

GEOTECHNICAL REPORT
Madrona Ridge Residential Development
Rainier Street
Port Townsend, Washington
Prepared for: Montebanc Management, LLC

Project No. 210338 • August 11, 2021 FINAL



e a r t h + w a t e r



GEOTECHNICAL REPORT
Madrona Ridge Residential Development
Rainier Street
Port Townsend, Washington
Prepared for: Montebanc Management, LLC

Project No. 210338 • August 11, 2021 FINAL

Aspect Consulting, LLC



8/11/2021

Alison J. Dennison

Alison J. Dennison, LEG
Senior Engineering Geologist
adennison@aspectconsulting.com.com



8/11/2021

Erik O. Andersen, PE
Principal Geotechnical Engineer
eandersen@aspectconsulting.com

V:\210338 Madrona Ridge\Deliverables\New Deliverable\Final\210338 Madrona Ridge - Geotechnical Report_2021.08.11.docx



Contents

1	Introduction	1
1.1	Scope of Services	1
1.2	Project Understanding.....	2
2	Surface Conditions	3
2.1	Site and Topography.....	3
2.2	Vegetation	3
2.3	Drainage and Surface Water.....	3
3	Subsurface Conditions	4
3.1	Geologic Setting.....	4
3.2	Subsurface Investigation.....	4
3.3	Stratigraphy	5
3.3.1	Topsoil	5
3.3.2	Fill	5
3.3.3	Lodgment Till	5
3.4	Groundwater	6
3.5	Laboratory Testing Results	6
4	Geologic Hazards	7
4.1	Seismic Design Considerations	7
4.2	Ground Response	7
4.3	Surficial Ground Rupture.....	8
4.4	Liquefaction.....	8
4.5	Erosion Hazard	9
5	Conclusions and Recommendations	10
5.1	Foundation Considerations	10
5.1.1	Shallow Foundations.....	10
5.2	Slab-On-Grade Support	11
5.3	Retaining Walls	11
5.4	Temporary and Permanent Slopes	12
5.5	Drainage Considerations.....	13
5.5.1	Stormwater Infiltration	13
6	Earthwork and Construction Recommendations	14
6.1	Wet Weather Earthwork.....	14
6.2	Site Preparation	14
6.3	Structural Fill	15

6.3.1 Compaction Considerations..... 16

6.4 Utility Construction Considerations..... 16

6.4.1 Pipe Support and Bedding 16

6.4.2 Trench Backfill and Compaction Criteria..... 17

7 Recommendations for Continuing Geotechnical Services18

7.1 Additional Design and Consultation Services 18

7.2 Additional Construction Services 18

References19

Limitations20

List of Tables

- 1 Summary of Particle-Size Distribution Results
- 2 Seismic Design Parameters
- 3 Temporary Excavation Cut Slope

List of Figures

- 1 Site Location Map
- 2 Site Exploration Plan

List of Appendices

- A Test Pit Logs
- B Laboratory Testing Results
- C Report Limitations and Guidelines for Use

1 Introduction

This report summarizes Aspect Consulting, LLC's (Aspect) observations, conclusions, and recommendations made during a geotechnical evaluation for the Madrona Ridge residential development (Project) located at 1601 Rainier Street in Port Townsend, Washington (Site; Figure 1) on five adjoining Jefferson County (County) parcel numbers 001091002, 001092005, 001092006, 973200201, and 973200301.

We performed our services in accordance with our contract dated June 11, 2021.

1.1 Scope of Services

Our scope of services included a Site reconnaissance, subsurface explorations, and geotechnical engineering analyses. This report describes Site conditions, summarizes the results of the completed analyses, and provides geotechnical engineering conclusions and design recommendations, including:

- Site and Project descriptions.
- Distribution and characteristics of subsurface soils and groundwater.
- Seismic design considerations in accordance with the current version of the International Building Code (IBC), as adopted by Port Townsend.
- Suitable foundation types, allowable soil bearing pressure(s), anticipated settlements, and geotechnical design parameters.
- Lateral earth pressures for design of residential basement and exterior site retaining walls.
- General Site earthwork considerations, including:
 - Evaluation of the Site soils for use as fill.
 - Temporary and permanent slope inclinations.
 - Structural fill materials and preparation.
 - Wet weather/wet conditions considerations.
- General Site earthwork considerations, including excavation, backfill, and subgrade preparation.
- Structural fill requirements and evaluation of the suitability of on-Site soil for reuse as fill.
- General stormwater drainage recommendations.
- A qualitative evaluation of stormwater infiltration feasibility.

The Site Exploration Plan (Figure 2) showing the locations of the exploratory test pits, the exploration logs (Appendix A), and the lab testing results (Appendix B) are included as appendices to this report.

1.2 Project Understanding

The Site is located west of Rainier Street and south of 20th Street in Port Townsend, Washington (Figure 2). The Project includes development of the 30-acre Site with about 180 single-family residential lots and associated infrastructure (Figure 2). To prepare the area for development, cuts and fills up to 10 feet thick are planned along with the installation of utilities and roadways. Four proposed stormwater facilities have been identified at the southwest corner, northeast corner, and southeast corner of the Site. We assume the new residential structures will typically be wood-framed above cast-in-place concrete foundations with crawl spaces and/or with concrete slabs-on-grade.

2 Surface Conditions

Aspect assessed the surface conditions of the Site through a literature review and field observations. We conducted our Site reconnaissance on July 8, 2021. The following sections discuss the results of our assessment.

2.1 Site and Topography

The approximately 30-acre Site occupies a rectangular footprint of approximately 640 feet (east-west) by 1,060 feet north-south (Figure 2). It is bounded by a City of Port Townsend water storage facility to the north and undeveloped properties to the west, east, and south. Rainier Street extends in a north-south direction through the eastern portion of the Site.

The western parcel, 001091002, is developed with a single-family residence and some outbuildings. The gravel access driveway to this residence crosses through the east-adjacent parcel, 001092005.

The Site gently slopes down to the west with less than 50 feet of elevation loss. A ravine is located towards the southwest corner of the Site and is out of the area of planned development.

2.2 Vegetation

The area around the existing residence and outbuildings has been cleared and is vegetated with grass. Other areas of the Site are vegetated with young to mature evergreens and deciduous trees with an established understory of ferns, woody shrubs, herbaceous ground cover, and areas of blackberries. In general, the mature evergreen trees were relatively straight, indicating relatively stable ground conditions.

2.3 Drainage and Surface Water

No surface water or saturated soils were observed on the Site in the areas traversed. Surface drainage conditions at the Site will vary with fluctuations in precipitation, Site usage (such as irrigation), and off-Site land use.

3 Subsurface Conditions

Subsurface conditions at the Site are inferred from our review of applicable geologic literature and maps, our experience with the local geology, and our subsurface explorations advanced on July 8, 2021. The following sections discuss the results of our assessment.

3.1 Geologic Setting

The Site is located within the Puget Lowland, a broad area of tectonic subsidence flanked by two mountain ranges: the Cascades to the east and the Olympics to the west. The sediments within the Puget Lowland are the result of repeated cycles of glacial and nonglacial deposition and erosion. The most recent cycle, the Vashon Stade (stage) of the Fraser Glaciation (about 13,000 to 16,000 years ago), is responsible for most of the present day geologic and topographic conditions.

During the Vashon Stade, the 3,000-foot-thick Cordilleran ice sheet advanced into the Puget Lowland from the north. As the ice sheet advanced southward, sediments transported by rivers flowing from the ice front were deposited in advance of the ice in rivers (glaciofluvial deposits or glacial outwash) and lakes (advance glaciolacustrine deposits). When the advancing ice overran these preglacial and proglacial sediments, it deposited a veneer of glacial till and then consolidated the entire package with its enormous weight, creating dense and hard soil deposits. In addition to consolidating the soils it overran, the Cordilleran ice sheet sculpted and smoothed the surface, directly by the ice and by high-pressure water flowing under the ice. Then, as the Cordilleran ice sheet retreated from the Puget Lowland, it left a layer of recessional deposits over the glacially consolidated deposits. This sequence of glacial deposition and erosion has been repeated as many as 7 times in the past 2 million years.

The geologic map indicates that the Site is underlain by Vashon-age ablation till (Qgt_a) with Vashon-age lodgment till (Qgt) mapped nearby (Schasse and Slaughter, 2011). Ablation till is found overlying lodgment till up to 5 feet thick and forms as the ice is melting. The lodgment till is deposited under the moving ice and has been consolidated by the weight of the ice sheet. Both deposits are described as an unsorted mix of silt, sand, and gravel. However, the lodgment till is considerably denser.

3.2 Subsurface Investigation

Aspect conducted a subsurface investigation on July 8, 2021, to collect subsurface soil and groundwater information. Fifteen test pits, ATP-01 through ATP-15, were excavated to depths of 6 to 12 feet below the existing ground surface (bgs). A summary of our field explorations, including geologic soil units and groundwater observations, are presented in the following sections. Detailed descriptions of the subsurface conditions encountered in our explorations, as well as the depths where characteristics of the soils changed, are on the test pit logs presented in Appendix A. Locations of the explorations are shown on Figure 2.

3.3 Stratigraphy

Our explorations encountered a relatively thin layer of topsoil and/or fill overlying native soil consisting of lodgment till (Qgt). The soil conditions we observed in the subsurface explorations are described in stratigraphic order from top to bottom below.

3.3.1 Topsoil

Topsoil refers to a unit that contains a high percentage of organics. Topsoil varying from 6 to 12 inches thick was encountered at the ground surface in our explorations ATP-01, ATP-02, ATP-04 through ATP-11, ATP-13, and ATP-15. The topsoil is dark in color and contains numerous organics.

3.3.2 Fill

Fill refers to human-placed material. Fill was encountered in ATP-03, ATP-12, and ATP-14, varying from about 10 to 18 inches thick. The fill was identified by color, presence of refuse, and lower density. It is typically very loose to medium dense,¹ dry to moist, brown to brown to dark brown, silty sand (SM)² with various amounts of gravel, iron-oxide staining, and refuse.

Our interpretations of the extents and depths of fill at the Site are based on limited, isolated, and discontinuous subsurface data across the Site. Variation in the subsurface conditions should be expected and verification of our interpretations and recommendations can only be completed at the time of construction.

3.3.3 Lodgment Till

Lodgment till was encountered underlying the topsoil or fill in all test pits, and extending to the maximum depths explored, 6 to 12 feet bgs. The lodgment till consists of medium dense to very dense, slightly moist, brown to gray, silty sand (SM) with variable amounts of gravel, cobbles, and boulders. The upper 2 to 4 feet of this unit is weathered with iron-oxide staining and is slightly less dense.

As observed in some of the test pits, lodgment till contains occasional large cobbles and boulders, which can impede earthwork activities, and should be expected during Site earthwork. Lodgment till exhibits high shear strength and low compressibility characteristics, making it suitable for support of new structure foundations. The very dense nature and high silt/clay content (fines) of this unit yields very low permeability causing an impediment to groundwater movement. It has moderate to high moisture sensitivity due to its significant fines content.

¹ Relative density was qualitatively assessed with a 0.5-inch-diameter, pointed steel T-probe at various depth intervals and difficulty by the excavator to advance the test pit.

² Soils were classified per the Unified Soil Classification System (USCS) in general accordance with ASTM International (ASTM) D2488, *Standard Practice for Description and Identification of Soils* (ASTM, 2018).

3.4 Groundwater

We did not observe any groundwater seepage or signs of saturated soils (such as hydrophilic vegetation) at the Site. A perched groundwater condition may develop on the top of the lodgment till in localized closed depressions during extended periods of wet weather.

3.5 Laboratory Testing Results

Seven samples collected from the test pits were submitted for laboratory testing to characterize engineering and index properties of the Site soils. Moisture content was measured for all seven samples and the particle-size distribution was determined for six of those samples. The table below contains a summary of the results and soil type based on the USCS. The laboratory testing report is presented in Appendix B. The moisture content results are also presented on the test pit logs presented in Appendix A.

Table 1. Summary of Particle-Size Distribution Results

Exploration Number	Sample Depth (feet bgs)	Percent Gravel	Percent Sand	Percent Fines	Moisture Content (percent)	USCS
ATP-01	6	0	68.5	31.5	5.8	SM
ATP-01	9.5	0	67.8	32.2	5.3	SM
ATP-02	2	0	79.8	20.2	6.2	SM
ATP-05 + ATP-06	4	8.3	57.9	33.8	10.5	SM
ATP-09	6	11.5	53.0	35.5	5.5	SM
ATP-10	2	6.5	59.1	34.4	8.9	SM

4 Geologic Hazards

The following sections describe the geologic hazards at and near the Site and associated design considerations, including seismic considerations, erosion hazards, and slope stability.

4.1 Seismic Design Considerations

The Site is located within the Puget Lowland physiographic province, an area of active seismicity that is subject to earthquakes on shallow crustal faults and deeper subduction zone earthquakes. The Site area lies just south of the Southern Whidbey Island fault zone, which consists of shallow crustal tectonic structures that are considered active (evidence for movement within the Holocene [since about 15,000 years ago]) and is believed to be capable of producing earthquakes of magnitude 7.0 or greater. The recurrence interval of earthquakes on this fault zone is believed to be on the order of 1,000 years or more. The most recent large earthquake on the Southern Whidbey Island fault occurred about 3,200 to 2,800 years ago. There are also several other shallow crustal faults in the region capable of producing earthquakes and strong ground shaking (Pratt et al., 2015).

