GEOTECHNICAL ENGINEERING REPORT

South Everett Solar
1226 Casino Road
Everett, Washington 98204

Project No. 2609.01
28 October 2022

Prepared for:
Snohomish County Public Utility District

Prepared by:

ZipperGeo
Geoprofessional Consultants

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Geoprofessional Consultants

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Snohomish County Public Utility District
PO Box 1107
Everett, Washington 98206

Attention: Mr. Adam Lewis

Subject: Geotechnical Engineering Report
South Everett Community Solar
1226 Casino Road
Everett, Washington 98204

Dear Adam:

In accordance with your request and written authorization, Zipper Geo Associates, LLC (ZGA) has completed our geotechnical engineering report for the above-referenced project. This report presents the findings of the subsurface evaluation and geotechnical recommendations for the project. Our work was completed in general accordance with our *Proposal for Geotechnical Engineering Services* (Proposal No. P22081) dated June 21, 2022. The District provided written authorization to proceed on June 21, 2022. We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please don't hesitate to contact us.

Sincerely,
Zipper Geo Associates, LLC

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Project Geologist

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Cover Photo Reference: Google Earth, 2015

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INTRODUCTION

This report presents the results of our geotechnical evaluation for the proposed South Everett Community Solar Project located at 1226 Casino Road in Everett, Washington. Our conclusions and recommendations are based upon a review of the documents referenced herein, soil conditions encountered in our subsurface explorations, laboratory testing, and geotechnical analysis. This report is an instrument of service, and the conclusions presented herein are in respect to the subject site. They have been prepared in accordance with generally accepted geotechnical engineering consulting practice. This report has been prepared for the exclusive use of the Snohomish County Public Utility District No. 1 (District) and its agents for specific application to the subject property and stated purpose.

SITE DESCRIPTION

The project site occupies a portion of two (2) adjoining parcels within the City of Everett's Walter P. Hall Park. Located at 1226 Casino Road, the north parcel 392100000103 is 7.57 acres and the south parcel is 5.49 acres. A local Pea Patch occupies the north section of the northern parcel and is accessed from a parking area along Hall Park Road at the west. Water reservoirs occupy the east and south portions of the lots. The proposed solar facility is proposed for construction in the western portion of the lots. Pertinent surface features described in this report are illustrated on Figure 1, the Site and Exploration Plan.

PROJECT UNDERSTANDING

Based on plans provided for our review, we understand the project consists of constructing a solar array facility of approximately 1.5 acres spanning the north and south parcels. Most of the array field will be located on the north parcel. Additionally, a small area of road improvements is proposed for access along the northeast corner of the project site. The eastern boundary of the solar array field will border an existing fence line, while the western boundary will be set back about 117 feet east from the western border of the parcels.

Surface Conditions

Two large water storage tanks and a water storage tower are located to the east and southeast of the proposed solar array area. A chain link fence surrounds this area. A utility vault, sewer access, and a concrete pad exist on the south side of the southern parcel. There is a standing pipe on the east side of the proposed site with an undergound connection identified leading to the utility vault from the vertical pipe. A workshop type outbuilding belonging to the golf course at the west is located in the southwest portion of the south parcel. Portions of the putting green are located within the western section of both parcels.

North to south, the site topography undulates slightly and has an elevation difference of about 6 feet, lower to the south. The east side of both parcels grades gradually from 624 feet to 613 east to west. The vegetation consists mostly of grasses, with several evergreen tree stands scattered about the site. We observed standing water and abundant equisetum (horsetail) in a shallow ditch along the east side of Hall Park Road immediately west of the proposed solar facility.

