand (medium dense, moist)			
487	3								
486	4	▯	2						
485	5				SM	Gray-brown silty fine to medium sand with gravel and cobbles (dense, moist)			
484	6	▯	3 / %F				14	26	
483	7	▯	4		SM	Blue-gray silty fine sand with occasional gravel (very dense, moist)			

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit PIT-3-20

GeoEngineers

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Figure A-9
Sheet 1 of 1

Date Excavated	4/14/2020	Total Depth (ft)	10	Logged By WCW Checked By DCO	Excavator Kelly's Excavating, Inc. Equipment Takeuchi TB 138

See "Remarks" section for groundwater observed
See "Remarks" section for caving observed

Surface Elevation (ft) Vertical Datum	490 NAVD88	Easting (X) Northing (Y)	1197914 671185	Coordinate System Horizontal Datum	WA State Plane South NAD83 (feet)

Elevation (feet)	Depth (feet)	Testing Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
490–488	0–2		1 MC		SM	Red-brown silty fine to coarse sand with gravel, cobbles and trace organic matter (roots) (loose, moist)	9		
488–483	2–7		2 SA		SP-SM	Brown fine sand with silt (loose, wet)	22	11	Slow groundwater seepage observed at 3¾ feet
			3			Grades to with gravel, dense			Minor to moderate caving observed from 6 to 10 feet
483–480	7–10		4 SA		GM	Brown-blue silty fine to coarse gravel with sand (dense, wet)	10	28	
			5						
			6						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit PIT-4-20

GeoEngineers

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Figure A-10
Sheet 1 of 1

Date Excavated	4/15/2020	Total Depth (ft)	10	Logged By: WCW Checked By: DCO	Excavator: Kelly's Excavating, Inc. Equipment: Takeuchi TB 138
Groundwater not observed Caving not observed					

Surface Elevation (ft)	530	Easting (X)	1198108	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	671098	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
			Duff	2 inches forest duff			
		1	SM	Brown silty fine to medium sand with gravel (loose to medium dense, moist)			
529	1						
528	2	2	GP	Brown fine to coarse gravel with sand (medium dense, moist)			
527	3		SM	Tan-brown silty fine sand with gravel (medium dense, moist)			
		3 MC			17		
526	4						
		4					
525	5						
			SP-SM	Tan fine sand with silt (dense, moist)			
524	6						
523	7						
		5 %F			24	8	
522	8						
521	9						
		6					
520	10						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit PIT-5-20

GeoEngineers

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Date Excavated	4/17/2020	Total Depth (ft)	8	Logged By	WCW	Excavator	Kelly's Excavating, Inc.	See "Remarks" section for groundwater observed
				Checked By	DCO	Equipment	Takeuchi TB 138	See "Remarks" section for caving observed

Surface Elevation (ft)	550	Easting (X)	1198109	Coordinate System	WA State Plane South
Vertical Datum	NAVD88	Northing (Y)	670686	Horizontal Datum	NAD83 (feet)

Elevation (feet)	Depth (feet)	SAMPLE: Testing Sample	SAMPLE: Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				SM	Red-brown silty fine to medium sand with occasional gravel and trace organic matter (loose, moist)			
549	1	X	1 MC				14		
548	2	X	2		SM	Brown silty fine sand (loose, moist)			
547	3				GP	Brown fine to coarse gravel with sand (medium dense, moist)			Minor to moderate caving observed from 3 to 8 feet
546	4	X	3 SA				5	5	
545	5				GP	Gray and brown fine to coarse gravel with sand and occasional cobbles (medium dense, moist to wet)			
544	6	X	4 SA				6	1	Moderate groundwater seepage observed at 6 feet following PIT saturation
543	7								
542	8	X	5						

Notes: See Figure A-1 for explanation of symbols.
The depths on the test pit logs are based on an average of measurements across the test pit and should be considered accurate to ½ foot.
Coordinates Data Source: Horizontal approximated based on Aerial Imagery. Vertical approximated based on Google Earth.

Log of Test Pit PIT-6-20

GeoEngineers

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	7/8/2020	7/8/2020	26.5	CJL	DCO	Advance Drill Technologies	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D-50 Turbo (Track-Mounted)
Surface Elevation (ft) / Vertical Datum	505 / NAVD88	Top of Casing Elevation (ft)	
Easting (X) / Northing (Y)	1198079 / 670882	Horizontal Datum	WA State Plane South NAD83 (feet)

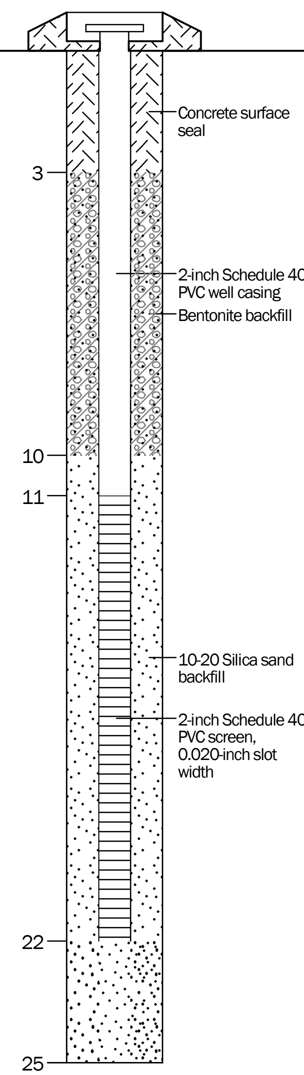
DOE Well I.D.: BMM217
A 2-in well was installed on 7/8/2020 to a depth of 25 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
12/18/2020	15.30	489.70