The Site area also lies within the zone of strong ground shaking from earthquakes associated with the Cascadia Subduction Zone (CSZ). Subduction zone earthquakes occur due to rupture between the subducting oceanic plate and the overlying continental plate. The CSZ can produce earthquakes up to magnitude 9.3 and the recurrence interval is thought to be on the order of about 500 years. A recent study estimates the most recent subduction zone earthquake occurred around 1700 (Atwater et al., 2015).

Deep intraslab earthquakes, which occur from tensional rupture of the sinking oceanic plate, are also associated with the CSZ. An example of this type of seismicity is the 2001 Nisqually earthquake. Deep intraslab earthquakes typically are magnitude 7.5 or less and occur approximately every 10 to 30 years.

The following sections present descriptions of seismic design considerations for the Project.

4.2 Ground Response

Seismic design of the residences will be in accordance with the 2018 International Building Code (IBC) that references the American Society of Civil Engineers (ASCE) Standard ASCE/SEI 7-16, *Minimum Design Loads for Buildings and Other Structures* (ASCE, 2018) for seismic design. In accordance with these codes, the seismic design will consider a “Maximum Considered Earthquake” (MCE) ground motion with a 2 percent probability of exceedance in 50 years, or a return period of 2,475 years (ICC, 2018).

The effects of Site-specific subsurface conditions on the MCE ground motion at the ground surface are determined based on the “Site Class.” The Site Class can be correlated to the average standard penetration resistance (N-value), average shear wave velocity, or average undrained strength (for fine-grained soils) in the upper 100 feet of the soil profile. Based on the difficulty digging our test pits and the known geologic conditions,

we conclude the Site soil profile can be classified as Site Class C (very dense soil and stiff rock).

The design spectral response acceleration parameters adjusted for Site Class C in accordance with the 2018 IBC and ASCE/SEI 7-16 are presented in Table 2.

Table 2. Seismic Design Parameters

Design Parameter	Recommended Value
Site Class	C – Very dense soil and soft rock
Peak Ground Acceleration (PGA)	0.543g ⁽¹⁾
Short Period Spectral Acceleration (S _s)	1.306g
1-Second Period Spectral Acceleration (S ₁)	0.529g
Site Coefficient (F _v)	1.300
Design Short Period Spectral Acceleration (S _{DS})	0.871g
Design 1-Second Period Spectral Acceleration (S _{D1})	0.459g

Notes:

- g = gravitational force
Based on the latitude and longitude of the Site: 48.112717°N, 122.809659°W, World Geodetic System 1984 (WGS84).
The risk category used was II, residential use.
Based on the American Society of Civil Engineers (ASCE) hazard tool (ASCE, 2018).

4.3 Surficial Ground Rupture

A trace of an east-west trending thrust fault zone (Southern Whidbey Island fault zone) projects through Port Townsend, with the nearest known active fault trace (an unnamed fault, class B) located approximately 1.9 miles southeast of the Site (Johnson et al., 2000). Due to the suspected long recurrence interval and the distance between the Site and the mapped fault trace, the potential for surficial ground rupture at the Site is considered low.

4.4 Liquefaction

Liquefaction occurs when loose, saturated, and relatively cohesionless soil deposits temporarily lose strength from seismic shaking. The primary factors controlling the onset of liquefaction include intensity and duration of strong ground motion, characteristics of subsurface soil, *in situ* stress conditions, and the depth to groundwater.

The Washington Department of Natural Resources (DNR) maps the Site as having very low liquefaction susceptibility (Palmer et al., 2004). Given the relative density, grain-size distribution, and geologic origin of the soils at the Site, liquefaction is not a hazard for this Site and Project.

4.5 Erosion Hazard

Erosion risk increases on sloped areas, whether natural or excavated during construction. Based on our observation of the Site and subsurface conditions, it is our opinion that the erosion hazard at the Site is relatively low and can be addressed through standard temporary erosion and sedimentation control (TESC) best management practices (BMPs) during construction. TESC measures should be used in accordance with the local BMPs. Specific TESC measures may include appropriately placed silt fencing, straw wattles, rock check dams, and plastic covering of exposed slope cuts and soil stockpiles. Outside of the proposed construction areas, the existing vegetation should be retained.

Permanent erosion control within the areas of construction should be achieved through pavement surfacing or the reestablishment of vegetation.

Areas on/near the Site slopes exposed to construction activities should be aggressively revegetated. Depending on the weather patterns, slope inclination, and degree of disturbance, the placement of an erosion-control blanket to provide temporary ground cover while vegetation takes root, or the use of live-staking, may be required to ensure successful establishment of new vegetation.

5 Conclusions and Recommendations

The native Vashon lodgment till underlying the Site will provide good bearing support for planned structures, retaining walls, and pavements. Structures may be supported using conventional spread footings, and site development may be completed via standard equipment and methods.

The lodgment till is infeasible for large-scale stormwater infiltration due its high relative density and high fines content. Stormwater generated from new impervious surfaces will need to be collected and conveyed off the Site.

The following sections present details of our geotechnical engineering recommendations for the Project.

5.1 Foundation Considerations

Spread footings and/or slab-on-grade are planned to be used for planned residence support. Bearing surfaces for the footings should be prepared as described in the Site Preparation Section 6.2.

5.1.1 Shallow Foundations

Shallow conventional isolated or continuous spread footings may be used to support the planned residence, provided they are founded on native, undisturbed lodgment till. Based on the anticipated foundation-bearing soils and our understanding of the planned construction, we recommend a maximum allowable bearing pressure of 3,000 pounds per square foot (psf) for spread and strip footings bearing on competent lodgment till. The recommended maximum allowable bearing pressure may be increased by one-third (i.e., to 4,000 psf) for short-term transient conditions, such as wind and seismic loading.

All exterior footings should be founded at least 18 inches below the lowest adjacent finished grade for frost protection; interior footings may be founded a minimum of 12 inches below grade.

Assuming construction is accomplished as recommended above, we estimate total settlement of spread foundations of less than 1 inch and differential settlement between two adjacent load-bearing components supported on competent soils of less than 0.5 inches. We anticipate that the majority of the estimated settlement will occur during construction, effective immediately after loads are applied.

Wind, earthquakes, and unbalanced earth loads will subject the planned residence to lateral forces. Lateral forces on a structure will be resisted by a combination of sliding resistance of its base or footing on the underlying soil and passive earth pressure against the buried portions of the structures.

An allowable coefficient of friction of 0.4 may be assumed along the interface between the base of the footing and subgrade soils. An allowable passive earth pressure of 300 pounds per cubic foot (pcf) may be assumed for soils adjacent to footings or other below-grade elements. The upper 1 foot of passive resistance should be neglected in design.

The above-recommended allowable coefficient of friction and passive pressure values include factors of safety of 1.5.

5.2 Slab-On-Grade Support

Slab-on-grade subgrade preparation should be completed in the same manner as shallow foundations described above in Section 5.1 (for foundations) except for interior slabs-on-grade beneath enclosed heated/air-conditioned interior spaces (such as those covered with flooring and carpet).

For interior slabs-on-grade, we recommend the uppermost 6 inches of the subgrade consist of compacted capillary break material (in lieu of 6 inches of Crushed Surfacing Base Course [CSBC]) to provide uniform support and moisture control. The capillary break material should consist of free-draining, clean, fine gravel and coarse sand with a maximum particle size of about 1 inch and less than 3 percent material passing the U.S. No. 200 sieve by weight (fines). Angular material manufactured by crushing is preferred over rounded material, such as bank run sand and gravel, to provide a subgrade surface that is not easily disturbed by workers laying steel rebar and concrete formwork. The capillary break material should be compacted to relatively firm and unyielding condition and evaluated by Aspect prior to placement of steel rebar and formwork.

For building areas where vapor intrusion mitigation would be detrimental to the interior finished space (such as air-conditioned office areas that may be covered with flooring), consideration should be given to placement of a vapor barrier over the capillary break. Detailed design and performance issues with respect to vapor intrusion and moisture control as it relates to the interior environment of the structure are beyond the expertise of Aspect. A building envelope specialist or contractor should be consulted to address these issues, as needed.

5.3 Retaining Walls

Based on our project understanding, retaining walls up to 8 feet in height may be used to accommodate exterior grade changes, and will be used in residences with daylight basements.

Yielding walls, such as cantilever retaining walls, should be designed using a lateral earth pressure based on an equivalent fluid having a unit weight of 35 pcf. Nonyielding or restrained walls should be designed for an equivalent fluid weight of 55 pcf. These values assume level backslope conditions, and adequate drainage. If inclined backslopes exist, we recommend adding 1 pound per cubic foot for each degree of inclination. For example, if the backslope is inclined at 2H:1V (Horizontal:Vertical; or 26 degrees) and the subject wall is a nonyielding basement wall, then the design earth pressure that should be utilized is 81 (55 plus 26) pcf.

Adequate drainage should consist of a subsurface drain combined with a free-draining wall backfill material that meets the gradation requirements described in Section 9-03.12(2) of the Standard Specifications for Gravel Backfill for Walls (WSDOT, 2021). Refer to the following section, Drainage Considerations, for detailed subsurface drain recommendations.

Earthquake shaking will subject walls to a temporary additional earth pressure. We estimated the lateral seismic soil pressure increment using the Mononobe-Okabe method, with consideration of the possible backfill soil properties and MCE. For retaining walls that support inhabited structures, such as daylight basement walls, we recommend an average seismic soil pressure increment of $8H$ (where H is the height of the wall) represented by a uniform rectangular pressure along the height of the wall. For exterior site walls that are less than 10 feet tall, the incremental seismic earth pressure need not be considered.

Lateral forces that may be induced on the wall due to other surcharge loads should be considered by the Structural Engineer.

Wind, earthquakes, and unbalanced earth loads will subject the proposed structures to lateral forces. Lateral forces will be resisted by passive and frictional resistance of below-grade portions of foundation elements. Please refer to Section 5.1.1 of this report for allowable design parameters for friction and passive earth pressure.

5.4 Temporary and Permanent Slopes

Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the Contractor. All temporary cuts in excess of four feet in height that are not protected by trench boxes, or otherwise shored, should be sloped in accordance with Part N of Washington Administrative Code (WAC) 296-155 (WAC, 2009), as shown in Table 3 below.

Table 3. Temporary Excavation Cut Slope

Soil Unit	OSHA Soil Classification	Maximum Temporary Slope	Maximum Height (ft)
Vashon Lodgment Till	A	0.75H:1V	20

The estimated maximum cut slope inclinations are provided for planning purposes only and are applicable to excavations without groundwater seepage, or runoff, and assume dewatered conditions. Flatter slopes will likely be necessary in areas where groundwater seepage exists, or where construction equipment surcharges are placed in close proximity to the crest of the excavation.

With time and the presence of seepage and/or precipitation, the stability of temporary unsupported cut slopes can be significantly reduced. Therefore, all temporary slopes should be protected from erosion by installing a surface water diversion ditch or berm at the top of the slope. In addition, the Contractor should monitor the stability of the temporary cut slopes, and adjust the construction schedule and slope inclination accordingly. Vibrations created by traffic and construction equipment may cause caving and raveling of the temporary slopes. In such an event, lateral support for the temporary slopes should be provided by the Contractor to prevent loss of ground support.

Ideally, permanent slopes for the Project should be no steeper than 2H:1V. Please contact us if permanent cut or fill slopes steeper than 2H:1V are proposed in certain locations.

Lateral forces that may be induced on the wall due to other surcharge loads should be considered by the Structural Engineer.

5.5 Drainage Considerations

The outside edge of all perimeter footings and embedded walls should be provided with a drainage system consisting of a 4-inch-diameter, perforated, rigid pipe embedded in free-draining gravel meeting the requirements of Section 9-03.12(4) of the Standard Specifications for Gravel Backfill for Drains (WSDOT, 2021). The footing and wall drains should be a minimum of 1 foot thick, and a layer of low permeability soils should be used over the upper foot of the drain section to reduce potential for surface water to enter the drain curtain. Prefabricated drain mats combined with relatively free-draining backfill may be used as an alternative to washed-rock footings and wall drains.

Final grades around the planned residences should be sloped such that surface water drains away from the structures. Downspouts and roof drains should not be connected to the foundation drains to reduce the potential for flooding foundation drains and clogging. The footing drains should include cleanouts to allow for periodic maintenance and inspection.

5.5.1 Stormwater Infiltration

The Project's current layout includes four stormwater ponds. Test pits advanced in and nearby to the areas of the planned ponds encountered very dense, lodgment till within 6 feet of the ground surface. Seasonal high groundwater was not encountered; however, a perched groundwater condition could develop at the contact with the lodgment till.

Stormwater infiltration facilities are designed to collect stormwater runoff and convey it into underlying soils where it can infiltrate and disperse. This requires moderate to higher permeability soils, absence of shallow groundwater, absence of shallow perching stratum, and an absence of nearby facilities that may be sensitive to increases in groundwater level, or discharge of groundwater to surface sources.

Lodgment till is glacially consolidated and has a high fines content (20 to 36 percent silt and clay). Infiltrated stormwater would generally perch, or mound, on this low permeability soil and migrate laterally and downgradient. The presence of relatively impermeable lodgment till combined with potential for shallow perched groundwater during the wet, winter months indicates that large-scale stormwater infiltration is infeasible at the Site. It should be assumed that infiltration rates would be less than 0.3 inches per hour for the lodgment till.