Geologic Conditions

Published Geologic Mapping

The site is located in what is referred to as the Puget Lowland. Geologists are in general agreement that the Puget Lowland was subjected to six or more glaciations. Most recently, around 17,000 years ago (Porter and Swanson, 1998), the Puget Lobe of the Vashon Glaciation advanced into the Puget Lowland, originating from the Canadian Rockies. The ice scoured the existing surface, eroding previous sediments and depositing new sediment. Meltwater streams emanating from the advancing glacier deposited sand and gravel (advance outwash). Beneath the glacier, an unstratified mixture of silt, sand, gravel, cobbles, and boulders (glacial till) was deposited. The glacier's weight compacted (overconsolidated) the glacial and remnant non-glacial soil. Later, as the glacier receded, meltwater deposited recessional glacial outwash and lacustrine sediments. The recessional deposits are overlain by younger (Holocene-age), relatively loose and soft soil, including alluvium and man-made fills. According to Minard, the site is underlain by Quaternary Vashon glacial till (Qvt) and advance outwash (Qva) from the Vashon glacial advance (Minard, 1985). Troost (2005) describes Qvt as a compact diamict (gravel and sand in a silt matrix) typically 3 to thirty 30 feet thick and very dense. The dense nature of glacial till soils typically does not allow stormwater to be infiltrated effectively due to the soil's low permeability. The author describes the Qva as dense to very dense well-sorted sand and gravel. Although not referenced on the geologic maps we reviewed, the developed nature of the park property is such that fill material may be present as well.

The US Department of Agriculture Natural Resource Conservation Service (NRCS) web soil survey maps the site as underlain by Alderwood-Urban land Complex, gravelly ashy sandy loam to very gravelly ashy sandy loam with 2 to 8 percent slopes. Relevant properties and qualities of Alderwood Complex soils are provided below.

- Alderwood Complex-Urban Land
- Hydrologic Soil Group B
- Erosion Susceptibility: Low

Subsurface Soil Conditions

Our subsurface evaluation consisted of completing thirteen (13) test pits with a rubber tracked excavator in July and August 2022. Explorations were completed to a depth of between approximately 4 to 10 feet below ground surface (bgs). The explorations were laid out based on a conceptual site plan provided to us and were completed in the proposed solar array area. The explorations' approximate locations are presented on Figure 1, the Site and Exploration Plan.

Soils were visually described during recovery in general accordance with the Explanation of Exploration Logs provided in Appendix A. Detailed descriptive logs of the subsurface explorations and the procedures utilized in the subsurface exploration program are presented in Appendix A. Generalized descriptions of subsurface soil conditions observed in specific areas of the site are presented below. Please refer to the exploration logs in Appendix A for a more detailed description of the conditions encountered at the exploration locations. Stratification boundaries on the test pit logs represent the approximate depth of changes in soil types, although the transition between materials may have been gradual. If variations become apparent during construction, it may be necessary to reevaluate the recommendations of this report.

We observed approximately 6 inches of topsoil that consisted of brown silty sand with grass roots at the locations of the test pits where we did not observe underlying fill material (TP-01, TP-04, and TP-05). We observed between about 2 inches and 6 inches of grass sod with fine roots at the locations of the remaining test pits where we observed underlying fill material. It should be noted that the depth of surficial organic soils likely varies across the site, and in particular may be deeper around tree root masses.

At the locations of test pits TP-01, TP-04, and TP-05 we observed approximately 2.5 to 3.5 feet of weathered glacial till (Qvt) that consisted of medium stiff to hard, moist, sandy silt and medium dense silty sand with a variable gravel and cobble content. The weathered till was underlain by less weathered and harder/denser material to the test pit termination depths. We observed uncontrolled fill material at the remaining test pit locations. The fill included medium dense soil consisting of silty sand with gravel with scattered concrete clasts (a few of boulder size), wood, tree limbs and branches, pieces of pipe, and some golf balls, to a maximum depth of about 9 feet. The fill was underlain by native glacial till. It should be noted that the composition, density, and depth of fill may vary considerably over relatively short distances. Our interpreted approximate extent of the site area underlain by uncontrolled fill is shown on Figure 1.

Groundwater Conditions

We observed slight groundwater seepage and associated caving while excavating test pits TP-02 and TP-04 at about 7.5 to 8 feet bgs. We also observed that a water vault located near the southwest portion of the proposed solar array was filled with water to within a few inches of the ground surface during one of our site visits. Groundwater fluctuations will likely occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the explorations were performed, and possibly also influenced by landscape irrigation.

Laboratory Testing Summary

Laboratory tests were completed on select soil samples obtained from our test pits. Laboratory testing included moisture content and grain size analysis. The results of moisture content testing are shown on the test pit logs. Results of remaining testing are provided in Appendix B. Moisture contents of the native soil samples collected ranged from about 10 to 24 percent. Grain size (sieve) tests indicate fines (silt and clay size particles) contents ranging from about 12 to 44 percent in representative native soil samples.