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0								DUFF	Approximately 4 inches forest duff		
									SM	Orange-brown silty fine to medium sand with occasional roots		
500	5		13	16		1 / SA			SM	Gray; silty fine to medium sand with occasional gravel (medium dense, moist)	11	30
									SP-SM	Gray fine to medium sand with silt (medium dense, moist)		
495	10		18	19		2 / SA					8	8
490	15		15	24		3 / %F			SP-SM	Gray fine to medium sand with silt (medium dense, wet)	25	11
485	20		12	31		4				Grades to dense		
480	25		18	54		5A, 5B			SM	Gray silty fine to medium sand with gravel (very dense, moist)		

WELL LOG



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

Log of Monitoring Well MW-1-20

GEOENGINEERS

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Drilled	Start	End	Total Depth (ft)	Logged By	Checked By	Driller	Drilling Method
	7/8/2020	7/8/2020	11.5	CJL	DCO	Advance Drill Technologies	Hollow-stem Auger

Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D-50 Turbo (Track-Mounted)
Surface Elevation (ft) / Vertical Datum	499 / NAVD88	Top of Casing Elevation (ft)	
Easting (X) / Northing (Y)	1198044 / 670603	Horizontal Datum	WA State Plane South NAD83 (feet)

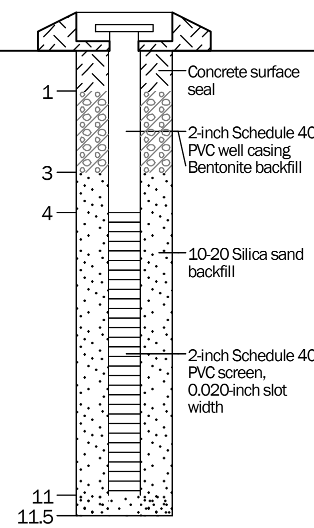
DOE Well I.D.: BMM-216
A 2-in well was installed on 7/8/2020 to a depth of 11.5 ft.

Groundwater Date Measured	Depth to Water (ft)	Elevation (ft)
12/18/2020	8.55	490.45

Notes:

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Water Level	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)
	0							DUFF	Approximately 4 inches forest duff		
								SM	Orange-brown silty fine to medium sand with gravel (recessional outwash)		
495								SM	Brown-gray with iron-oxide staining silty fine to medium sand with occasional gravel (medium dense, moist)		
	5		12	15		1 / SA				14	42
490								SM	Gray silty fine to medium sand with gravel (very dense, moist)		
	10		18	50		2					

WELL LOG



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

Log of Monitoring Well MW-2-20

GEOENGINEERS

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

Figure A-14
Sheet 1 of 1

Drilled	Start	End	Total Depth (ft)	25.75	Logged By	CJL	Driller	Advance Drill Technologies	Drilling Method	Hollow-stem Auger
	7/8/2020	7/8/2020			Checked By	DCO				

Surface Elevation (ft) Vertical Datum	500 NAVD88	Hammer Data	Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment	Diedrich D-50 Turbo (Track-Mounted)
Easting (X) Northing (Y)	1198046 670601	System Datum	WA State Plane South NAD83 (feet)	Groundwater not observed at time of exploration	

Notes:

FIELD DATA

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
500	0							DUFF	Approximately 4 inches forest duff			
								SM	Orange-brown silty fine to medium sand with gravel (medium dense, moist)			Soil description inferred from observation of drilling cuttings
495	5	X	12	13		1A		SM	Brown-gray with iron-oxide staining silty fine to medium sand (medium dense, moist)			
						1B			Gray silty fine to medium sand (medium dense, moist)			
								SM	Brown-gray silty fine to medium sand with occasional gravel (dense, moist)			
490	10	X	18	48		2						
								GP	Gray fine gravel with sand and trace silt (medium dense, wet)			Water observed on drill rods at approximately13 feet
485	15	X	18	28		3A						
						3B		SM	Brown with iron-oxide staining silty fine sand (medium dense, moist)			
								SM	Gray silty fine to coarse sand with gravel (very dense, moist)			Drill chatter at 18 feet
480	20	X	9	50/3"		4						Drill chatter at 20 to 25 feet
475	25	X	6	50/4"		5						

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

Log of Boring B-3

GEOENGINEERS

Project: Benaroya Co South Hill Business & Technology Center
Project Location: Puyallup, Washington
Project Number: 4565-064-06

APPENDIX B
Laboratory Testing

APPENDIX B
LABORATORY TESTING

Soil samples obtained from the explorations were transported to our laboratory and examined to confirm or modify field classifications, as well as to evaluate index properties of the soil samples. Representative samples were selected for laboratory testing consisting of the determination of the moisture content, percent passing the No. 200 sieve and grain size distribution. The tests were performed in general accordance with test methods of the ASTM International (ASTM) or other applicable procedures.

Moisture Content Testing

Moisture content tests were completed in general accordance with ASTM D 2216 for representative samples obtained from the explorations. The results of these tests are presented on the exploration logs in Appendix A at the depths at which the samples were obtained.

Percent Passing U.S. No. 200 Sieve (%F)

Selected samples were "washed" through the No. 200 mesh sieve to estimate the relative percentages of coarse and fine-grained particles in the soil. The percent passing value represents the percentage by weight of the sample finer than the U.S. No. 200 sieve. These tests were conducted to verify field descriptions and to estimate the fines content for analysis purposes. The tests were conducted in accordance with ASTM D 1140, and the results are shown on the exploration logs in Appendix A at the respective sample depths.

Grain Size Distribution

Sieve analyses were performed on selected samples in general accordance with ASTM D 422. The wet sieve analysis method was used to estimate the percentage of soil greater than the U.S. No. 200 mesh sieve. The results of the sieve analyses were plotted, classified in general accordance with the Unified Soil Classification System (USCS), and presented on Figures B-1 through B-5.

