SHANNON & WILSON
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

August 6, 2019

Mr. Matt Martenson
Berger Partnership
1927 Post Alley, Suite 2
Seattle, WA 98101

RE: PRELIMINARY GEOTECHNICAL ENGINEERING EVALUATION, YELM HIGHWAY COMMUNITY PARK, OLYMPIA, WASHINGTON

Dear Mr. Martenson:

This letter presents the results of our preliminary geotechnical engineering evaluation to aid in the design of structures for the proposed Yelm Highway Community Park (Park) in Olympia, Washington. Our scope of services was performed in accordance with Task 3 of our Subconsultant Agreement with the Berger Partnership, and included the following:

- A review of existing subsurface data.
- A visit to the project site to advance hand probes and record subsurface observations.
- Geotechnical laboratory testing of representative soil samples retrieved during our site visit.
- Analyses of subsurface information gathered during our review, site visit, and laboratory testing to provide the preliminary engineering recommendations in this letter.

SITE AND PROJECT DESCRIPTION

The proposed Park is located to the south of Yelm Highway SE and is bordered to the west and east by residential neighborhoods, as shown in Figure 1, Vicinity Map. Grass fields and a residential neighborhood delineate the southern border of the proposed Park. The site is relatively flat and is partitioned into agricultural and grass fields with small clusters of trees scattered throughout the northeast, south, and middle sections of the property. We understand that the City of Olympia plans to develop the site by constructing playing fields and courts, hiking trails, an off-leash dog park, restroom/storage facilities, light poles, stormwater infiltration facilities, and other structures.

REVIEW OF EXISTING DATA

To improve our understanding of subsurface conditions at the proposed Park site, we reviewed geologic maps prepared by the Washington State Department of Natural Resources (DNR) (Walsh and Logan, 2005[1]) and subsurface exploration data gathered by GeoEngineers (2000[2]).

Site Geology

The proposed Park site is within a region known as the Puget Lowland, a structural depression within about 500 feet of sea level and bordered by the Olympic and Cascade Mountain ranges. The geology of the area has been influenced by repeated cycles of glaciation, which worked to fill the Lowland to significant depths with a complex sequence of glacial and nonglacial deposits. DNR maps indicate that the site is underlain by Vashon recessional outwash, consisting primarily of loose sand and silt deposited during glacial retreat that occurred at the end of the Pleistocene epoch.

Existing Subsurface Information

Previous subsurface explorations performed by GeoEngineers during June 2000 consisted of shallow hand auger borings advanced to about 0.5 to 7 feet below ground surface (bgs). The explorations, conducted to evaluate potential contamination at the Greene Property, were performed in the northeast corner of the proposed Park site. GeoEngineers characterized subsurface conditions as loose to moderately compacted sand and gravel underlain by compacted silty sand with gravel and cobbles.

SUBSURFACE EXPLORATIONS

Geotechnical engineers from Shannon & Wilson visited the proposed Park site on June 28, 2019, to perform reconnaissance and subsurface explorations. We excavated shallow hand borings at the approximate locations indicated in Figure 2, Site and Exploration Plan. The exploration locations, designated probes P-1 to P-6, were chosen based on preliminary Park development plans provided by the Olympia City Council. During excavation, we visually identified soils and documented subsurface conditions. We collected representative soil

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[1] Walsh, Timothy J and Logan, Robert L., 2005, Geologic Map of the East Olympia 7.5-minute Quadrangle, Thurston County, Washington, June.

[2] GeoEngineers, 2000, Phase I/II Environmental Site Assessment, Greene Property, Olympia, Washington, for City of Olympia, Department of Parks, Recreation and Cultural Services, June 28.

samples and returned them to our office for further visual classification and laboratory testing. Following exploration, we backfilled the holes with excavated material. Subsurface conditions encountered in our hand borings were generally consistent throughout the site and are detailed in Table 1.