CONCLUSIONS AND RECOMMENDATIONS

General Considerations

We understand that the solar arrays will be supported on metal frameworks relying upon cast-in-place drilled pier foundations and that structural loads are expected to be relatively low. Grading is expected to be minimal due to efforts to reduce overall site disturbance. A relatively small area of new asphalt pavement is planned in the northeast portion of the site, and an unpaved access route for light service vehicles along the east side of the site is proposed as well. Based on the subsurface conditions observed and described in previous sections, it is our opinion that the proposed solar facility project is feasible from the geotechnical perspective. Key aspects of the project include:

- The undisturbed native dense glacial till soils are well-suited for support of drilled pier foundations. The drilled piers will need to extend through the uncontrolled fill material observed at many of the test pit locations. This could present problems during drilling due to the presence of wood and concrete debris in the fill, and removal of the existing fill and its replacement with compacted structural fill is eliminate the issue of drilling obstructions.

- The existing fill may be left in place outside of foundation areas as part of efforts to minimize site disturbance.

- Due to a combination of uncontrolled fill of varied composition and thickness, shallow glacially consolidated soils, and shallow perched groundwater, conventional stormwater infiltration is not considered feasible from the geotechnical perspective.

Our geotechnical engineering conclusions and recommendations are presented below. The recommendations contained in this report are based upon soils encountered in our explorations, the results of field and laboratory testing (which are presented in Appendices A and B), engineering analyses, and our current understanding of the proposed project.

Geologically Hazardous Areas

Chapter 19.37-Regulations for Environmentally Critical Areas of the Everett Municipal Code (the Code) categorizes Geologically Hazardous Areas (GHAs) as Erosion Hazard; Landslide Hazard; Seismic Hazard; and Other geological areas which the City has reason to believe are geologically hazardous. The GHAs are described in the *Dames and Moore Methodology for the Inventory, Classification and Designation of Geologically Hazardous Areas, City of Everett, Washington*, July 1, 1991 (Dames and Moore). As part of our services, we performed an evaluation of the presence or absence of GHAs at the project site. The following paragraphs present the results of our evaluation and further discussion.

Erosion Hazard

The Code Chapter 19.37.080(3) classifies erosion hazards using the Dames and Moore methodology as medium to very high/severe erosion hazard areas based on geologic, topographic, and other factors. The Everett Erosion Hazard Map does not indicate any erosion hazard at the project location and therefore the risk is low. It is our opinion that potential construction phase erosion can be adequately mitigated through the preparation and execution of a properly prepared temporary erosion and sedimentation control (TESC) plan and maintenance of TESC BMPs during construction.

Landslide Hazard

The Code classifies potential landslide risk from very high to medium risk based on a combination of geologic, topographic, and hydrologic factors. Based on our review of the Code, existing site conditions, the Everett Landslide Hazard Map, and due to the site's low relief, the risk of landslide hazard at the site is low, in our opinion.

Seismic Hazards

Seismic Hazards include soil liquefaction and ground surface fault rupture. The Code defines seismic/liquefaction hazards per Dames and Moore, 1991, and those mapped as high and moderate to high liquefaction susceptibility on the *Liquefaction Susceptibility Map of Snohomish County, Washington*, Washington State Department of Natural Resources, Palmer, Stephen, et al., September 2004.

Soil Liquefaction: Liquefaction is a phenomenon wherein cohesionless soils below the groundwater table build up excess pore water pressure during earthquake loading. Liquefaction typically occurs in loose, cohesionless soils located below the groundwater table. The potential hazardous impacts of liquefaction include liquefaction-induced settlement and lateral spreading. Seismic Hazard areas as defined by Dames and Moore in the City are mapped on the *Critical Areas Map 4, Liquefaction (Seismic) Susceptibility*. The site is mapped as not having liquefaction potential. Based on soil and groundwater conditions observed at the test pit locations, we concur with the City mapping.