It should be noted that the sieve analyses were performed on soils obtained from samplers that have an opening size of 1½ inches so larger sized particles cannot be obtained by the samplers. Therefore, the sieve results do not account for soil particles that are larger than 1½ inches. Soils with larger sized materials are described in this report qualitatively based on visual observations and experience on projects where excavations were made into similar formations.

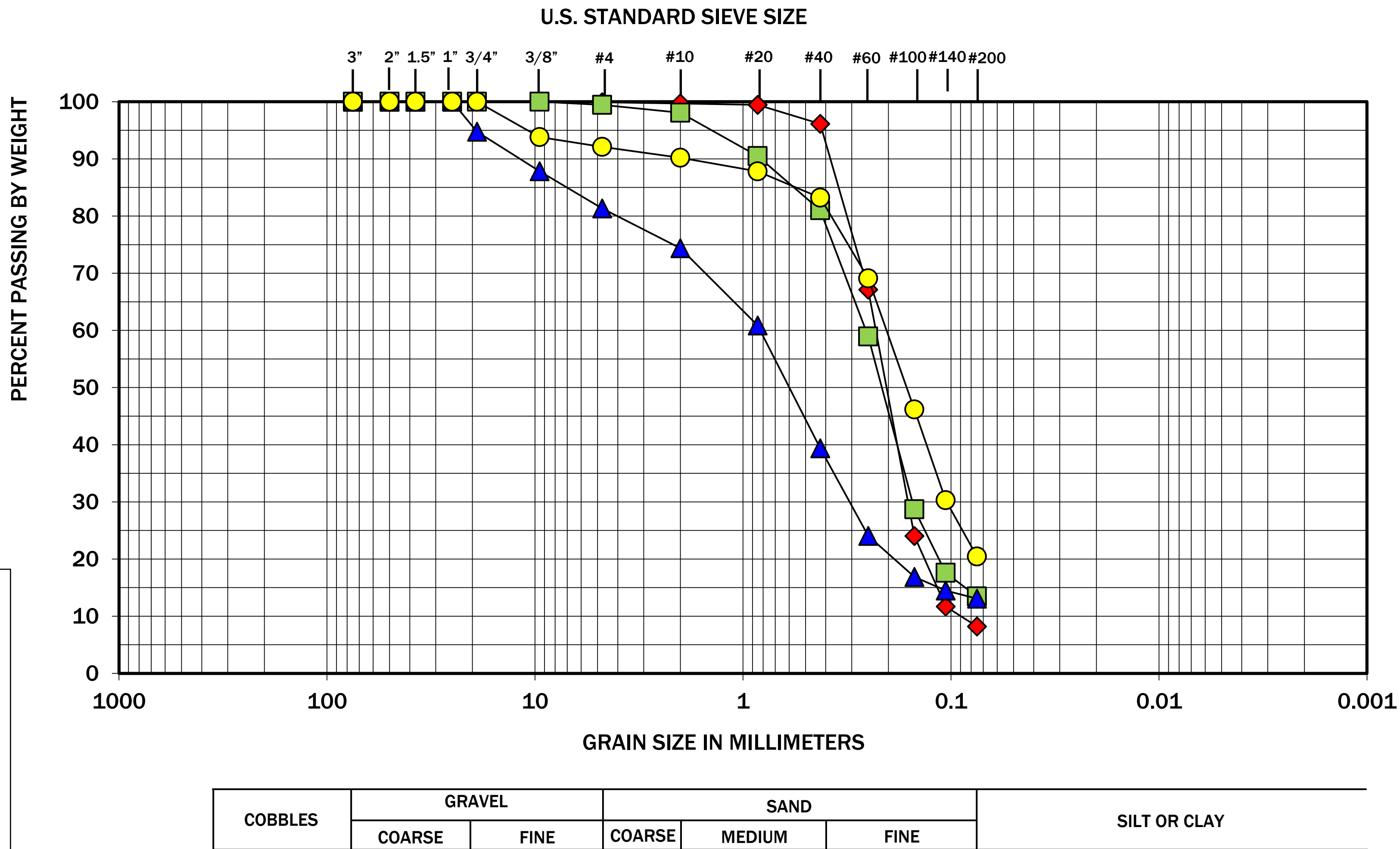
Organic Content and Cation Exchange

Organic content and cation exchange tests were completed on samples obtained from the explorations with additional grab samples collected at the proposed parking lot locations. The results of the test are provided in Table B-1.

TABLE B-1. RESULTS OF CATION EXCHANGE AND ORGANIC CONTENT

Exploration/Sample Location	Depth (feet)	Cation Exchange (meq/100g)	Organic Content (%)
PIT-5-20	4	6.7	2.0
PIT-6-20	4	3.5	1.2

As noted in Table B-1, cation exchange capacity (CEC) of the two samples range from 3.5 to 6.7, with an average value of 5.1. CEC values should be greater than 5 meq/100g (milliequivalent per gram) to be considered suitable for removing target pollutants. The organic content of the treatment soil should be greater than 1.0 percent. As shown above, the organic content percentage results were 1.2 and 2.0.