Table 1: Subsurface Conditions

Probe Designation	Depth Interval (feet bgs)	Soil Description
P-1	0 - 3.5	Medium dense, dark brown, Silty Sand (SM); moist; fine sand; scattered small organics.
P-2	0 - 2.5	Medium dense, dark brown, Poorly Graded Sand (SP); moist; fine sand; trace silt.
P-3	0 - 2.5	Medium dense, dark brown, Poorly Graded Sand with Silt (SP-SM); moist; fine sand; scattered small organics.
P-4	0 - 1.0	Loose, dark brown, Poorly Graded Sand with Silt (SP-SM); moist.
	1.0 - 3.0	Medium dense, dark brown, Poorly Graded Sand with Silt and Gravel (SP-SM); moist; refusal on gravel and cobbles at 3 feet.
P-5	0 - 0.5	Loose, dark brown, Poorly Graded Sand (SP); moist; trace silt.
	0.5 - 1.5	Dense, dark brown, Poorly Graded Sand with Gravel (SP); moist; trace silt.
	1.5 - 6	Medium dense, dark brown, Poorly Graded Sand (SP); moist; trace silt. (probed to 6 feet bgs with T-bar probe)
P-6	0 - 3.0	Medium dense, dark brown, Poorly Graded Sand with Silt (SP-SM); moist; fine sand; scattered small organics.

Based on existing subsurface information, we estimate that the groundwater level at the proposed Park site is below 10 feet bgs; it likely fluctuates depending on the season and magnitude of rainfall.

LABORATORY TESTING

We performed grain size analyses of soils collected at a depth of 2 feet bgs at P-1 and P-2. The tests were performed at our Seattle laboratory in accordance with ASTM Standard C136: Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. The results, shown in Figure 3, indicate that the samples contain between 9 and 22 percent fines. We used these results to estimate preliminary stormwater infiltration rates.

PRELIMINARY ENGINEERING RECOMMENDATIONS

Light Pole Foundations

The light pole foundations will likely bear on drilled concrete piers that will be designed based primarily on lateral loading conditions. Resistance to lateral loading will be derived from passive resistance developed along the length of the drilled concrete piers. We anticipate that design of the drilled concrete piers will be based on the 2015 International Building Code (IBC) (International Code Council, 2014[3]), as incorporated into City of Olympia building code. Based on IBC 2015 Section 1806.2 for design of the lateral resistance and our experience with soils such as those we encountered at the proposed Park site, we recommend the design parameters presented in Table 2 for preliminary design of light pole foundations.

Table 2: Preliminary Recommended Soil Parameters for Light Pole Design

Soil Type	Average Exploration Depth (ft bgs) (Approximate)	Allowable Lateral Bearing Pressures (psf/ft)
Medium dense, Silty Sand and Sand with Silt	3	150

NOTES:
ft = feet; psf = pounds per square foot

Backfill in the annular space around the light pole foundations should be by one of the methods described in IBC 2015 Section 1807.3.3, as summarized below:

- 2,000 pounds per square inch concrete
- Compacted clean sand
- Controlled low-strength material (lean mix concrete)

Stormwater Infiltration Rate

We understand that low-impact designs for onsite stormwater control are under consideration. We estimated preliminary infiltration rates for potential stormwater infiltration facilities based on the sieve test results of our selected soil samples. Our analyses

[3] International Code Council, Inc., 2014, International Building Code 2015: Country Club Hills, Ill., International Code Council, Inc., 700 p.

were performed in accordance with City of Olympia Drainage Design and Erosion Control Manual, Volume III – Hydrologic Analysis and Flow Control BMPs, Section 3.3.6-1. Based on the grain size distribution and fines content observed in both laboratory samples, we estimate a preliminary stormwater infiltration rate ranging from approximately 15 to 35 inches per hour, depending on location.

This rate range should be used as an indicator of the feasibility of stormwater infiltration facilities at a depth of 2 feet at the Park site; design infiltration rates will likely be lower after correction factors are applied. After the locations of infiltration facilities have been determined, we recommend performing small-scale infiltration tests at these locations to further refine design infiltration rates. The tests should be performed in accordance with Olympia Drainage Design and Erosion Control Manual, Volume III – Hydrologic Analysis and Flow Control BMPs, Section 3.3.6-3.

Footing Design

During our subsurface exploration program, we used a 0.5-inch-diameter, steel T-probe to evaluate the in-place density of soils exposed by excavation with the hand auger. Generally, we observed soils between 2 and 3 feet bgs to be in a medium dense condition. Based on these observations, it is our opinion that the restroom/storage foundations could be supported on conventional spread footings bearing in the native sand and silt. Foundations bearing in this material may be designed for an allowable bearing pressure of 2,000 pounds per square foot.