Fault Ground Surface Rupture: Based on our review of the USGS Quaternary age fault database for Washington State, an inferred fault trace of the Southern Whidbey Island fault zone is located approximately 1.6 miles southwest of the project site. It is our opinion that the risk of ground surface rupture at the site is low given the referenced fault's distance from the site.

Seismic Design Criteria

The 2018 IBC indicates that the seismic site classification is based on the average soil and bedrock properties in the top 100 feet. To determine the Site Class, we used the data from the shallow test pits as well as previously referenced geologic mapping. The current scope does not include a 100-foot soil profile determination. The seismic site class definition recommended in the following table considers that soils encountered at depth in our explorations continue below the termination depth. Per the 2018 IBC seismic design procedures and ASCE 7-16, we recommend using Site Class D for seismic design.

Site Preparation

Erosion Control Measures: The site has relatively mild topography and limited grading is expected. City-approved TESC BMPs that are adequately designed, installed, and maintained will help to reduce the erosion potential. We recommend that silt fences, berms, and/or swales be installed around stripped areas and stockpiles in order to capture runoff water and sediment. If earthwork occurs during wet weather, we recommend covering stripped surfaces with straw and protecting soil stockpiles with anchored plastic sheeting when areas are not being worked for long periods.

Temporary Drainage: Stripping, excavation, grading, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and provide proper control of erosion. The site should be graded to prevent water from ponding in construction areas and/or flowing into excavations. Exposed grades should be crowned, sloped, and smooth-drum rolled at the end of each day to facilitate drainage if inclement weather is forecasted. Accumulated water must be removed from subgrades and work areas immediately and prior to performing further work in the area. The site soils have a relatively high fines content and should be considered highly moisture-sensitive. As such, equipment access may be limited and the amount of soil rendered unfit for use as structural fill may be greatly increased if drainage efforts are not accomplished in a timely manner.

Stripping: In preparation for grading we recommend removal of all existing vegetation and grubbing of roots larger than about a half inch. Organic-rich topsoil (soils containing more than 4 percent organic material by weight) will need to be stripped from the new pavement location as well as those areas to receive structural fill. We observed up to about 6 inches of organic-rich surficial soils at the test pit locations and in some areas moderate size roots extended to a depth of about a foot. However, variation in the organic material thickness should be expected; deeper accumulations of organics may be encountered in depressions and around root masses. When removed, organic topsoil should not be reused as structural fill. Organic materials may be used in landscaping.

We observed uncontrolled fill material and underlying relic topsoil to a maximum depth of about 9 feet in the area shown on Figure 1. Provided that the decision is made to attempt to install the planned drilled pier foundations through the fill material, it may be left in place. However, this could present problems during drilling of the piers and we recommend that the District consider removing the existing uncontrolled fill and replacing it with structural fill placed and compacted in accordance with the recommendations summarized subsequently. The existing uncontrolled fill material should be removed under the observation of a ZGA representative. Our representative will identify unsuitable materials that should be removed and those that may be re-used as structural fill.

We recommend that site preparation activities take place in the drier summer months. Operating wheeled and tracked equipment when the weathered glacial till soils are wet will result in significant disturbance of the non-organic weathered glacial till soils and likely requiring its removal. This will increase construction costs. Completion of logging and stripping under dry site and weather conditions will reduce the potential for disturbance of the weathered till soils and reduce the likelihood of subgrade disturbance and the need to replace disturbed soils with imported granular fill.

<u>Subgrade Preparation</u>: Once stripping has been completed, all areas that are at design subgrade elevation or areas that will receive new structural fill should be compacted to a firm and unyielding condition and to a compaction level of at least 95 percent of the maximum laboratory density (per ASTM D 1557) within the upper 12 inches. Some moisture conditioning of site soils may be required to achieve an appropriate moisture content for compaction within ±2 percent of the soils laboratory optimum moisture content, particularly during the warmer summer months when the soils will tend to dry relatively quickly when exposed to sun and wind.