Symbol	Exploration Number	Depth (feet)	Moisture (%)	Soil Description
◆ (red diamond)	TP-1-20	5	11	Fine sand with silt (SP-SM)
■ (green square)	TP-2-20	5	16	Silty fine to medium sand (SM)
▲ (blue triangle)	TP-3-20	5	9	Silty fine to medium sand with gravel (SM)
● (yellow circle)	TP-4-20	5	20	Silty fine sand with occasional gravel (SM)

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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

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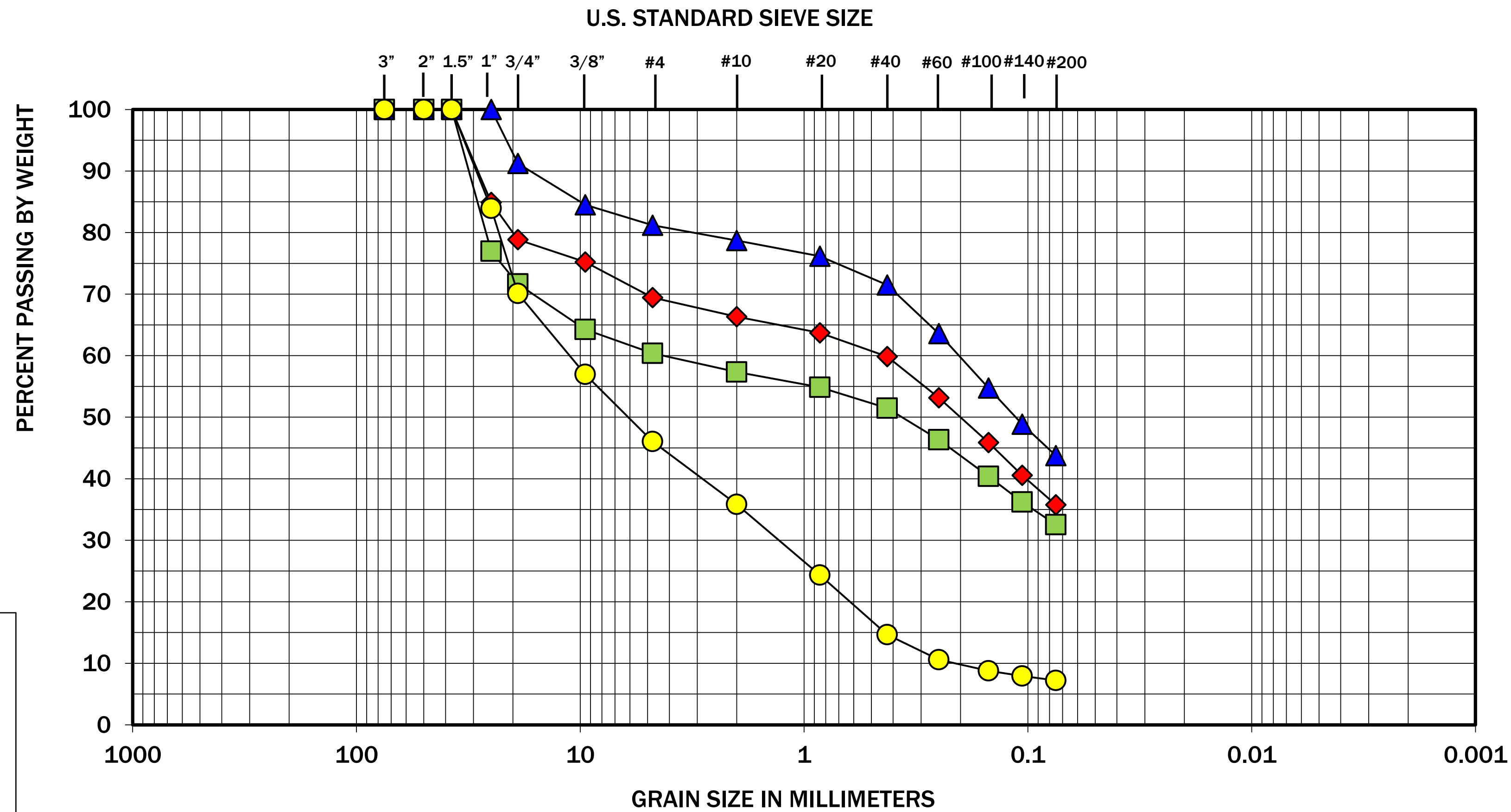
Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

Sieve Analysis Results

Figure B-1

4565-064-06 Date Exported: 4/30/20



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Exploration Number	Depth (feet)	Moisture (%)	Soil Description
◆ (red diamond)	TP-5-20	5	15	Silty fine sand with gravel (SM)
■ (green square)	TP-5-20	7	13	Silty fine to coarse gravel with sand (GM)
▲ (blue triangle)	PIT-1	4	15	Silty fine sand with gravel (SM)
● (yellow circle)	PIT-2	5	8	Fine to coarse gravel with silt and sand (GP-GM)