6 Earthwork and Construction Recommendations

Based on the explorations performed and our understanding of the Project, it is our opinion that the Contractor should be able to complete planned excavations and earthwork with standard construction equipment. However, the presence of potential obstructions, such as small boulders or other large debris, in any of the materials encountered should be anticipated.

The soils encountered contain a significant percentage of fines (particles passing the U.S. Standard No. 200 sieve), making them moisture sensitive and subject to disturbance when wet. We recommend planning the earthwork portions of the Project during the drier summer months. From a geotechnical standpoint, the lodgment till may be suitable for reuse as structural fill on the Project provided the materials are screened to ensure they are relatively free of organics and other deleterious debris and can be moisture conditioned for compaction.

6.1 Wet Weather Earthwork

The soils encountered during explorations at the Site contain a high percentage of fines (silty and clay, soil particles passing the No. 200 sieve) and are typically moisture sensitive and will be difficult to handle, prepare, or compact with construction equipment during periods of wet weather. Earthwork is typically most economical when performed under dry weather conditions. If earthwork is to be performed or fill is to be placed in wet weather or under wet conditions when soil moisture content is difficult to control, we provide the following recommendations:

- Earthwork should be performed in small areas to minimize exposure to wet weather. Excavation or the removal of unsuitable soils should be followed promptly by the placement and compaction of clean structural fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance.
- If bearing surfaces are open during the winter season or periods of wet weather, it may be helpful to provide a layer of crushed rock or gravel to help preserve the subgrade. If gravel is used to protect the bearing surfaces, it should meet the gradation requirements for Class A Gravel Backfill for Foundations, as described in Section 9-03.12(1)A of the Standard Specifications (WSDOT, 2021).
- The ground surface within the construction area should be sealed by a smooth drum vibratory roller (or equivalent) and under no circumstances should be left uncompacted and exposed to moisture. Soils which become too wet for compaction should be removed and replaced with clean granular materials.
- Local BMPs for erosion protection should be strictly followed.

6.2 Site Preparation

Site preparation within the proposed construction footprint should include removal of topsoil and fill containing roots, organics, debris, and any other deleterious materials. The

suitable bearing soils should consist of undisturbed, medium dense or better lodgment till. The Contractor must use care during Site preparation and excavation operations so that any bearing surfaces are not disturbed. If disturbance does occur, the disturbed material should be removed to expose undisturbed material or be compacted in place to acceptable criteria as determined by Aspect. Overexcavated soils in footing subgrade areas should be replaced with compacted CSBC specified in Section 9-03.9(3) of the Standard Specifications (WSDOT, 2021) and placed as structural fill.

All bearing surfaces should be trimmed neat, and the bottom of the excavation should be carefully prepared. All loose or softened soil should be removed or compacted in place prior to placing reinforcing steel bars, concrete, structural fill, or capillary break materials. We recommend that all bearing surfaces be observed by Aspect prior to placing steel and concrete to verify the recommendations in this report have been followed.

If bearing surfaces are open during the winter season or periods of wet weather, it may be helpful to provide a layer of crushed rock or gravel to help preserve the subgrade. If gravel is used to protect the bearing surfaces, it should meet the gradation requirements for Class A Gravel Backfill for Foundations, as described in Section 9-03.12(1)A of the Standard Specifications (WSDOT, 2021).

6.3 Structural Fill

Structural fill is anticipated to be required for the minor grade adjustments, foundation support, pavement support, and for utility trench backfill. the lodgment till may be suitable for reuse as structural fill on the Project provided the materials are screened to ensure they are relatively free of organics and other deleterious debris and can be moisture conditioned for compaction. For these applications, we provide the following recommendations:

- Excavation and placement of fill should be observed by Aspect to verify that all unsuitable materials are removed, and suitable compaction is achieved.
- Imported structural fill should consist of relatively freely draining, uniformly graded sand and gravel. We recommend Gravel Borrow, as specified in Section 9-03.14(1) of the Standard Specifications (WSDOT, 2021), be specified for imported structural fill.
- CSBC as specified in Section 9-03.9(3) of the Standard Specifications (WSDOT, 2021) should be underneath new pavement.
- Structural fill should be at or within 3 percent of optimum moisture content at the time of placement and should be compacted to at least 95 percent of the maximum dry density (MDD; ASTM D1557; ASTM, 2018).
- Overcompaction of the backfill behind retaining walls should be avoided. In this regard, we recommend compacting the backfill to about 90 percent of the MDD (as determined by test method ASTM D1557). Heavy compactors and large pieces of construction equipment should not operate within 5 feet of any embedded wall to avoid the buildup of excessive lateral pressures. Compaction

close to the walls should be accomplished using hand-operated vibratory plate compactors.

- The moisture content of the structural fill should be controlled to within 3 percent of the optimum moisture. Optimum moisture is the moisture content corresponding to the MDD (as determined by test method ASTM D 1557).
- Nonstructural fill areas (e.g., general grading, landscape, or common areas not beneath or around structures, utilities, slabs-on-grade, or below paved areas) that can accommodate some settlement may be placed and compacted to a relatively firm and unyielding condition.

6.3.1 Compaction Considerations

The procedure to achieve the specified minimum relative compaction depends on the size and type of compacting equipment, the number of passes, thickness of the layer being compacted, and certain soil properties. Structural fill should be placed and compacted in lifts with a loose thickness no greater than 12 inches when using relatively large compaction equipment, such as a vibrating plate attached to an excavator (hoe pack) or a large drum roller. If small, hand-operated compaction equipment is used to compact structural fill, lifts should not exceed 6 inches in loose thickness. A sufficient number of in-place density tests should be performed as the fill is placed to verify the required relative compaction is being achieved. The frequency of the in-place density testing can be determined by Aspect at the time of final design, when more details of the Project grading and backfilling plans are available.

Generally, loosely compacted soils are a result of poor construction technique or improper moisture content. Soils with a high percentage of silt or clay are particularly susceptible to becoming too wet, and coarse-grained materials easily become too dry, for proper compaction. Silty or clayey soils with a moisture content too high for adequate compaction should be dried, as necessary, or moisture conditioned by mixing with drier materials or other methods.

6.4 Utility Construction Considerations

6.4.1 Pipe Support and Bedding

The fill encountered in our completed subsurface explorations is generally expected to provide suitable foundation support for the utilities, provided it is free of organics/deleterious debris and is not disturbed during construction, and appropriate provisions for bedding and backfilling are included. Disturbance of trench bottoms can be minimized by excavating with a smooth-bladed bucket wherever possible and limiting foot traffic on the trench bottoms. If very soft, organic-rich, or otherwise unsuitable soils are encountered at the invert level of utilities, we recommend that they be removed and replaced with bedding materials or a geosynthetic fabric may be used to maintain separation between the bedding and poor subgrade soil. The fill could contain oversized particles that if encountered, should be removed from the utility subgrade and replaced with bedding materials.

We recommend that pipe bedding meet the requirements of Section 7-08.3(1)C of the Standard Specifications (WSDOT, 2021). Specific recommendations relative to the bedding of the proposed underground pipelines include:

- Bedding for the proposed pipes should meet the gradation requirements for Gravel Backfill for Pipe Zone Bedding, Section 9-03.12(3) of the Standard Specifications (WSDOT, 2021).
- Prior to installation of the pipe, the bedding material should be shaped to fit the lower portion of the pipe exterior with reasonable closeness to provide continuous support along the pipe.
- Backfill around the pipe should be placed in layers and tamped around the pipe to obtain complete contact. Pipe zone bedding material should extend at least 6 inches above the crown of the pipe, for the full width of the trench. In areas where a trench box is used, the bedding material should be placed before the trench box is advanced.
- Where a trench box is used and restraint of the installed pipe appears to be in question, we recommend that pipe restraint in the form of a cable and winch system be used inside the pipe so that the joints of previously laid pipe are not pulled apart as the trench box is advanced.

6.4.2 Trench Backfill and Compaction Criteria

For general structural fill and compaction considerations, refer to Section 6.3 of this report. The following criteria for trench backfill and compaction is provided.

Trench backfill should follow the requirements of Section 7-08.3(3) of the Standard Specifications (WSDOT, 2021). During placement of the initial lifts, the trench backfill material should not be bulldozed into the trench or dropped directly on the pipe. Furthermore, heavy vibratory equipment should not be permitted to operate over the pipe until at least 2 feet of backfill has been placed. The trench backfill should be placed in 8- to 12-inch, loose lifts and compacted using mechanical equipment. Trench backfill more than 3 feet below the finish grades should be compacted to at least 90 percent of the MDD (ASTM D1557). Within the proposed building pads or extents of the access roadways, the upper 3 feet of the backfill should be compacted to at least 95 percent of the MDD to provide an adequate subgrade for the future buildings and pavement sections.

7 Recommendations for Continuing Geotechnical Services

Throughout this report, we have provided recommendations where we consider it would be appropriate for Aspect to provide additional geotechnical input to the design and construction process. Additional recommendations are summarized in this section.

7.1 Additional Design and Consultation Services

Before construction begins, we recommend that Aspect:

- Continue to meet with the design team, as needed, to address geotechnical questions that may arise throughout the remainder of the design process.
- Review the geotechnical elements of the Project plans and specifications to see that the geotechnical engineering recommendations are properly interpreted.

7.2 Additional Construction Services

We are available to provide geotechnical engineering and monitoring services during construction. The integrity of the geotechnical elements depends on proper Site preparation and construction procedures. In addition, engineering decisions may have to be made in the field if variations in subsurface conditions become apparent.

During the construction phase of the Project, Aspect should perform the following tasks:

- Review applicable submittals
- Observe and evaluate subgrade and structural fill placement for all footings, slabs-on-grade, and retaining walls
- Evaluate pavement subgrade prior to placement of base coarse
- Attend meetings, as needed
- Address other geotechnical engineering considerations that may arise during construction

The purpose of our observations is to verify compliance with design concepts and recommendations, and to allow design changes or evaluation of appropriate construction methods should subsurface conditions differ from those anticipated prior to the start of construction.

References

- American Society of Civil Engineers (ASCE), 2018, ASCE 7 Hazard Tool, <https://asce7hazardtool.online/>, accessed July 28, 2021.
- Atwater, B.F., S. Musumi-Rokkaku, D. Satake, Y. Tsuji, K. Ueda, and D.K. Yamaguchi (Atwater et al.), 2015, The orphan tsunami of 1700—Japanese clues to a parent earthquake in North America, U.S. Geological Survey, Professional Paper 1707.
- International Code Council (ICC), 2018, International Building Code (IBC), Prepared by International Code Council, January 2018.
- Johnson, S. Y.; D.C. Mosher, S.V. Dadisman, J.R. Childs, and S.B. Rhea (Johnson et al.), 2000, Tertiary and Quaternary structures of the eastern Juan de Fuca Strait--Interpreted map. IN Mosher, D.C., Johnson, S.Y. editors, and others, Neotectonics of the eastern Juan de Fuca Strait--A digital geological and geophysical atlas: Geological Survey of Canada Open File Report 3931.
- Palmer, S.P., S.L. Magsino, E.L. Bilderback, J.L. Poelstra, D.S. Folger, and R.A. Niggemann (Palmer et al.), 2004, Liquefaction Susceptibility Map of Kitsap County, Washington: Washington State Department of Natural Resources, Washington Division of Geology and Earth Resources Open-File Report 2004-20.
- Pratt, T.L., K.G. Troost, J.K. Odum, and W.J. Stephenson (Pratt et al.), 2015, Kinematics of shallow backthrusts in the Seattle fault zone, Washington State, *Geosphere*, v. 11, no. 6, p. 1–27, doi:10.1130/GES01179.1.
- Schasse, H.W. and S.L. Slaughter (Schasse and Slaughter), 2005, Geologic Map of the Port Townsend South and Port of the Port Townsend North 7.5-minute Quadrangles, Jefferson County, Washington, Washington State Department of Natural Resources, Division of Geology and Earth Resources, Geologic Map GM-57, Scale 1:24,000, June 2005.
- Washington State Department of Transportation (WSDOT), 2021, Standard Specifications for Road, Bridge and Municipal Construction, Document M 41-10.
- Washington State Legislature, 2009, Washington Administrative Code (WAC), April 1, 2009.

Limitations

Work for this project was performed for Montebanc Management, LLC (Client), and this report was prepared consistent with recognized standards of professionals in the same locality and involving similar conditions, at the time the work was performed. No other warranty, expressed or implied, is made by Aspect Consulting, LLC (Aspect).

Recommendations presented herein are based on our interpretation of site conditions, geotechnical engineering calculations, and judgment in accordance with our mutually agreed-upon scope of work. Our recommendations are unique and specific to the project, site, and Client. Application of this report for any purpose other than the project should be done only after consultation with Aspect.

Variations may exist between the soil and groundwater conditions reported and those actually underlying the site. The nature and extent of such soil variations may change over time and may not be evident before construction begins. If any soil conditions are encountered at the site that are different from those described in this report, Aspect should be notified immediately to review the applicability of our recommendations.

Risks are inherent with any site involving slopes and no recommendations, geologic analysis, or engineering design can assure slope stability. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the Client.