Subgrades should be evaluated through density testing and proof rolling with a loaded dump truck or heavy rubber-tired construction equipment in order to detect soft and/or yielding soils. In the event that soft or yielding areas are detected during proof rolling, the upper 12 inches of subgrade should be scarified, moisture conditioned and re-compacted as necessary to obtain at least 95 percent of the maximum laboratory density (per ASTM D 1557) and to a firm, non-yielding condition. Those soils which are soft/loose, yielding, or unable to be compacted to the specified criteria should be over-excavated and replaced with suitable material as recommended in the *Structural Fill* section of this report. If subgrade compaction during wet site conditions or wet weather cannot be achieved, a minimum of 12 inches of subgrade should be over-excavated and backfilled with compacted imported structural fill consisting of free-draining *Gravel Borrow* or crushed rock. A stabilization geotextile could be used in unstable areas to reduce the depth of over-excavation.

We recommend completing earthwork during drier periods of the year when the soil moisture content can be controlled by aeration and drying, if necessary. If earthwork or construction activities take place during extended periods of wet weather, the site-characteristic glacial till may become unstable or not be compactable. In the event the exposed subgrade becomes unstable, yielding, or unable to be compacted due to high moisture conditions, we recommend that the affected material be removed to a sufficient depth in order to develop a stable subgrade that can be compacted to the minimum recommended levels. The severity of construction problems will be dependent, in part, on the precautions that are taken by the contractor to protect the subgrade soils.

Once subgrades are compacted, it may be desirable to protect prepared subgrades To protect stable subgrades, we recommend using crushed rock. The thickness of the protective layer should be determined at the time of construction and be based on the moisture condition of the soil and the amount of anticipated traffic.

Freezing Conditions: If earthwork takes place during freezing conditions, all exposed subgrades should be allowed to thaw and then be compacted prior to placing subsequent lifts of structural fill. Alternatively, the frozen material could be stripped from the subgrade to expose unfrozen soil prior to placing subsequent lifts of fill or foundation components. The frozen soil should not be reused as structural fill until allowed to thaw and adjusted to the proper moisture content, which may not be possible during winter months.

Structural Fill Materials and Placement

Structural fill includes any material placed in non-landscaping embankments, below pavement sections, and within utility trenches outside of landscaping. Prior to the placement of structural fill, all surfaces to receive fill should be prepared as previously recommended in the Site Preparation section of this report.

Laboratory Testing

Representative samples of on-site and imported soils to be used as structural fill should be submitted for laboratory testing at least four days in advance of the materials' intended use in order to complete the necessary Proctor tests.

Re-use of Site Soils as Structural Fill

The suitability for re-use of site soils as structural fill depends on the composition and moisture content of the soil. Shallow soils encountered in our explorations generally consisted of sandy silt and silty sand with a relatively high fines content. As the fines content increases, the soil becomes increasingly sensitive to small changes in moisture content. Soils containing more than about 5 percent fines cannot be consistently compacted to the appropriate levels when the moisture content is more than approximately 2 percent above or below the optimum moisture content (per ASTM D1557). Optimum moisture content is the moisture content which results in the greatest compacted dry density with a specified compactive effort.

The optimum moisture content of a sample of the native glacial till which we tested in our laboratory was 9 percent. The *in situ* moisture contents of shallow soils that we tested were above the optimum moisture content for compaction. However, it should be noted that the samples were collected at the end of a particularly wet spring and that we anticipate that the moisture content of shallow soils will likely be lower later in the summer and early fall during a typical year. Provided that earthwork occurs during the driest summer months, it appears site soils will be suitable for reuse as structural fill. However, some selective moisture conditioning such as windrowing and drying may be required. During wet weather, site soils will quickly become too wet for reuse as structural fill and moisture conditioning will be impossible. If earthwork occurs during wet weather, the District should assume that site soils will not be suitable for reuse as structural fill. The suitability of reusing site soils that contain deleterious materials, such as the existing fill observed at the test pit TP-02 and TP-03 locations, should be made during construction by a representative from ZGA.

Imported Structural Fill

Imported structural fill may be required during earthwork. The appropriate type of imported structural fill will depend on the weather conditions. During extended periods of dry weather, we recommend imported fill meet the requirements of Common Borrow, Type 2 as specified in Section 9-03.14(3) of the 2020 WSDOT Standard Specifications. During wet weather, higher-quality (lower fines content) structural fill might be required, as Common Borrow may contain sufficient fines to be moisture sensitive. During wet weather, we recommend that imported structural fill meet the requirements of Gravel Borrow as specified in Section 9-03.14(1) of the Standard Specifications although we recommend limiting the fines content to 5 percent based on the soil fraction passing the ¾-inch sieve.