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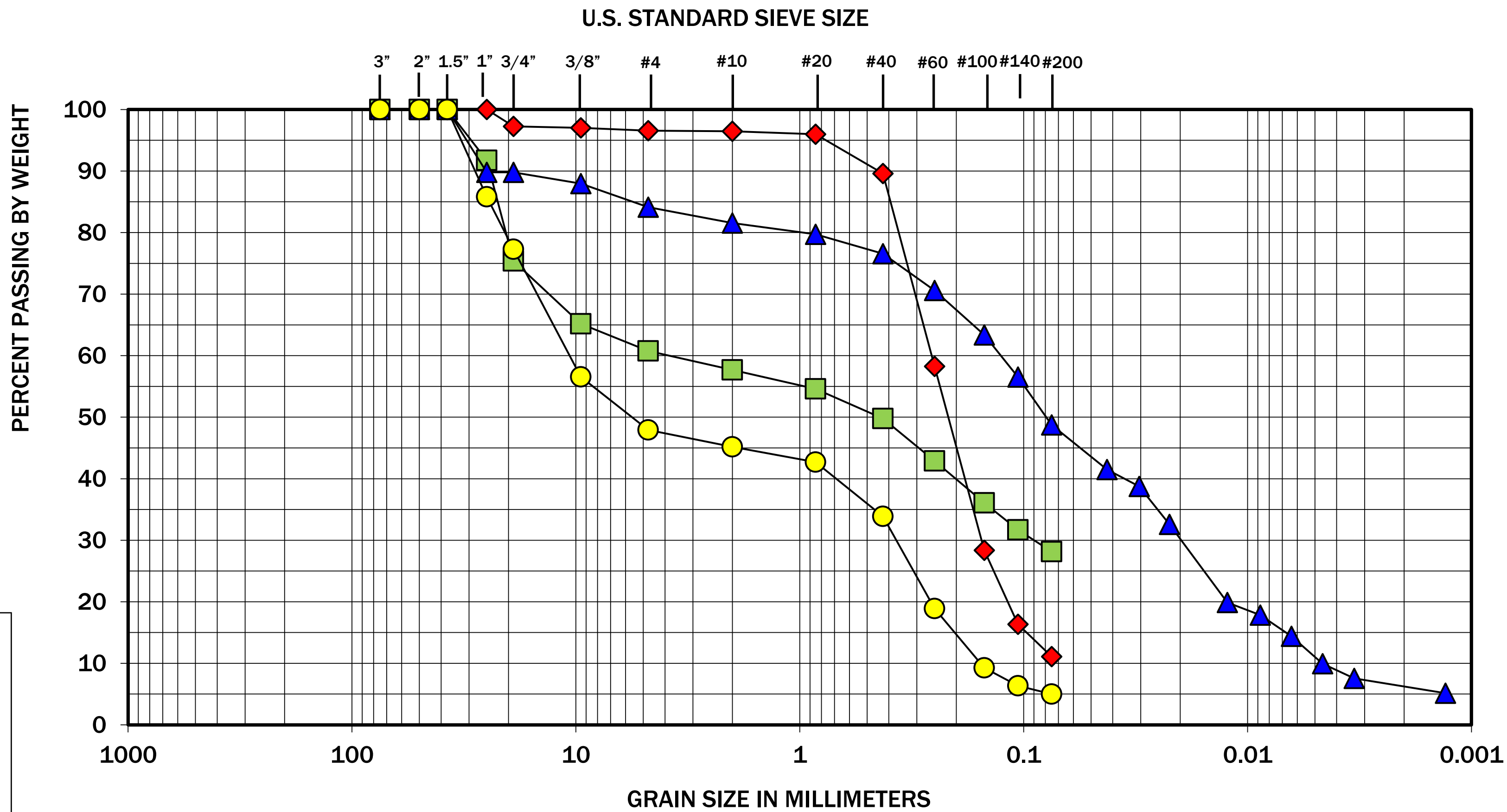
The grain size analysis results were obtained in general accordance with ASTM C 136. GeoEngineers 17425 NE Union Hill Road Ste 250, Redmond, WA 98052

Sieve Analysis Results

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

GeoEngineers

Figure B-2



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Exploration Number	Depth (feet)	Moisture (%)	Soil Description
◆ (red diamond)	PIT-4	4	22	Fine sand with silt (SP-SM)
■ (green square)	PIT-4	8	10	Silty fine to coarse gravel with sand (GM)
▲ (blue triangle)	PIT-5	4	16	Silty fine sand with gravel (SM)
● (yellow circle)	PIT-6	4	5	Fine to coarse gravel with sand (GP)

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

Sieve Analysis Results

Benaroya Co South Hill Business & Technology Center
Puyallup, Washington

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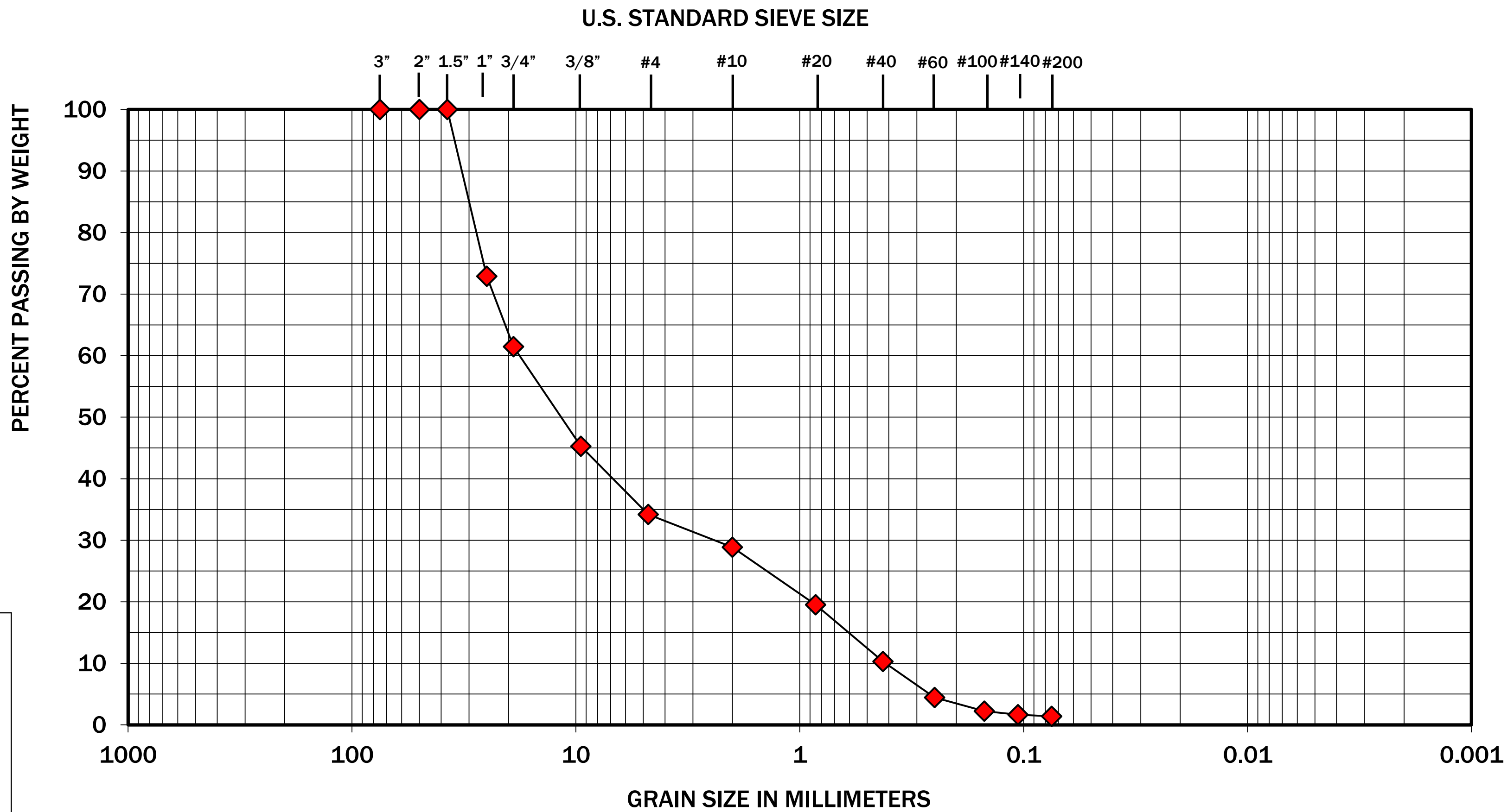
Figure B-3