It is the Client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, and agents, are made aware of this report in its entirety. At the time of this report, design plans and construction methods have not been finalized, and the recommendations presented herein are based on preliminary project information. If project developments result in changes from the preliminary project information, Aspect should be contacted to determine if our recommendations contained in this report should be revised and/or expanded upon.

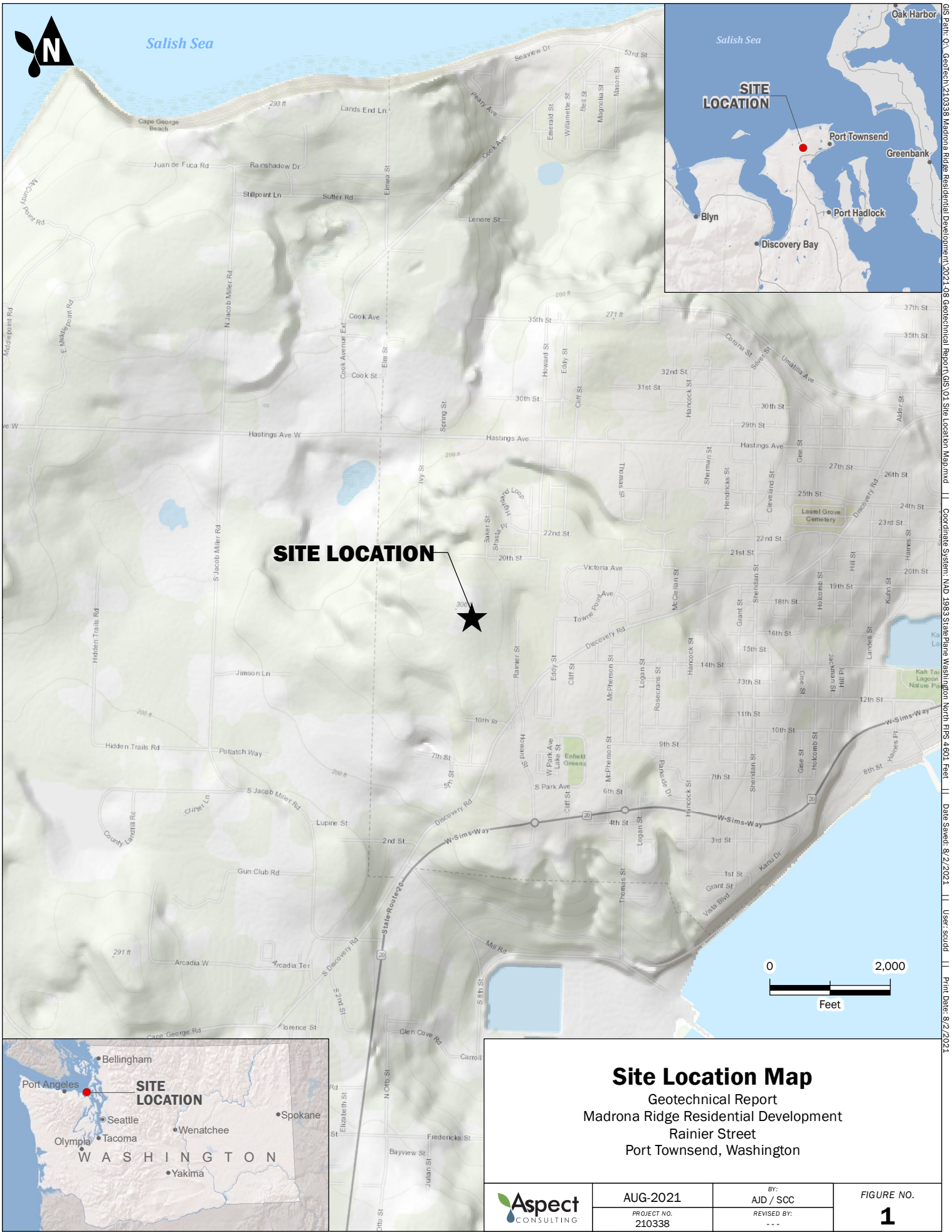
The scope of work does not include services related to construction safety precautions. Site safety is typically the responsibility of the contractor, and our recommendations are not intended to direct the contractor's site safety methods, techniques, sequences, or procedures. The scope of our work also does not include the assessment of environmental characteristics, particularly those involving potentially hazardous substances in soil or groundwater.

All reports prepared by Aspect for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect. Aspect's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

Please refer to Appendix C titled "Report Limitations and Guidelines for Use" for additional information governing the use of this report.

We appreciate the opportunity to perform these services. If you have any questions, please call Alison Dennison, project manager, at 206-780-7717.

FIGURES

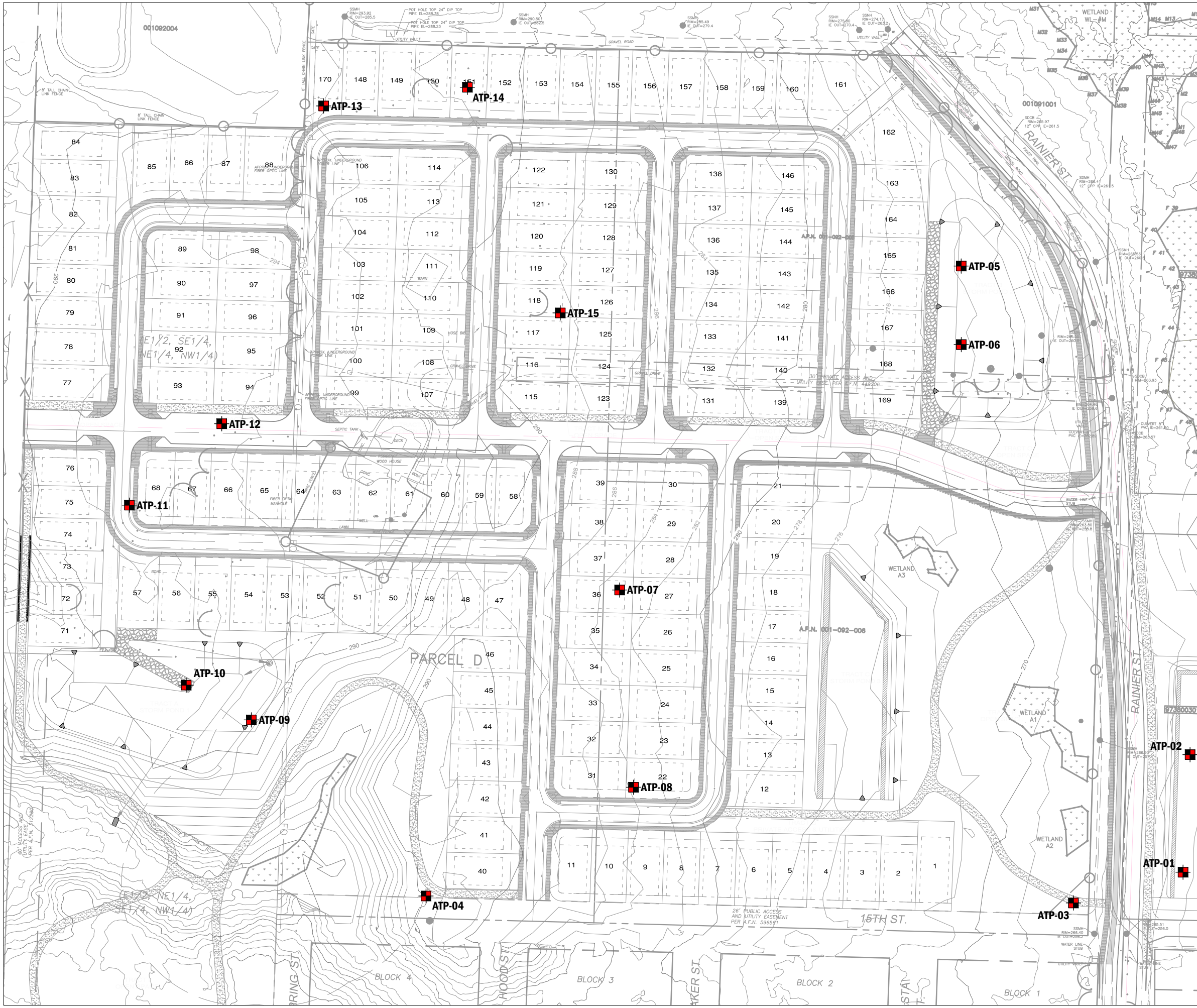


GIS Path: Q:\Geotechn\210338 Madrona Ridge Residential Development\2021-08 Geotechnical Report\GIS\01 Site Location Map.mxd | Coordinate System: NAD 1983 StatePlane Washington North FIPS 4803 Feet | Date Saved: 8/2/2021 | User: srudd | Print Date: 8/2/2021

			FIGURE NO. 1

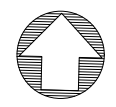
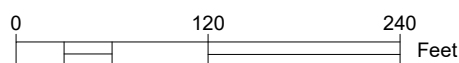
Site Location Map
 Geotechnical Report
 Madrona Ridge Residential Development
 Rainier Street
 Port Townsend, Washington

Basemap Layer Credits || Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
 Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community




Legend

- Test Pit Location
- Elevation Contour (2 Foot Interval)

Source: Base CAD files from "Madrona Ridge Pre-Plat P.U.D., Preliminary Lot Layout", ESM Consulting Engineers, LLC, Federal Way, Washington, 7/29/21.

Site Exploration Plan
 Geotechnical Report
 Madrona Ridge Residential Development
 Rainier Street
 Port Townsend, Washington

	Aug-2021	BY: AJD/SCC	FIGURE NO.
	PROJECT NO. 210338	REVISED BY: -	2

APPENDIX A

Test Pit Logs

A. Field Exploration Program

A.1. Test Pits

Aspect observed the excavation of 15 test pits (ATP-01 through ATP-15) on July 8, 2021, across the Site. Test pits were advanced using a mini-tracked excavator, John Deere 50G, operated by Seton Construction, Inc., under direction of Aspect. The locations of the test pits are shown on Figure 2. Copies of the test pit logs are included in this appendix.

Samples were obtained from select soil units to aid in the determination of engineering properties of the subsurface materials. The relative density/consistency of the materials was evaluated qualitatively by observation of digging difficulty and in the shallow depths using a 0.5-inch-diameter, pointed steel T-probe at various depth intervals. The test pits were backfilled with the excavated materials and compacted with the excavator bucket.

Detailed descriptions of the subsurface conditions encountered in our explorations, as well as the depths where characteristics of the soils changed, are indicated on the test pit logs. The depths indicated on the log where conditions changed may represent gradational variations between soil types. Soils were classified in general accordance with the ASTM D2488, *Standard Practice for Description and Identification of Soils (Visual and Manual Procedure)*. A key to the symbols and terms used on the logs is provided on the first page of Appendix A.

Coarse-Grained Soils - More than 50% ¹ Retained on No. 200 Sieve	Gravels - More than 50% ¹ of Coarse Fraction Retained on No. 4 Sieve	≤ 5% Fines	GW	Well-graded GRAVEL Well-graded GRAVEL WITH SAND
			GP	Poorly-graded GRAVEL Poorly-graded GRAVEL WITH SAND
			GM	SILTY GRAVEL SILTY GRAVEL WITH SAND
	Sands - 50% ¹ or More of Coarse Fraction Passes No. 4 Sieve	≥ 15% Fines	GC	CLAYEY GRAVEL CLAYEY GRAVEL WITH SAND
			SW	Well-graded SAND Well-graded SAND WITH GRAVEL
			SP	Poorly-graded SAND Poorly-graded SAND WITH GRAVEL
Fine-Grained Soils - 50% ¹ or More Passes No. 200 Sieve	Sands - 50% ¹ or More of Coarse Fraction Passes No. 4 Sieve	≤ 5% Fines	SM	SILTY SAND SILTY SAND WITH GRAVEL
			SC	CLAYEY SAND CLAYEY SAND WITH GRAVEL
			Sils and Clays Liquid Limit Less than 50%	ML
	CL	LEAN CLAY SANDY or GRAVELLY LEAN CLAY LEAN CLAY WITH SAND LEAN CLAY WITH GRAVEL		
	OL	ORGANIC SILT SANDY or GRAVELLY ORGANIC SILT ORGANIC SILT WITH SAND ORGANIC SILT WITH GRAVEL		
	Sils and Clays Liquid Limit 50% or More	MH	ELASTIC SILT SANDY or GRAVELLY ELASTIC SILT ELASTIC SILT WITH SAND ELASTIC SILT WITH GRAVEL	
CH		FAT CLAY SANDY or GRAVELLY FAT CLAY FAT CLAY WITH SAND FAT CLAY WITH GRAVEL		
OH		ORGANIC CLAY SANDY or GRAVELLY ORGANIC CLAY ORGANIC CLAY WITH SAND ORGANIC CLAY WITH GRAVEL		
Highly Organic Soils			PT	PEAT and other mostly organic soils

"WITH SILT" or "WITH CLAY" means 5 to 15% silt and clay, denoted by a "-" in the group name; e.g., SP-SM • "SILTY" or "CLAYEY" means >15% silt and clay • "WITH SAND" or "WITH GRAVEL" means 15 to 30% sand and gravel. • "SANDY" or "GRAVELLY" means >30% sand and gravel. • "Well-graded" means approximately equal amounts of fine to coarse grain sizes • "Poorly graded" means unequal amounts of grain sizes • Group names separated by "/" means soil contains layers of the two soil types; e.g., SM/ML.