We recommend that the allowable bearing capacities be increased by one-third when used with alternative basic load combinations that include wind or earthquake loads. This recommendation is in accordance with the 2015 IBC, Section 1806. Minimum footing widths should be 24 inches for individual column footings and 18 inches for continuous spread footings. Exterior footings should be at least 1.5 feet below the lowest adjacent grade. All loose or soft soil, existing loose fill, and all soil containing organics should be removed from beneath footings.

Pavements

We understand that a parking area and driveways may be constructed on the proposed Park site. Existing designs provided by the Olympia City Council call for a parking lot with 250+ stalls on the northeast side of the site and an extension of 57th Avenue. In our opinion, light-duty sections of hot-mix asphalt (HMA) over crushed surfacing base course (CSBC)

may be used for these paved areas. We recommend 3.5 inches of HMA over 6 inches of CSBC for preliminary design of pavement sections.

Geologic Hazards

Earthquake-induced geologic hazards that may affect a given project site include land sliding, fault rupture, and the associated effects of liquefaction (such as loss of shear strength, bearing capacity failures, loss of lateral support, ground oscillation, settlement, and lateral spreading). Based on our review of previous subsurface explorations and liquefaction maps provided by the Washington State DNR, it is our opinion that the risk of liquefaction and its effects due to seismic activity is considered low. There is also little risk of a seismically induced landslide due to the relatively flat topography of the proposed Park site. The potential for fault rupture is low, given that there are no mapped faults within the immediate vicinity of the project site. The nearest mapped fault is the northwest-southeast-trending Olympia Structure, located about 2 miles away.

CLOSURE

The analyses, conclusions, and preliminary recommendations contained in this letter are based on site conditions as they presently exist, and further assume that our explorations are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the explorations. If subsurface conditions different from those encountered in the explorations are encountered or appear to be present during construction, we should be advised at once so that we can review these conditions and reconsider our recommendations, where necessary.

This letter was prepared for the exclusive use of the Berger Partnership and other members of the design team. The preliminary recommendations herein should be provided to potential contractors for factual information only, but our letter, conclusions, and interpretations should not be construed as a warranty of subsurface conditions included in this letter. We have prepared the enclosed, "Important Information About Your Geotechnical/Environmental Report," to assist you and others in understanding the use and limitations of our reports.

The scope of our services for this letter did not include any evaluation regarding the presence or absence of wetlands or endangered/threatened species. No assessments or

evaluations regarding the presence or absence of hazardous or toxic substances in the soil or groundwater on or below this site were in our authorized scope of services.

We appreciate this opportunity to be of service to you. Please contact Martin Page at (206) 695-6875 or mwp@shanwil.com if you have any questions or if we can be of further assistance.

Sincerely,

SHANNON & WILSON

Justin P.B. Cook, PE
Geotechnical Engineer

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REGISTERED
PROFESSIONAL ENGINEER