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Exploration Number	Depth (feet)	Moisture (%)	Soil Description
◆	PIT-6	6	6	Fine to coarse gravel with sand (GP)

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

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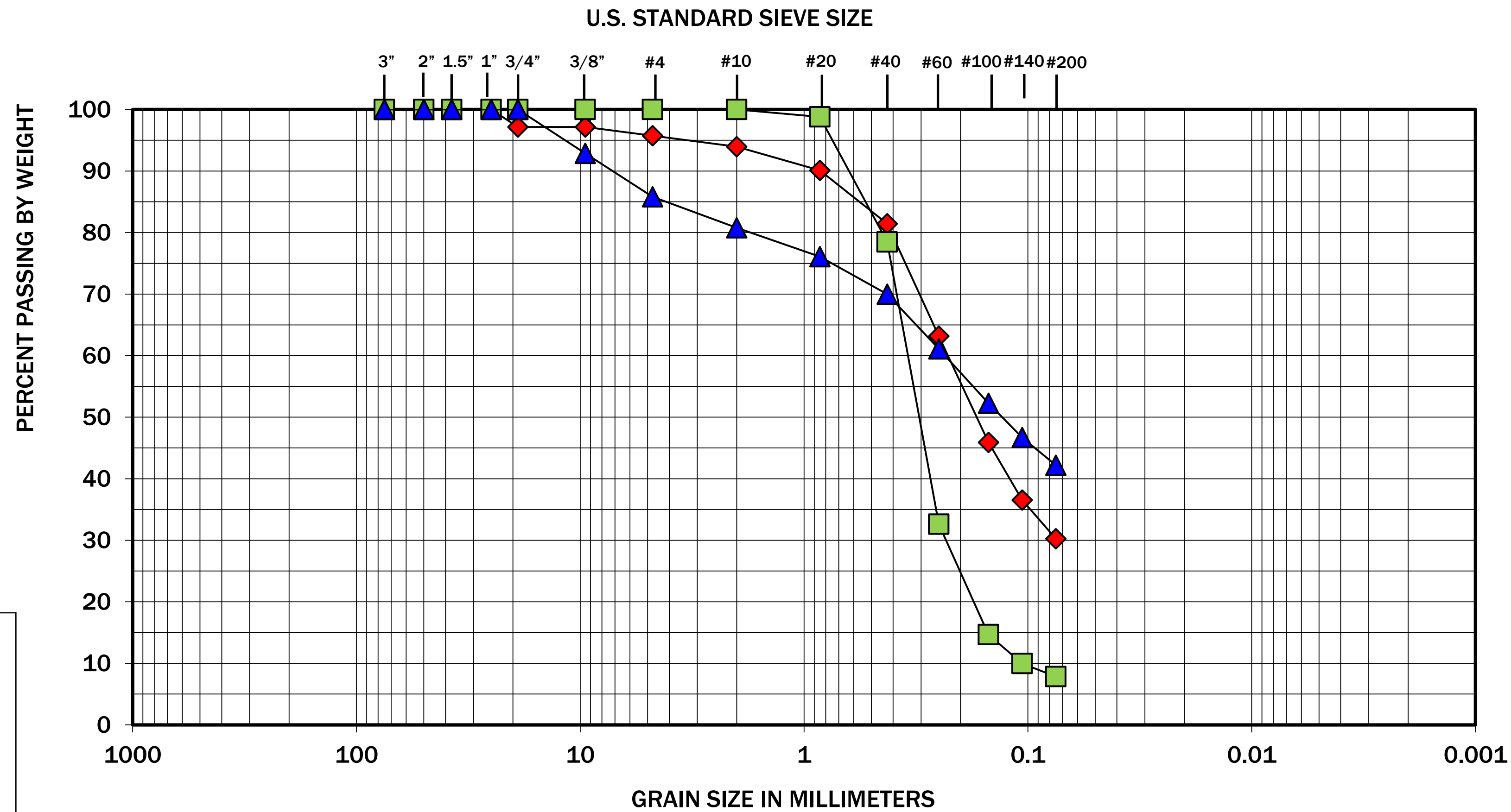
Puyallup, Washington

Sieve Analysis Results

Figure B-4



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Exploration Number	Depth (feet)	Moisture (%)	Soil Description
◆	MW-1-20	5	11	Silty fine to medium sand (SM)
■	MW-1-20	10	8	Fine to medium sand with silt (SP-SM)
▲	MW-2-20	5	14	Silty fine to medium sand with occasional gravel (SM)

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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