Soils were described and identified in the field in general accordance with the methods described in ASTM D2488. Where indicated in the log, soils were classified using ASTM D2487 or other laboratory tests as appropriate. Refer to the report accompanying these exploration logs for details.

1. Estimated or measured percentage by dry weight
2. (SPT) Standard Penetration Test (ASTM D1586)
3. Determined by SPT, DCPT (ASTM STP399) or other field methods. See report text for details.

MC	=	Natural Moisture Content	GEOTECHNICAL LAB TESTS
PS	=	Particle Size Distribution	
FC	=	Fines Content (% < 0.075 mm)	
GH	=	Hydrometer Test	
AL	=	Atterberg Limits	
C	=	Consolidation Test	
Str	=	Strength Test	
OC	=	Organic Content (% Loss by Ignition)	
Comp	=	Proctor Test	
K	=	Hydraulic Conductivity Test	
SG	=	Specific Gravity Test	

Organic Chemicals			CHEMICAL LAB TESTS
BTEX	=	Benzene, Toluene, Ethylbenzene, Xylenes	
TPH-Dx	=	Diesel and Oil-Range Petroleum Hydrocarbons	
TPH-G	=	Gasoline-Range Petroleum Hydrocarbons	
VOCs	=	Volatile Organic Compounds	
SVOCs	=	Semi-Volatile Organic Compounds	
PAHs	=	Polycyclic Aromatic Hydrocarbon Compounds	
PCBs	=	Polychlorinated Biphenyls	
Metals			
RCRA8	=	As, Ba, Cd, Cr, Pb, Hg, Se, Ag, (d = dissolved, t = total)	
MTCA5	=	As, Cd, Cr, Hg, Pb (d = dissolved, t = total)	
PP-13	=	Ag, As, Be, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Se, Tl, Zn (d=dissolved, t=total)	

PID	=	Photoionization Detector	FIELD TESTS
Sheen	=	Oil Sheen Test	
SPT ²	=	Standard Penetration Test	
NSPT	=	Non-Standard Penetration Test	
DCPT	=	Dynamic Cone Penetration Test	

Descriptive Term	Size Range and Sieve Number	COMPONENT DEFINITIONS
Boulders	= Larger than 12 inches	
Cobbles	= 3 inches to 12 inches	
Coarse Gravel	= 3 inches to 3/4 inches	
Fine Gravel	= 3/4 inches to No. 4 (4.75 mm)	
Coarse Sand	= No. 4 (4.75 mm) to No. 10 (2.00 mm)	
Medium Sand	= No. 10 (2.00 mm) to No. 40 (0.425 mm)	
Fine Sand	= No. 40 (0.425 mm) to No. 200 (0.075 mm)	
Silt and Clay	= Smaller than No. 200 (0.075 mm)	

% by Weight	Modifier	% by Weight	Modifier	ESTIMATED¹ PERCENTAGE
<1	=	Subtrace	15 to 25 = Little	
1 to <5	=	Trace	30 to 45 = Some	
5 to 10	=	Few	>50 = Mostly	

Dry	=	Absence of moisture, dusty, dry to the touch	MOISTURE CONTENT
Slightly Moist	=	Perceptible moisture	
Moist	=	Damp but no visible water	
Very Moist	=	Water visible but not free draining	
Wet	=	Visible free water, usually from below water table	

Non-Cohesive or Coarse-Grained Soils			RELATIVE DENSITY
Density³	SPT² Blows/Foot	Penetration with 1/2" Diameter Rod	
Very Loose	= 0 to 4	≥ 2'	
Loose	= 5 to 10	1' to 2'	
Medium Dense	= 11 to 30	3" to 1'	
Dense	= 31 to 50	1" to 3"	
Very Dense	= > 50	< 1"	

Cohesive or Fine-Grained Soils			CONSISTENCY
Consistency³	SPT² Blows/Foot	Manual Test	
Very Soft	= 0 to 1	Penetrated >1" easily by thumb. Extrudes between thumb & fingers.	
Soft	= 2 to 4	Penetrated 1/4" to 1" easily by thumb. Easily molded.	
Medium Stiff	= 5 to 8	Penetrated >1/4" with effort by thumb. Molded with strong pressure.	
Stiff	= 9 to 15	Indented ~1/4" with effort by thumb.	
Very Stiff	= 16 to 30	Indented easily by thumbnail.	
Hard	= > 30	Indented with difficulty by thumbnail.	

GEOLOGIC CONTACTS		
Observed and Distinct	Observed and Gradual	Inferred

	Exploration Log Key
---	----------------------------



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1103, -122.8061

ATP-01

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

268'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/8/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	267	Backfilled with excavated material.										TOPSOIL SILTY SAND (SM); loose, dry, brown; fine sand; some roots, decomposed organic matter, and woody debris.	1
2	266		S1							T-probe <= 1"		VASHON TILL SILTY SAND WITH GRAVEL (SM); medium dense, slightly moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; rounded 3- to 5-inch diameter cobbles; few roots.	2
3	265	Difficulty digging.											3
4	264		S2							T-probe <= 1"		Becomes very dense, light gray; trace rounded 3-inch diameter cobbles; massive structure with socketing; few faceted gravel.	4
5	263												5
6	262		S3							PS, MC FC=31.5%			6
7	261												7
8	260												8
9	259	Machine limited end of excavation.	S4							PS, MC FC=32.2%			9
10	258											Bottom of exploration at 9.5 ft. bgs. Note: No sidewall caving observed.	10
11	257												11
12	256												12
13	255												13
14	254												14

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-01

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\210338 MADRONA RIDGE.GPJ August 5, 2021



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1107, -122.8061

ATP-02

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

268'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/8/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	267	Backfilled with excavated material.	S1							T-probe = 3-4"	<p>TOPSOIL</p> <p>SILTY SAND WITH GRAVEL (SM); loose, dry, brown; fine sand; fine to coarse, rounded gravel; trace 3- to 5-inch diameter, rounded to subrounded cobbles; some roots, decomposed organic matter, and woody debris.</p>	1	
2	266	Difficulty digging. Benched down to 2 feet bgs.	S2							T-probe =< 1" PS, MC FC=20.2%	<p>VASHON TILL</p> <p>SILTY SAND WITH GRAVEL (SM); medium dense to dense, slightly moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; rounded 3- to 5-inch diameter cobbles; few roots.</p>	2	
3	265											3	
4	264		S3							T-probe =< 1"		4	
5	263									T-probe =< 1"	<p>Becomes very dense, light gray; trace rounded 3-inch diameter cobbles; massive structure with socketing; few faceted gravel.</p>	5	
6	262											6	
7	261	Difficulty digging.	S4									7	
8	260											8	
9	259											9	
10	258											10	
11	257											11	
12	256										Bottom of exploration at 11.5 ft. bgs.	12	
13	255										Note: No sidewall caving observed.	13	
14	254											14	

Legend

Grab sample

Plastic Limit — Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-02

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\210338 MADRONA RIDGE.GPJ August 5, 2021



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1102, -122.8067

ATP-03

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

272'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/8/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)	
				0	10	20	30	40						50
1	271	Backfilled with excavated material. Difficulty digging.									T-probe = 1"-2"	<p>FILL</p> <p>SILTY SAND (SM); loose to medium dense, dry, brown; fine sand; fine to coarse, rounded to angular gravel; few branches, decomposed organics, and woody debris; trace plastic coated wire and rusted fencing pieces.</p> <p>VASHON TILL</p> <p>SILTY SAND WITH GRAVEL (SM); dense, slightly moist to moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; few roots.</p> <p>Becomes very dense, moist, light gray; trace rounded 3- to 5-inch diameter cobbles; massive structure with socketing; few faceted gravel.</p>	1	
2	270										T-probe =< 1"		2	
3	269													3
4	268												T-probe =< 1"	4
5	267													5
6	266													6
7	265			S2									PS, MC	7
8	264													8
9	263													9
10	262													10
11	261													11
12	260											12		
13	259											13		
14	258											14		

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-03

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\210338 MADRONA RIDGE.GPJ August 5, 2021



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1102, -122.8100

ATP-04

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Grab

Ground Surface Elev. (NAVD88)

293'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/8/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	292	Backfilled with excavated material.	S1									<p>TOPSOIL</p> <p>SILTY SAND (SM); loose, dry, brown; fine sand; some roots, decomposed organic matter, and woody debris.</p>	1
2	291											<p>VASHON TILL</p> <p>SILTY SAND (SM); dense, slightly moist, mottled orange, brown, and gray; fine to coarse sand; few fine to coarse, rounded to subrounded gravel; few roots.</p>	2
3	290	Difficulty digging.	S2									<p>SILTY SAND (SM); very dense, slightly moist, light gray; fine to coarse sand; few fine to coarse, rounded to subrounded gravel; massive structure with socketing; volcanic and granitic gravel; few faceted gravel.</p>	3
4	289												4
5	288												5
6	287												6
7	286										7		
8	285										Bottom of exploration at 7.5 ft. bgs.	8	
9	284										Note: No sidewall caving observed. Practical refusal on dense soils.	9	
10	283											10	
11	282											11	
12	281											12	
13	280											13	
14	279											14	

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-04

Sheet 1 of 1



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1124, -122.8074

ATP-05

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

277'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/8/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)	
				0	10	20	30	40						50
1	276	Backfilled with excavated material.	S1							T-probe = 3-4"	TOPSOIL SILTY SAND (SM); medium dense, dry, brown; fine sand; some roots, decomposed organic matter, charcoal, and woody debris.	1		
2	275									T-probe =< 1"		VASHON TILL SILTY SAND (SM); dense, slightly moist, mottled orange, brown, and gray; fine to coarse sand; few fine to coarse, rounded to subrounded gravel; few roots.	2	
3	274												3	
4	273				S2							T-probe =< 1" PS, MC FC=33.8%		4
5	272												SILTY SAND WITH GRAVEL (SM); very dense, slightly moist, light gray; fine to coarse sand; fine to coarse, rounded to angular gravel; trace rounded 3- to 5-inch diameter cobbles; massive structure with socketing; few faceted gravel.	5
6	271													6
7	270				S3									7
8	269										Bottom of exploration at 7.5 ft. bgs.	8		
9	268										Note: No sidewall caving observed. Practical refusal on dense soils.	9		
10	267											10		
11	266											11		
12	265											12		
13	264											13		
14	263											14		

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-05

Sheet 1 of 1



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1121, -122.8073

ATP-06

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

277'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/8/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)	
				0	10	20	30	40						50
1	276	Backfilled with excavated material.									T-probe =< 1"	<p>TOPSOIL</p> <p>SILTY SAND (SM); loose to medium dense, dry, brown; fine sand; some roots, decomposed organic matter, and woody debris.</p>	1	
2	275									<p>VASHON TILL</p> <p>SILTY SAND WITH GRAVEL (SM); medium dense to dense, moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; rounded 3-inch to 4-inch diameter cobbles; few roots.</p>		2		
3	274												3	
4	273			S1								T-probe =< 1" PS, MC FC=33.8%	<p>Becomes very dense, light gray; trace rounded 3-inch diameter cobbles; massive structure with socketing; few faceted gravel.</p>	4
5	272													5
6	271			S2									<p>Bottom of exploration at 6 ft. bgs.</p>	6
7	270										<p>Note: No sidewall caving observed. Practical refusal on dense soils.</p>	7		
8	269											8		
9	268											9		
10	267											10		
11	266											11		
12	265											12		
13	264											13		
14	263											14		

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-06

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\210338 MADRONA RIDGE.GPJ August 5, 2021



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1113, -122.8091

ATP-07

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

293'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/8/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	292	Backfilled with excavated material.	S1							T-probe = 0.5-4"	TOPSOIL SILTY SAND (SM); loose, dry, brown; fine sand; some roots, decomposed organic matter, and woody debris.	1	
2	291											T-probe = < 1"	VASHON TILL SILTY SAND (SM); medium dense to very dense, slightly moist, mottled orange, brown, and gray; fine to coarse sand; few fine to coarse, rounded to subrounded gravel; few roots; trace oxidized iron bearing minerals.
3	290								T-probe = < 1"	SILTY SAND WITH GRAVEL (SM); very dense, slightly moist, light gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; trace rounded 3-inch diameter cobbles; massive structure with socketing; few faceted gravel.	3		
4	289										T-probe = < 1"	SILTY SAND WITH GRAVEL (SM); very dense, slightly moist, light gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; trace rounded 3-inch diameter cobbles; massive structure with socketing; few faceted gravel.	4
5	288			S2									T-probe = < 1"
6	287										T-probe = < 1"	SILTY SAND WITH GRAVEL (SM); very dense, slightly moist, light gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; trace rounded 3-inch diameter cobbles; massive structure with socketing; few faceted gravel.	
7	286									T-probe = < 1"			Bottom of exploration at 6 ft. bgs. Note: No sidewall caving observed. Practical refusal on dense soils.
8	285										T-probe = < 1"	Bottom of exploration at 6 ft. bgs. Note: No sidewall caving observed. Practical refusal on dense soils.	
9	284									T-probe = < 1"			Bottom of exploration at 6 ft. bgs. Note: No sidewall caving observed. Practical refusal on dense soils.
10	283										T-probe = < 1"	Bottom of exploration at 6 ft. bgs. Note: No sidewall caving observed. Practical refusal on dense soils.	
11	282									T-probe = < 1"			Bottom of exploration at 6 ft. bgs. Note: No sidewall caving observed. Practical refusal on dense soils.
12	281										T-probe = < 1"	Bottom of exploration at 6 ft. bgs. Note: No sidewall caving observed. Practical refusal on dense soils.	
13	280									T-probe = < 1"			Bottom of exploration at 6 ft. bgs. Note: No sidewall caving observed. Practical refusal on dense soils.
14	279										T-probe = < 1"	Bottom of exploration at 6 ft. bgs. Note: No sidewall caving observed. Practical refusal on dense soils.	