8/6/19

Martin W. Page, PE, LEG
Vice President
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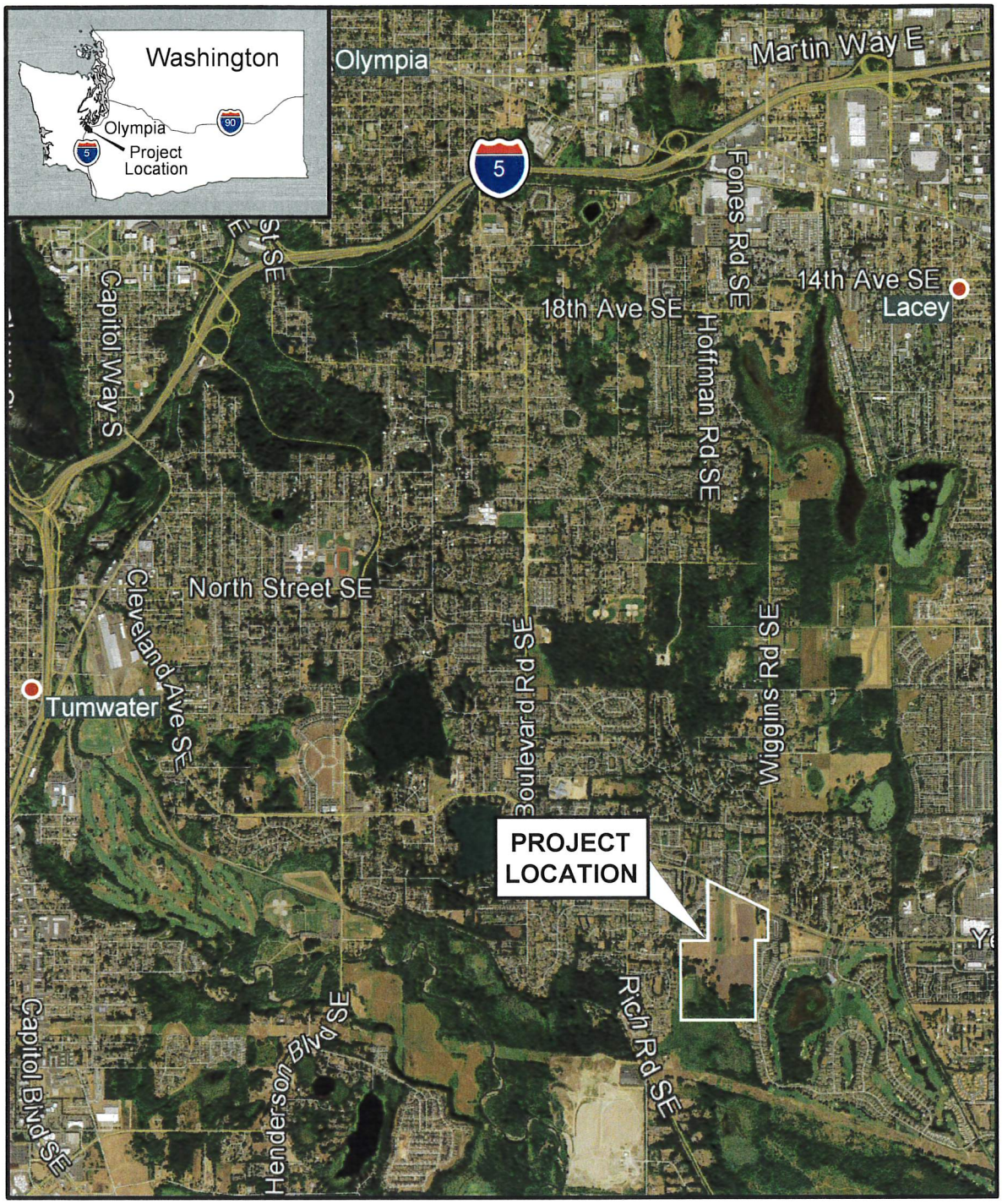
JPC:MWP/jpc

Enc. Figure 1 – Vicinity Map
Figure 2 – Site and Exploration Plan
Figure 3 – Grain Size Distribution Tests
Important Information About Your Geotechnical/Environmental Report



0 3000 6000

Approximate Scale in Feet

NOTE

Map adapted from aerial imagery provided by Google Earth Pro, downloaded 7-3-19.