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Puyallup, Washington

Sieve Analysis Results

Figure B-5

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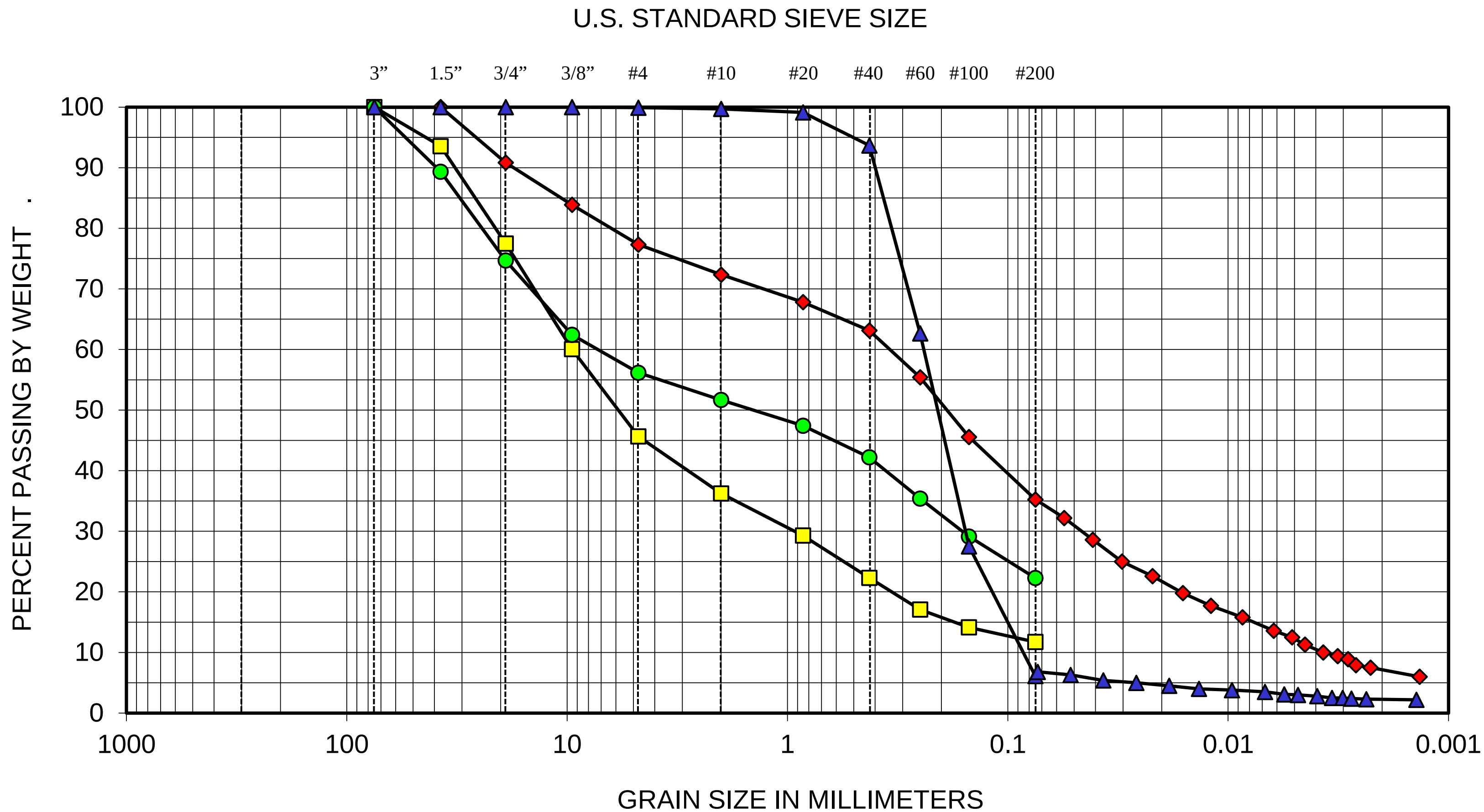
SIEVE AND HYDROMETER ANALYSIS RESULTS