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-07

Sheet 1 of 1



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1106, -122.8090

ATP-08

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

289'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/8/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	288	Backfilled with excavated material.								T-probe = 1"		TOPSOIL SILTY SAND (SM); dense, slightly moist, brown; fine sand; some roots, decomposed organic matter, and woody debris.	1
2	287											VASHON TILL SILTY SAND WITH GRAVEL (SM); dense to very dense, moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; few roots.	2
3	286		S1							T-probe = 0.5-2"			3
4	285	Difficulty digging.								T-probe = < 1"		Becomes very dense, moist, light gray; massive structure with socketing; few faceted gravel.	4
5	284	Difficulty digging.											5
6	283											Bottom of exploration at 6 ft. bgs.	6
7	282											Note: No sidewall caving observed. Practical refusal on dense soils.	7
8	281												8
9	280												9
10	279												10
11	278												11
12	277												12
13	276												13
14	275												14

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-08

Sheet 1 of 1



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1108, -122.8109

ATP-09

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

294'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/9/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	293	Backfilled with excavated material.	S1							T-probe = 6"		TOPSOIL SILTY SAND (SM); medium dense, slightly moist, brown; fine sand; fine to coarse, rounded gravel; some roots, decomposed organic matter, and woody debris.	1
2	292									T-probe = 1-3"		VASHON TILL SILTY SAND WITH GRAVEL (SM); dense to very dense, moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; trace rounded 3-inch diameter cobble; few roots.	2
3	291	Difficulty digging.											3
4	290	Difficulty digging.								T-probe = < 1"			4
5	289	Difficulty digging.										Becomes very dense, light gray; massive structure with socketing; few faceted gravel.	5
6	288	Difficulty digging.	S2							PS, MC FC=35.5%		Bottom of exploration at 6 ft. bgs.	6
7	287											Note: No sidewall caving observed. Practical refusal on dense soils.	7
8	286												8
9	285												9
10	284												10
11	283												11
12	282												12
13	281												13
14	280												14

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-09

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\210338 MADRONA RIDGE.GPJ August 5, 2021



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1109, -122.8112

ATP-10

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

293'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/9/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	292	Backfilled with excavated material.								T-probe = 6"	TOPSOIL SILTY SAND (SM); medium dense, dry, brown; fine sand; some roots, decomposed organic matter, and woody debris.	1	
2	291	Difficulty digging.	51							T-probe =< 1" PS, MC FC=34.4%		VASHON TILL SILTY SAND WITH GRAVEL (SM); very dense, slightly moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; trace rounded 5-inch diameter cobbles; few roots.	2
3	290												3
4	289	Difficulty digging.								T-probe =< 1"	Becomes light gray; massive structure with socketing; few faceted gravel.	4	
5	288												5
6	287										Bottom of exploration at 6 ft. bgs.	6	
7	286										Note: No sidewall caving observed. Practical refusal on dense soils.	7	
8	285											8	
9	284											9	
10	283											10	
11	282											11	
12	281											12	
13	280											13	
14	279											14	

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-10

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\210338 MADRONA RIDGE.GPJ August 5, 2021



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1115, -122.8116

ATP-11

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

295'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/9/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)								
				0	10	20	30	40						50							
1	294	Backfilled with excavated material.							T-probe = 3-4"		TOPSOIL SILTY SAND (SM); medium dense, dry, brown; fine sand; some roots, decomposed organic matter, and woody debris.	1									
2	293										VASHON TILL SILTY SAND WITH GRAVEL (SM); dense to very dense, slightly moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; rounded 3-inch to 8-inch diameter cobbles; few 12-inch to 14-inch boulders; few roots.	2									
3	292										S1									3	
4	291																			Becomes very dense, moist, light gray; massive structure with socketing; few faceted gravel.	4
5	290										S2										5
6	289																				6
7	288																				7
8	287																				8
9	286																				9
10	285										Difficulty digging.									3-inch pocket of gray fine to medium sand	10
11	284											11									
12	283											12									
13	282											Bottom of exploration at 12 ft. bgs. Note: No sidewall caving observed.	13								
14	281											14									

Legend

Grab sample

Plastic Limit — Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-11

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\210338 MADRONA RIDGE.GPJ August 5, 2021



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1118, -122.8111

ATP-12

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

302'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/9/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	301	Backfilled with excavated material. Difficulty digging.									T-probe = 1-4"	<p>FILL</p> <p>SILTY SAND (SM); medium dense, slightly moist, brown; fine to coarse sand; fine to coarse, rounded to subrounded gravel; little to some tree branches, logs, roots, decomposed grass, wire fence pieces, plastic twine.</p> <p>OLDER TOPSOIL</p> <p>SILTY SAND (SM); loose, slightly moist, light brown; fine sand; some roots, decomposed organic matter, and woody debris.</p> <p>VASHON TILL</p> <p>SILTY SAND WITH GRAVEL (SM); very dense, slightly moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; few roots.</p> <p>Becomes light gray; trace rounded 3- to 5-inch diameter cobbles; massive structure with socketing; few faceted gravel.</p>	1
2	300										T-probe = 1"		2
3	299										T-probe = < 1"		3
4	298												4
5	297										T-probe = < 1"		5
6	296												6
7	295										7		
8	294										8		
9	293										9		
10	292										10		
11	291										11		
12	290										12		
13	289										13		
14	288										14		



5'

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-12

Sheet 1 of 1



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1129, -122.8106

ATP-13

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

304'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/9/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	303	Backfilled with excavated material.								T-probe = 3"	TOPSOIL SILTY SAND (SM); medium dense, slightly moist, light brown; fine sand; some roots, decomposed organic matter, and woody debris.	1	
2	302	Difficulty digging.	S1							T-probe = < 1"		VASHON TILL SILTY SAND WITH GRAVEL (SM); very dense, slightly moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; few roots.	2
3	301											3	
4	300									T-probe = < 1"	Becomes, light gray; trace rounded 3-inch diameter cobbles; massive structure with socketing; few faceted gravel.	4	
5	299											5	
6	298		S2									6	
7	297										Bottom of exploration at 6 ft. bgs.	7	
8	296										Note: No sidewall caving observed. Practical refusal on dense soils.	8	
9	295											9	
10	294											10	
11	293											11	
12	292											12	
13	291											13	
14	290											14	

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-13

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\210338 MADRONA RIDGE.GPJ August 5, 2021



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1130, -122.8099

ATP-14

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Ground Surface Elev. (NAVD88)

Grab

306'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/9/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	305	Backfilled with excavated material.	S1							T-probe = 1"-1.5"	<p>FILL</p> <p>SILTY SAND WITH GRAVEL AND COBBLES (SM); loose to medium dense, dry, light brown; fine to coarse sand; fine to coarse, rounded gravel; 3-inch diameter rounded cobbles; little roots, woody debris, and aluminum bottle cap.</p> <p>BURIED TOPSOIL</p> <p>SILTY SAND WITH GRAVEL (SM); loose, dry, brown; fine to coarse sand; fine, rounded to subrounded gravel; some roots, decomposed organic matter, and woody debris.</p> <p>VASHON TILL</p> <p>SILTY SAND WITH GRAVEL (SM); dense to very dense, slightly moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; little to some rounded 5-inch diameter cobbles; few roots.</p> <p>Becomes very dense, light gray; massive structure with socketing; few faceted gravel.</p>	1	
2	304									T-probe = 0.5-1"		2	
3	303											3	
4	302									T-probe = < 1"		4	
5	301											5	
6	300			Difficulty digging.	S2								
7	299										7		
8	298										8		
9	297										9		
10	296										10		
11	295										11		
12	294										12		
13	293										13		
14	292								14				
Bottom of exploration at 7.5 ft. bgs.													
Note: No sidewall caving observed. Practical refusal on dense soils.													

Legend

Grab sample

Plastic Limit — Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-14

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\210338 MADRONA RIDGE.GPJ August 5, 2021



Madrona Ridge Development - 210338

Geotechnical Exploration Log

Project Address & Site Specific Location

Coordinates (Lat, Lon WGS84)

Exploration Number

1601 Rainier Street, Port Townsend, Washington, See Figure 2

48.1122, -122.8094

ATP-15

Contractor
Seton Construction, Inc.

Equipment
John Deere 50G Mini Excavator

Sampling Method

Grab

Ground Surface Elev. (NAVD88)

302'

Operator

Exploration Method(s)

Work Start/Completion Dates

Top of Casing Elev. (NAVD88)

Depth to Water (Below GS)

Kyle

Excavator

7/9/2021

NA

No Water Encountered

Depth (feet)	Elev. (feet)	Exploration Notes and Completion Details	Sample Type/ID	Blows/foot					Blows/6'	Tests	Material Type	Description	Depth (ft)
				0	10	20	30	40					
1	301	Backfilled with excavated material.	S1							T-probe = 3-4"	<p>TOPSOIL</p> <p>SILTY SAND WITH GRAVEL (SM); medium dense, slightly moist, dark brown; fine to medium sand; fine to coarse, rounded to subangular gravel; rounded 3- to 5-inch diameter cobbles; some roots, decomposed organic matter, and woody debris.</p> <p>VASHON TILL</p> <p>SILTY SAND WITH GRAVEL (SM); medium dense to very dense, moist, mottled orange, brown, and gray; fine to coarse sand; fine to coarse, rounded to subrounded gravel; rounded 3-inch to 4-inch diameter cobbles; one 12-inch diameter boulder; few roots.</p>	1	
2	300									T-probe = 0.5-3"		2	
3	299											3	
4	298									T-probe = < 1"		4	
5	297											5	
6	296				S2								Bottom of exploration at 6 ft. bgs.
7	295									Note: No sidewall caving observed. Practical refusal on dense soils.	7		
8	294										8		
9	293										9		
10	292										10		
11	291										11		
12	290										12		
13	289										13		
14	288										14		

Legend

Grab sample

Plastic Limit | Liquid Limit

No Water Encountered

Water Level

See Exploration Log Key for explanation of symbols

Logged by: CAL
Approved by: AJD 8/3/2021

Exploration Log ATP-15

Sheet 1 of 1

NEW STANDARD EXPLORATION LOG TEMPLATE P:\GINT\PROJECTS\210338 MADRONA RIDGE.GPJ August 5, 2021

APPENDIX B

Laboratory Testing Results

B. Geotechnical Laboratory Testing

Geotechnical laboratory tests were conducted on selected soil samples collected during the field exploration program. The tests performed, and the procedures followed are outlined below. The laboratory tests were conducted by Phoenix Soil Research in general accordance with appropriate ASTM International (ASTM) test methods.

B.1. Particle-Size Analyses, PS

A particle-size analysis was performed on six selected soil samples in general accordance with ASTM D6913. This test method allows for the laboratory determination of the percent of the size fractions (by weight) of coarse-grained soil and the percent of fines in a soil sample. The result of the test is presented in this appendix as curves depicting the percent finer by weight versus grain size.

B.2. Moisture Content Determination, MC

All six of the selected soil samples previously mentioned plus one additional sample were submitted for analysis of water content by the ASTM D2216 test method. This test method allows for the laboratory determination of the moisture (water) content of a soil sample by measuring and recording the mass of a sample before and then after drying. Test results are illustrated graphically on the boring logs in Appendix A and tabulated in this appendix.