Yelm Highway Community Park
Olympia, Washington

VICINITY MAP

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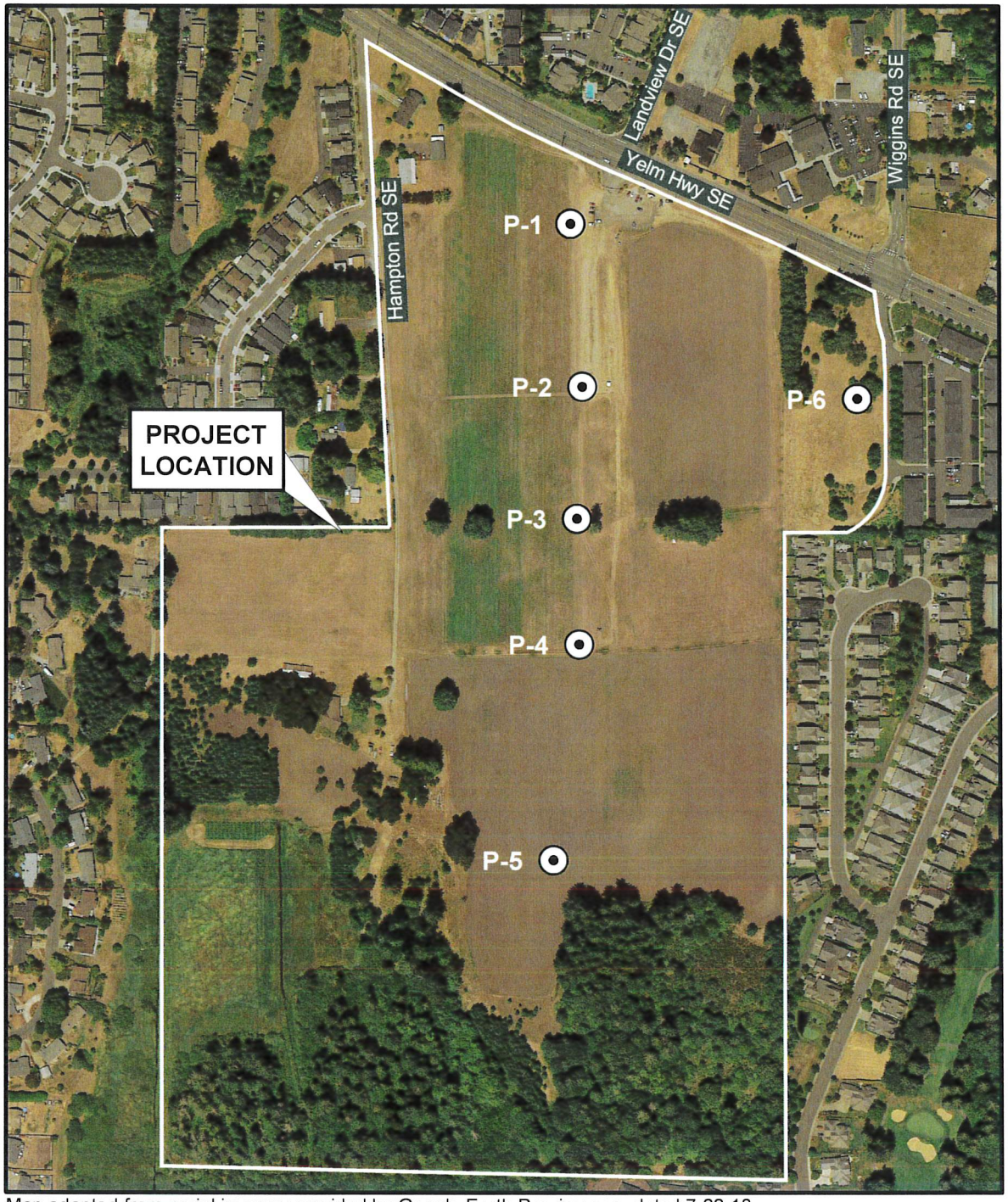
FIG. 1

Filename: J:_SEA\103284\004\103284-004 Fig 1 - Vicinity Map.dwg Date: 07-03-2019 Login: sac



Map adapted from aerial imagery provided by Google Earth Pro, imagery dated 7-22-18.