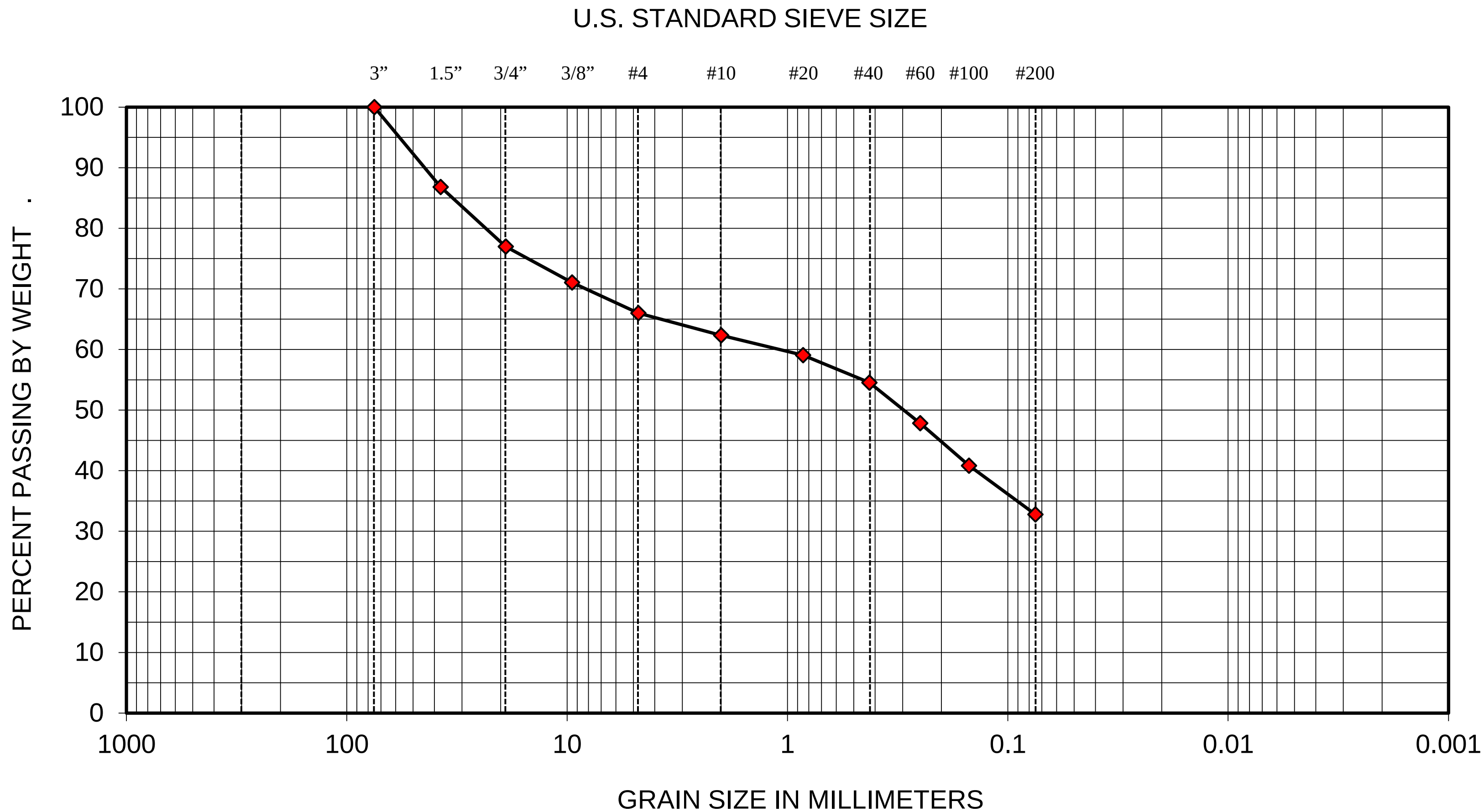


BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	SOIL CLASSIFICATION
◆	TP-1	3	Silty sand with gravel (SM)
■	TP-2	1	Poorly graded gravel with silt and sand (GP-GM)
●	TP-3	2	Silty gravel with sand (GM)
▲	TP-4	2	Poorly graded sand with silt (SP-SM)

FIGURE B-6

4565-064-04 SAS: SAS 09-5-2014



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

SYMBOL	EXPLORATION NUMBER	DEPTH (ft)	SOIL CLASSIFICATION
◆	TP-4	6	Silty gravel with sand (GM)

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SIEVE AND HYDROMETER ANALYSIS RESULTS

FIGURE B-7

APPENDIX C
Report Guidelines and Limitations for Use

APPENDIX C
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

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

Geotechnical Services Are Performed for Specific Purposes, Persons and Projects

This report has been prepared for the exclusive use of the Benaroya Company LLC and other project team members for the East Parking Lot Expansion project at the South Hill Business and Technology Center in Puyallup, Washington. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

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

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

This report has been prepared for the East Parking Lot Expansion project at the South Hill Business and Technology Center in Puyallup, Washington. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

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

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

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

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

- Composition of the design team; or
- Project ownership.

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

Subsurface Conditions Can Change

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

Most Geotechnical and Geologic Findings Are Professional Opinions

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

Geotechnical Engineering Report Recommendations Are Not Final

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

Sufficient monitoring, testing and consultation by GeoEngineers should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A Geotechnical Engineering or Geologic Report Could Be Subject to Misinterpretation

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

Do Not Redraw the Exploration Logs

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

Give Contractors a Complete Report and Guidance

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

Contractors are Responsible for Site Safety on Their Own Construction Projects

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

Read These Provisions Closely

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

Geotechnical, Geologic and Environmental Reports Should Not be Interchanged

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

Biological Pollutants

GeoEngineers' Scope of Work specifically excludes the investigation, detection, prevention or assessment of the presence of Biological Pollutants. Accordingly, this report does not include any interpretations, recommendations, findings, or conclusions regarding the detecting, assessing, preventing or abating of

Biological Pollutants and no conclusions or inferences should be drawn regarding Biological Pollutants, as they may relate to this project. The term "Biological Pollutants" includes, but is not limited to, molds, fungi, spores, bacteria, and viruses, and/or any of their byproducts.

If Client desires these specialized services, they should be obtained from a consultant who offers services in this specialized field.

Environmental Regulations Are Always Evolving

Some substances may be present in the vicinity of the subject property in quantities or under conditions that may have led, or may lead, to contamination of the subject property, but are not included in current local, state or federal regulatory definitions of hazardous substances or do not otherwise present current potential liability. GeoEngineers cannot be responsible if the standards for appropriate inquiry, or regulatory definitions of hazardous substances, change or if more stringent environmental standards are developed in the future.

Uncertainty May Remain Even After This Environmental Soil Sampling Is Completed

Performance of environmental soil sampling is intended to reduce uncertainty regarding the potential for contamination in connection with a property, but no environmental sampling can wholly eliminate that uncertainty. Our interpretation of subsurface conditions in this study is based on field observations and chemical analytical data from widely spaced sampling locations. It is always possible that contamination exists in areas that were not explored, sampled or analyzed.

Soil and Groundwater End Use

The cleanup levels referenced in this report are site- and situation-specific. The cleanup levels may not be applicable for other properties or for other on-site uses of the affected soil and/or groundwater. Note that hazardous substances may be present in some of the on-site soil and/or groundwater at detectable concentrations that are less than the referenced cleanup levels. GeoEngineers should be contacted prior to the export of soil or groundwater from the subject property or reuse of the affected soil or groundwater on-site to evaluate the potential for associated environmental liabilities. We are unable to assume responsibility for potential environmental liability arising out of the transfer of soil and/or groundwater from the subject property to another location or its reuse on-site in instances that we did not know or could not control.

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