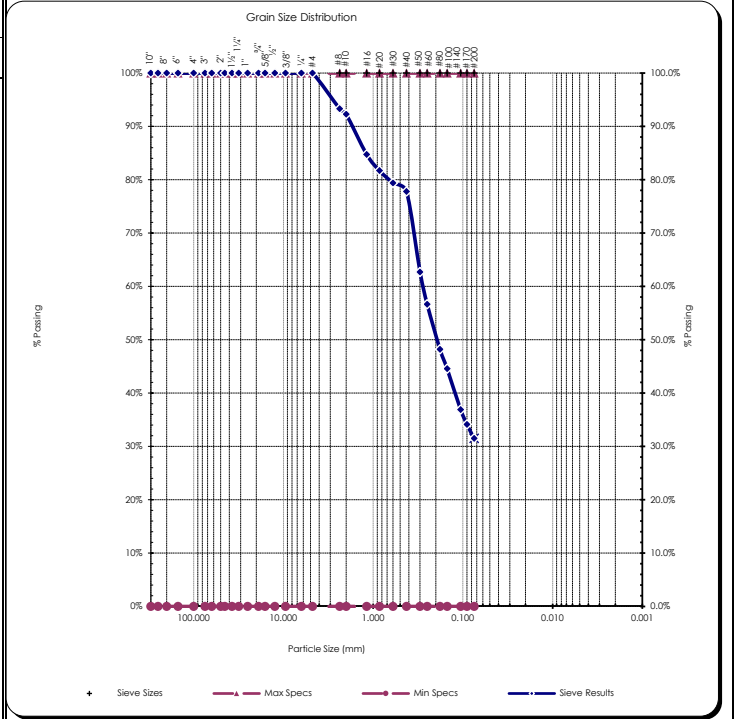
Sieve Report

Project: Q.C. - Madrona Ridge Project #: 21B077-17 Client: Aspect Consulting Source: ATP-01, S-3 @ 6.0 ft Sample#: B21-1074	Date Received: 15-Jul-21 Sampled By: Client Date Tested: 16-Jul-21 Tested By: C. Kriss	Unified Soil Classification System, ASTM-2487 SM, Silty Sand Sample Color: grayish-brown	ACCREDITED Certificate #: 1366.01
--	---	---	--------------------------------------

ASTM D2216, ASTM D2419, ASTM D4318, ASTM D5281			
Specifications No Specs Sample Meets Specs ? N/A	D ₍₅₎ = 0.012 mm D ₍₁₀₎ = 0.024 mm D ₍₁₅₎ = 0.036 mm D ₍₃₀₎ = 0.071 mm D ₍₅₀₎ = 0.195 mm D ₍₆₀₎ = 0.278 mm D ₍₉₀₎ = 1.751 mm Dust Ratio = 32/79	% Gravel = 0.0% % Sand = 68.5% % Silt & Clay = 31.5% Liquid Limit = n/a Plasticity Index = n/a Sand Equivalent = n/a Fracture %, 1 Face = n/a Fracture %, 2+ Faces = n/a	Coeff. of Curvature, C _c = 0.77 Coeff. of Uniformity, C _u = 11.66 Fineness Modulus = 1.35 Plastic Limit = n/a Moisture %, as sampled = 5.8% Req'd Sand Equivalent = Req'd Fracture %, 1 Face = Req'd Fracture %, 2+ Faces =

ASTM C136, ASTM D6913, ASTM C117

Sieve Size		Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
US	Metric				
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	100%	100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75	100%	100%	100.0%	0.0%
#8	2.36		93%	100.0%	0.0%
#10	2.00	92%	92%	100.0%	0.0%
#16	1.18		85%	100.0%	0.0%
#20	0.850		82%	100.0%	0.0%
#30	0.600		79%	100.0%	0.0%
#40	0.425	78%	78%	100.0%	0.0%
#50	0.300		63%	100.0%	0.0%
#60	0.250		57%	100.0%	0.0%
#80	0.180		48%	100.0%	0.0%
#100	0.150	45%	45%	100.0%	0.0%
#140	0.106		37%	100.0%	0.0%
#170	0.090		34%	100.0%	0.0%
#200	0.075	31.5%	31.5%	100.0%	0.0%



Copyright Spears Engineering & Technical Services PS, 1996-98
 All results apply only to actual locations and materials tested. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

Comments: _____

Reviewed by:
 Meghan Blodgett-Carrillo



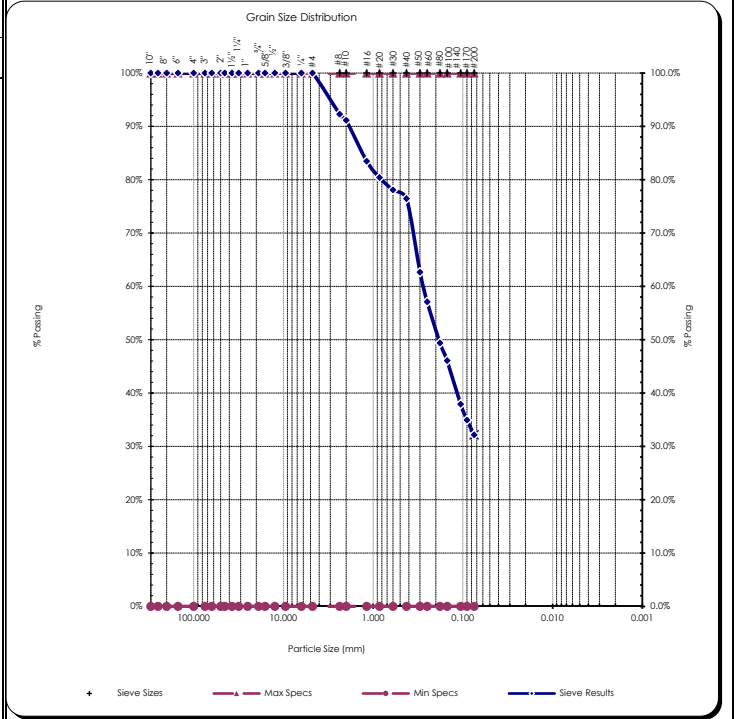
Sieve Report

Project: Q.C. - Madrona Ridge Project #: 21B077-17 Client: Aspect Consulting Source: ATP-01, S-4 @ 9.5 ft Sample#: B21-1075	Date Received: 15-Jul-21 Sampled By: Client Date Tested: 16-Jul-21 Tested By: C. Kriss	Unified Soil Classification System, ASTM-2487 SM, Silty Sand Sample Color: grayish-brown	ACCREDITED Certificate #: 1366.01
--	---	---	--------------------------------------

ASTM D2216, ASTM D2419, ASTM D4318, ASTM D5281			
Specifications No Specs Sample Meets Specs ? N/A	D ₍₅₎ = 0.012 mm D ₍₁₀₎ = 0.023 mm D ₍₁₅₎ = 0.035 mm D ₍₃₀₎ = 0.070 mm D ₍₅₀₎ = 0.185 mm D ₍₆₀₎ = 0.276 mm D ₍₉₀₎ = 1.878 mm Dust Ratio = 8/19	% Gravel = 0.0% % Sand = 67.8% % Silt & Clay = 32.2% Liquid Limit = n/a Plasticity Index = n/a Sand Equivalent = n/a Fracture %, 1 Face = n/a Fracture %, 2+ Faces = n/a	Coeff. of Curvature, C _c = 0.76 Coeff. of Uniformity, C _u = 11.84 Fineness Modulus = 1.37 Plastic Limit = n/a Moisture %, as sampled = 5.3% Req'd Sand Equivalent = Req'd Fracture %, 1 Face = Req'd Fracture %, 2+ Faces =

ASTM C136, ASTM D6913, ASTM C117

Sieve Size		Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
US	Metric				
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	100%	100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75	100%	100%	100.0%	0.0%
#8	2.36		92%	100.0%	0.0%
#10	2.00	91%	91%	100.0%	0.0%
#16	1.18		83%	100.0%	0.0%
#20	0.850		80%	100.0%	0.0%
#30	0.600		78%	100.0%	0.0%
#40	0.425	76%	76%	100.0%	0.0%
#50	0.300		63%	100.0%	0.0%
#60	0.250		57%	100.0%	0.0%
#80	0.180		49%	100.0%	0.0%
#100	0.150	46%	46%	100.0%	0.0%
#140	0.106		38%	100.0%	0.0%
#170	0.090		35%	100.0%	0.0%
#200	0.075	32.2%	32.2%	100.0%	0.0%



Copyright Spears Engineering & Technical Services PS, 1996-98
 All results apply only to actual locations and materials tested. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

Comments: _____

Reviewed by:
 Meghan Blodgett-Carrillo



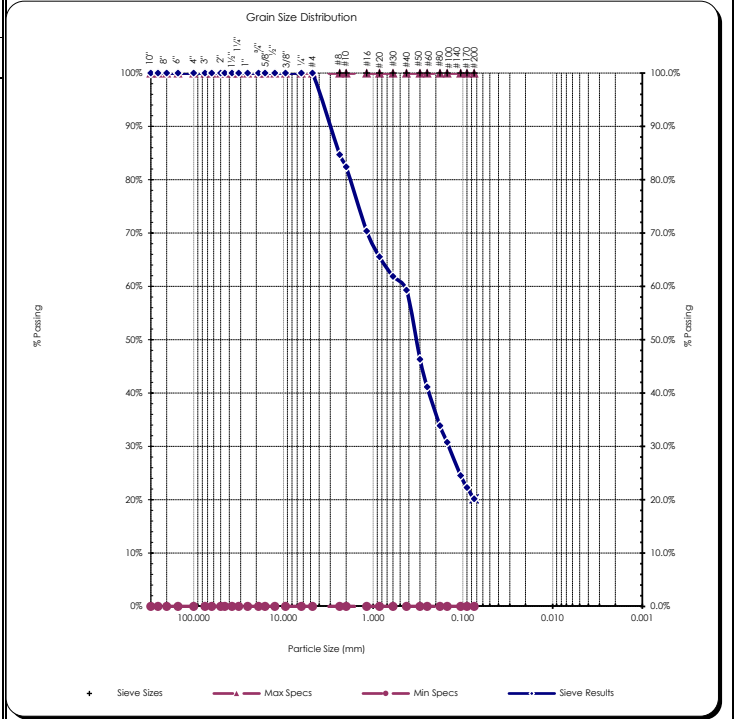
Sieve Report

Project: Q.C. - Madrona Ridge Project #: 21B077-17 Client: Aspect Consulting Source: ATP-02, S-2 @ 2.0 ft Sample#: B21-1076	Date Received: 15-Jul-21 Sampled By: Client Date Tested: 16-Jul-21 Tested By: C. Kriss	Unified Soil Classification System, ASTM-2487 SM, Silty Sand Sample Color: brown	 Certificate #: 1366.01
--	---	---	----------------------------

ASTM D2216, ASTM D2419, ASTM D4318, ASTM D5281			
Specifications No Specs Sample Meets Specs ? N/A	$D_{(5)} = 0.019$ mm $D_{(10)} = 0.037$ mm $D_{(15)} = 0.056$ mm $D_{(30)} = 0.145$ mm $D_{(50)} = 0.335$ mm $D_{(60)} = 0.472$ mm $D_{(90)} = 3.186$ mm Dust Ratio = 16/47	% Gravel = 0.0% % Sand = 79.8% % Silt & Clay = 20.2% Liquid Limit = n/a Plasticity Index = n/a Sand Equivalent = n/a Fracture %, 1 Face = n/a Fracture %, 2+ Faces = n/a	Coeff. of Curvature, $C_c = 1.19$ Coeff. of Uniformity, $C_u = 12.70$ Fineness Modulus = 2.06 Plastic Limit = n/a Moisture %, as sampled = 6.2% Req'd Sand Equivalent = Req'd Fracture %, 1 Face = Req'd Fracture %, 2+ Faces =

ASTM C136, ASTM D6913, ASTM C117

Sieve Size		Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
US	Metric				
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	100%	100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75	100%	100%	100.0%	0.0%
#8	2.36		85%	100.0%	0.0%
#10	2.00	82%	82%	100.0%	0.0%
#16	1.18		70%	100.0%	0.0%
#20	0.850		66%	100.0%	0.0%
#30	0.600		62%	100.0%	0.0%
#40	0.425	59%	59%	100.0%	0.0%
#50	0.300		46%	100.0%	0.0%
#60	0.250		41%	100.0%	0.0%
#80	0.180		34%	100.0%	0.0%
#100	0.150	31%	31%	100.0%	0.0%
#140	0.106		25%	100.0%	0.0%
#170	0.090		22%	100.0%	0.0%
#200	0.075	20.2%	20.2%	100.0%	0.0%




Copyright Spears Engineering & Technical Services PS, 1996-98
 All results apply only to actual locations and materials tested. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

Comments: _____

Reviewed by:
 Meghan Blodgett-Carrillo



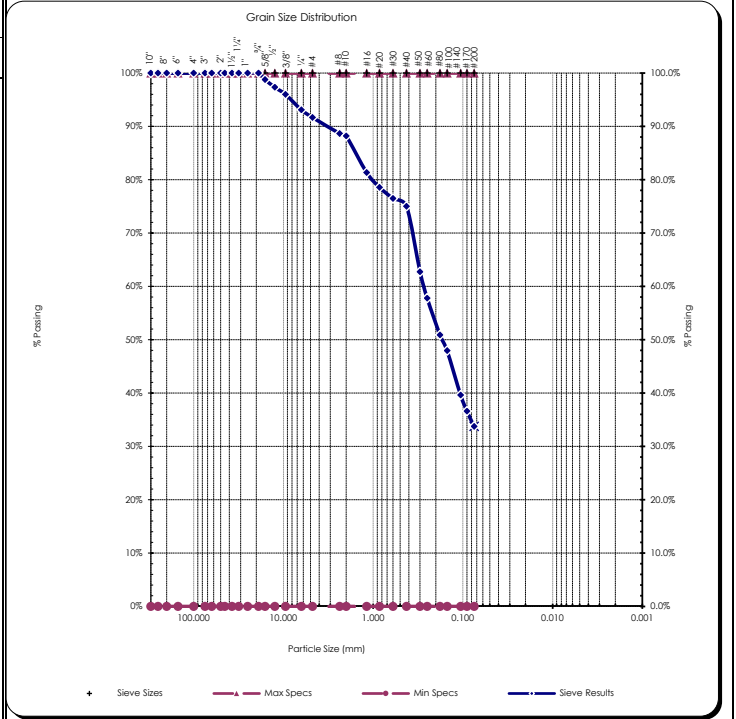
Sieve Report

Project: Q.C. - Madrona Ridge Project #: 21B077-17 Client: Aspect Consulting Source: ATP-05+06, S-2/S-1 @ 4.0 ft Sample#: B21-1078	Date Received: 15-Jul-21 Sampled By: Client Date Tested: 16-Jul-21 Tested By: C. Kriss	Unified Soil Classification System, ASTM-2487 SM, Silty Sand Sample Color: brown	 Certificate #: 1366.01
---	---	---	---