0 400 800

Approximate Scale in Feet

LEGEND

P-1 ⊙ Probe Designation and Approximate Location

Yelm Highway Community Park
Olympia, Washington

SITE AND EXPLORATION PLAN

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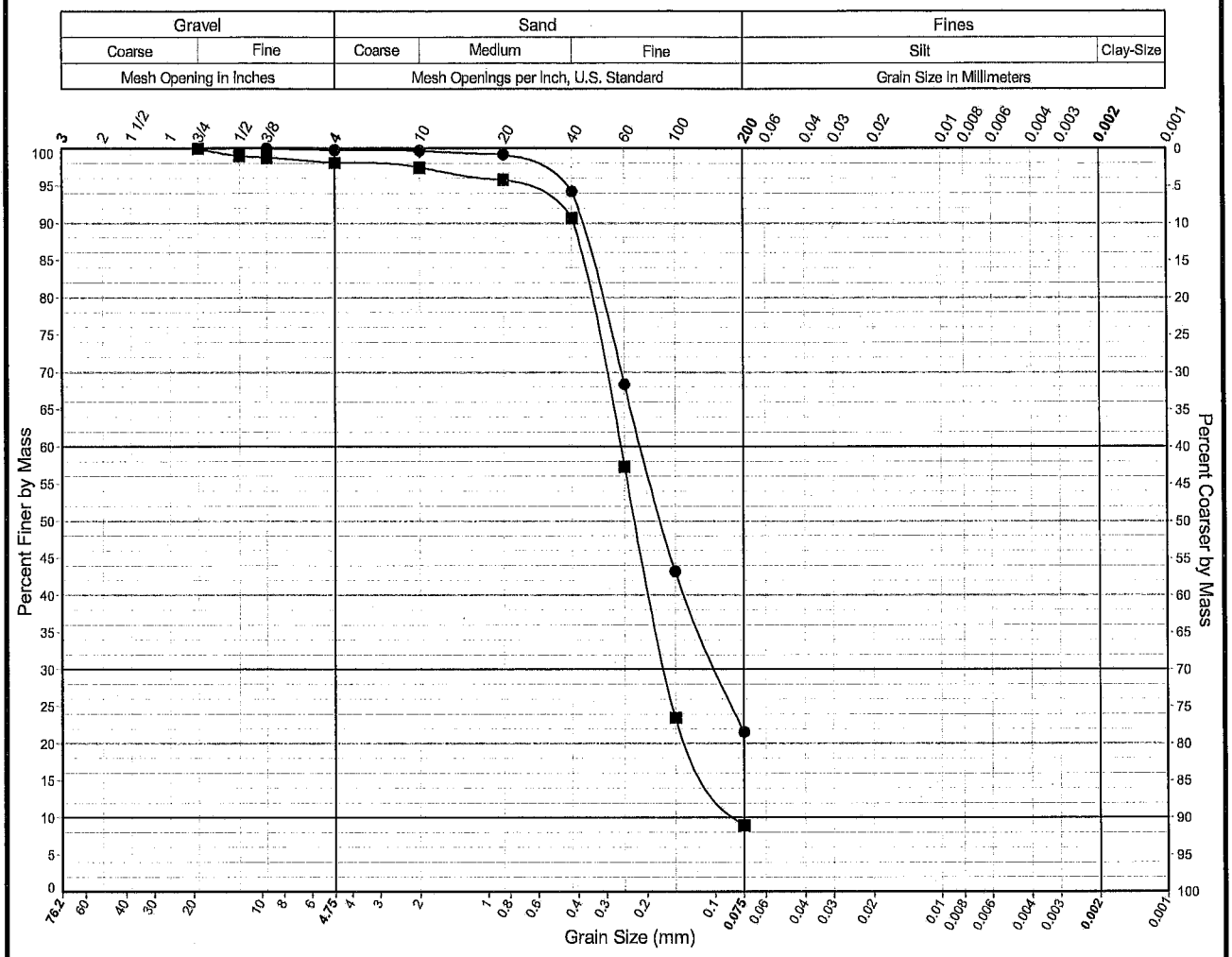
FIG. 2

Filename: J:_SEA\103284\003\103284-003 Fig 2 - Site Plan.dwg Date: 07-24-2019 Login: JRS

SHANNON & WILSON, INC. — GRAIN SIZE DISTRIBUTION PLOT

Yelm Highway Community Park
Yelm, Washington

P-1|2, P-6|2



Sample Identification	Depth (ft)	USCS Group Symbol	USCS Group Name	Gravel %	Sand %	Fines %	< 20µm %	< 2µm %	WC %	Tested By	Review By	ASTM Std.
● P-1, S-1	2.0	SM	Silty Sand	0	78	22			13.8	CTC		D422
■ P-6, S-1*	2.0	SP-SM	Poorly Graded Sand with Silt	2	89	9.0			10.1	CTC		C136

* *Test specimen did not meet minimum mass recommendations.*

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Attachment to and part of Report: 103284-003
Date: August 6, 2019
To: Mr. Matt Martenson
Berger Partnership

Important Information About Your Geotechnical/Environmental Report

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the ASFE/Association of Engineering Firms Practicing in the Geosciences, Silver Spring, Maryland