ASTM D2216, ASTM D2419, ASTM D4318, ASTM D5281			
Specifications No Specs Sample Meets Specs ? N/A	D ₍₅₎ = 0.011 mm D ₍₁₀₎ = 0.022 mm D ₍₁₅₎ = 0.033 mm D ₍₃₀₎ = 0.067 mm D ₍₅₀₎ = 0.171 mm D ₍₆₀₎ = 0.272 mm D ₍₉₀₎ = 3.418 mm Dust Ratio = 9/20	% Gravel = 8.3% % Sand = 57.9% % Silt & Clay = 33.8% Liquid Limit = n/a Plasticity Index = n/a Sand Equivalent = n/a Fracture %, 1 Face = n/a Fracture %, 2+ Faces = n/a	Coeff. of Curvature, C _c = 0.73 Coeff. of Uniformity, C _u = 12.26 Fineness Modulus = 1.55 Plastic Limit = n/a Moisture %, as sampled = 10.5% Req'd Sand Equivalent = Req'd Fracture %, 1 Face = Req'd Fracture %, 2+ Faces =


ASTM C136, ASTM D6913, ASTM C117

Sieve Size		Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
US	Metric				
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		99%	100.0%	0.0%
1/2"	12.50	97%	97%	100.0%	0.0%
3/8"	9.50	96%	96%	100.0%	0.0%
1/4"	6.30		93%	100.0%	0.0%
#4	4.75	92%	92%	100.0%	0.0%
#8	2.36		89%	100.0%	0.0%
#10	2.00	88%	88%	100.0%	0.0%
#16	1.18		81%	100.0%	0.0%
#20	0.850		79%	100.0%	0.0%
#30	0.600		76%	100.0%	0.0%
#40	0.425	75%	75%	100.0%	0.0%
#50	0.300		63%	100.0%	0.0%
#60	0.250		58%	100.0%	0.0%
#80	0.180		51%	100.0%	0.0%
#100	0.150	48%	48%	100.0%	0.0%
#140	0.106		40%	100.0%	0.0%
#170	0.090		37%	100.0%	0.0%
#200	0.075	33.8%	33.8%	100.0%	0.0%



Copyright Spears Engineering & Technical Services PS, 1996-98
 All results apply only to actual locations and materials tested. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

Comments: _____

Reviewed by: 
 Meghan Blodgett-Carrillo

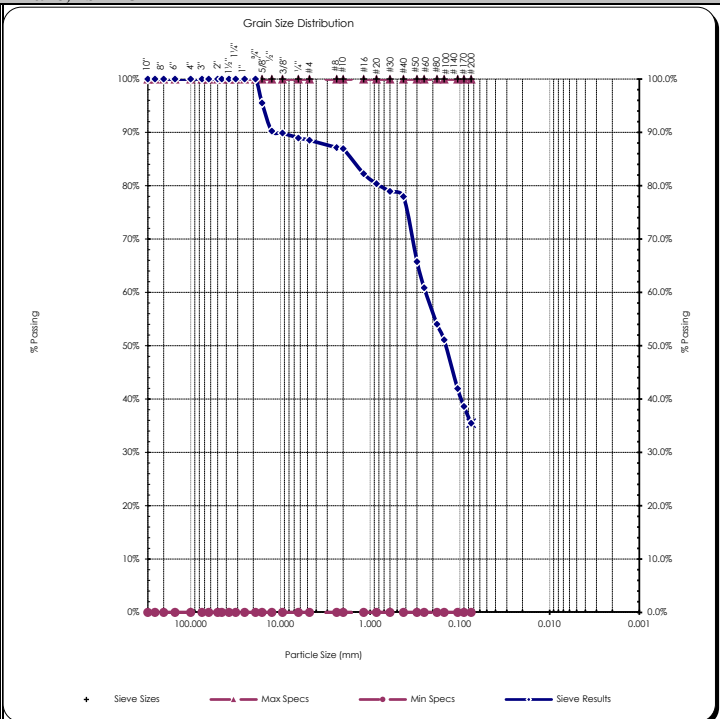


Sieve Report

Project: Q.C. - Madrona Ridge Project #: 21B077-17 Client: Aspect Consulting Source: ATP-09, S-2 @ 6.0 ft Sample#: B21-1079	Date Received: 15-Jul-21 Sampled By: Client Date Tested: 16-Jul-21 Tested By: C. Kriss	Unified Soil Classification System, ASTM-2487 SM, Silty Sand Sample Color: gray	ACCREDITED Certificate #: 1366.01
--	---	--	--------------------------------------

ASTM D2216, ASTM D2419, ASTM D4318, ASTM D5281			
Specifications No Specs Sample Meets Specs ? N/A	D ₍₅₎ = 0.011 mm D ₍₁₀₎ = 0.021 mm D ₍₁₅₎ = 0.032 mm D ₍₃₀₎ = 0.063 mm D ₍₅₀₎ = 0.145 mm D ₍₆₀₎ = 0.241 mm D ₍₉₀₎ = 10.494 mm Dust Ratio = 5/11	% Gravel = 11.5% % Sand = 53.0% % Silt & Clay = 35.5% Liquid Limit = n/a Plasticity Index = n/a Sand Equivalent = n/a Fracture %, 1 Face = n/a Fracture %, 2+ Faces = n/a	Coeff. of Curvature, C _c = 0.79 Coeff. of Uniformity, C _u = 11.40 Fineness Modulus = 1.56 Plastic Limit = n/a Moisture %, as sampled = 5.5% Req'd Sand Equivalent = Req'd Fracture %, 1 Face = Req'd Fracture %, 2+ Faces =

ASTM C136, ASTM D6913, ASTM C117					
Sieve Size		Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
US	Metric				
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		96%	100.0%	0.0%
1/2"	12.50	90%	90%	100.0%	0.0%
3/8"	9.50	90%	90%	100.0%	0.0%
1/4"	6.30		89%	100.0%	0.0%
#4	4.75	89%	89%	100.0%	0.0%
#8	2.36		87%	100.0%	0.0%
#10	2.00	87%	87%	100.0%	0.0%
#16	1.18		82%	100.0%	0.0%
#20	0.850		80%	100.0%	0.0%
#30	0.600		79%	100.0%	0.0%
#40	0.425	78%	78%	100.0%	0.0%
#50	0.300		66%	100.0%	0.0%
#60	0.250		61%	100.0%	0.0%
#80	0.180		54%	100.0%	0.0%
#100	0.150	51%	51%	100.0%	0.0%
#140	0.106		42%	100.0%	0.0%
#170	0.090		39%	100.0%	0.0%
#200	0.075	35.5%	35.5%	100.0%	0.0%



Copyright Spears Engineering & Technical Services PS, 1996-98
 All results apply only to actual locations and materials tested. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

Comments: _____

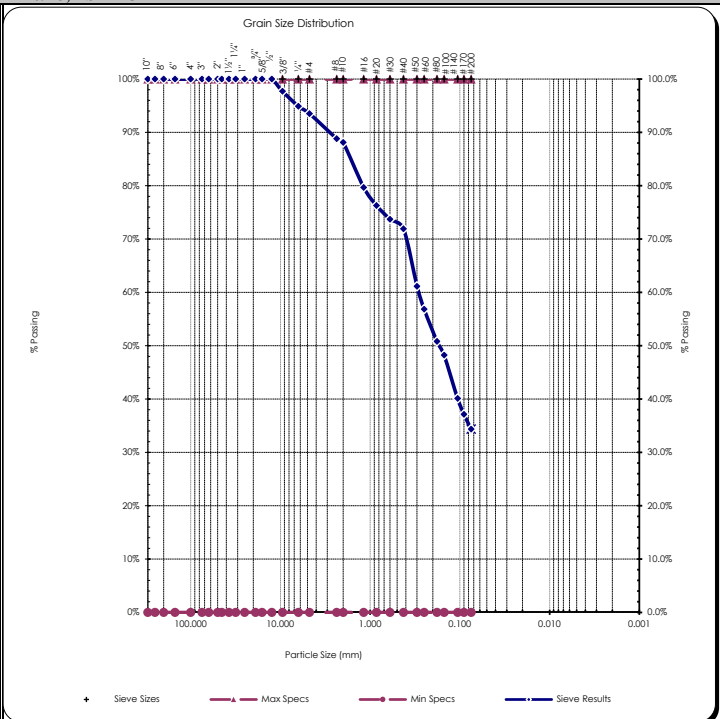
Reviewed by: _____
 Meghan Blodgett-Carrillo

Sieve Report

Project: Q.C. - Madrona Ridge Project #: 21B077-17 Client: Aspect Consulting Source: ATP-10, S-1 @ 2.0 ft Sample#: B21-1080	Date Received: 15-Jul-21 Sampled By: Client Date Tested: 16-Jul-21 Tested By: C. Kriss	Unified Soil Classification System, ASTM-2487 SM, Silty Sand Sample Color: reddish-brown	 ACCREDITED Certificate #: 1366.01
--	---	---	---

ASTM D2216, ASTM D2419, ASTM D4318, ASTM D5281			
Specifications No Specs Sample Meets Specs ? N/A	D ₍₅₎ = 0.011 mm D ₍₁₀₎ = 0.022 mm D ₍₁₅₎ = 0.033 mm D ₍₃₀₎ = 0.065 mm D ₍₅₀₎ = 0.170 mm D ₍₆₀₎ = 0.286 mm D ₍₉₀₎ = 2.951 mm Dust Ratio = 11/23	% Gravel = 6.5% % Sand = 59.1% % Silt & Clay = 34.4% Liquid Limit = n/a Plasticity Index = n/a Sand Equivalent = n/a Fracture %, 1 Face = n/a Fracture %, 2+ Faces = n/a	Coeff. of Curvature, C _c = 0.69 Coeff. of Uniformity, C _u = 13.13 Fineness Modulus = 1.57 Plastic Limit = n/a Moisture %, as sampled = 8.9% Req'd Sand Equivalent = Req'd Fracture %, 1 Face = Req'd Fracture %, 2+ Faces =

ASTM C136, ASTM D6913, ASTM C117					
Sieve Size		Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
US	Metric				
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	98%	98%	100.0%	0.0%
1/4"	6.30		95%	100.0%	0.0%
#4	4.75	94%	94%	100.0%	0.0%
#8	2.36		89%	100.0%	0.0%
#10	2.00	88%	88%	100.0%	0.0%
#16	1.18		80%	100.0%	0.0%
#20	0.850		76%	100.0%	0.0%
#30	0.600		74%	100.0%	0.0%
#40	0.425	72%	72%	100.0%	0.0%
#50	0.300		61%	100.0%	0.0%
#60	0.250		57%	100.0%	0.0%
#80	0.180		51%	100.0%	0.0%
#100	0.150	48%	48%	100.0%	0.0%
#140	0.106		40%	100.0%	0.0%
#170	0.090		37%	100.0%	0.0%
#200	0.075	34.4%	34.4%	100.0%	0.0%



Copyright Spears Engineering & Technical Services PS, 1996-98
 All results apply only to actual locations and materials tested. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

Comments: _____

Reviewed by:
 Meghan Blodgett-Carrillo

APPENDIX C

Report Limitations and Guidelines for Use

REPORT LIMITATIONS AND GUIDELINES FOR USE

Geoscience is Not Exact

The geoscience practices (geotechnical engineering, geology, and environmental science) are far less exact than other engineering and natural science disciplines. It is important to recognize this limitation in evaluating the content of the report. If you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or property, you should contact Aspect Consulting, LLC (Aspect).

This Report and Project-Specific Factors

Aspect's services are designed to meet the specific needs of our clients. Aspect has performed the services in general accordance with our agreement (the Agreement) with the Client (defined under the Limitations section of this project's work product). This report has been prepared for the exclusive use of the Client. This report should not be applied for any purpose or project except the purpose described in the Agreement.

Aspect considered many unique, project-specific factors when establishing the Scope of Work for this project and report. You should not rely on this report if it was:

- Not prepared for you;
- Not prepared for the specific purpose identified in the Agreement;
- Not prepared for the specific subject property assessed; or
- Completed before important changes occurred concerning the subject property, project, or governmental regulatory actions.

If changes are made to the project or subject property after the date of this report, Aspect should be retained to assess the impact of the changes with respect to the conclusions contained in the report.

Reliance Conditions for Third Parties

This report was prepared for the exclusive use of the 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 liability claims by third parties with whom there would otherwise be no contractual limitations. Within the limitations of scope, schedule, and budget, our services have been executed in accordance with our Agreement with the Client and recognized geoscience practices in the same locality and involving similar conditions at the time this report was prepared.

Property Conditions Change Over Time

This 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 events such as a change in property use or occupancy, or by natural events, such as floods,

earthquakes, slope instability, or groundwater fluctuations. If any of the described events may have occurred following the issuance of the report, you should contact Aspect so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Geotechnical, Geologic, and Environmental Reports Are Not Interchangeable

The equipment, techniques, and personnel used to perform a geotechnical or geologic study differ significantly from those used to perform an environmental study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually address 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 the subject property.

We appreciate the opportunity to perform these services. If you have any questions, please contact the Aspect Project Manager for this project.