Moisture Content

The suitability of soil for use as structural fill will depend on the prevailing weather at the time of construction, the moisture content of the soil, and the fines content (that portion passing the US No. 200 sieve) of the soil. As the amount of fines increases, the soil becomes increasingly sensitive to small changes in moisture content. Soils containing more than about 5 percent fines (such as most of the on-site soils) cannot be consistently compacted to the appropriate levels when the moisture content is more than approximately 2 percent above or below the optimum moisture content (per ASTM D1557). Optimum moisture content is that moisture content which results in the greatest compacted dry density with a specified compactive effort.

Fill Placement and Compaction

Structural fill should be placed in horizontal lifts not exceeding 10 inches in loose thickness. Each lift of fill should be compacted using compaction equipment suitable for the soil type and lift thickness. With the exception of fill placed in landscaping areas, each lift of fill should be compacted to at least 95 percent of the maximum laboratory dry density as determined by the ASTM D1557 Modified Proctor testing procedures. Moisture content of fill at the time of placement should be within plus or minus 2 percent of optimum moisture content for compaction as determined by the ASTM D1557 test method. We recommend compacting landscaping fill to between 85 and 90 percent density.

Utility Trenching and Backfilling

We recommend that utility trenching conform to all applicable federal, state, and local regulations, such as OSHA and WISHA, for open excavations. Trench excavation safety guidelines are presented in WAC Chapter 296-155 and WISHA RCW Chapter 49.17.

Utility Subgrade Preparation

We recommend that all utility subgrades be firm and unyielding and free of all soils that are loose, disturbed, or pumping. Soils that pump or yield should be removed and replaced. Given the localized presence of undocumented fill at the site, we recommend that the upper foot of utility subgrades be compacted to a firm and unyielding condition. All structural fill used to replace over-excavated soils should be compacted as recommended in the Structural Fill section of this report.

Bedding and Initial Backfill

We recommend that a minimum of 4 inches of bedding material be placed above and below all utilities or in general accordance with the utility manufacturer's recommendations and local ordinances. We recommend that pipe or conduit bedding consist of granular material free from particles greater than 3 inches. If water is encountered in the excavations, it should be removed prior to fill placement.

Trench Backfill

Materials, placement and compaction of utility trench backfill should be in accordance with the recommendations presented in the Structural Fill section of this report. In our opinion, the initial lift thickness should not exceed 1 foot unless recommended by the manufacturer to protect utilities from damage by compacting equipment. Light, hand operated compaction equipment may be utilized directly above utilities if damage resulting from heavier compaction equipment is of concern.

Temporary and Permanent Slopes

Temporary excavation slope stability is a function of many factors, including:

- The presence and abundance of groundwater;
- The type and density of the various soil strata;
- The depth of cut;
- Surcharge loadings adjacent to the excavation; and
- The length of time the excavation remains open.

As the cut is deepened, or as the length of time an excavation is open, the likelihood of bank failure increases; therefore, maintenance of safe slopes and worker safety should remain the responsibility of the contractor, who is present at the site, able to observe changes in the soil conditions, and monitor the performance of the excavation.

It is exceedingly difficult under the variable circumstances to pre-establish a safe and "maintenance-free" temporary cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe temporary slope configurations since the contractor is continuously at the job site, able to observe the nature and condition of the cut slopes, and able to monitor the subsurface materials and groundwater conditions encountered. Unsupported vertical slopes or cuts deeper than 4 feet are not recommended if worker access is necessary. The cuts should be adequately sloped, shored, or supported to prevent injury to personnel from local sloughing and spalling. The excavation should conform to applicable Federal, State, and Local regulations.

According to Chapter 296-155 of the Washington Administrative Code (WAC), the contractor should make a determination of excavation side slopes based on classification of soils encountered at the time of excavation. Temporary cuts may need to be constructed at flatter angles based upon the soil moisture and groundwater conditions at the time of construction. Adjustments to the slope angles should be determined by the contractor at that time. For preliminary planning purposes, we recommend considering the shallow medium dense and medium stiff native soils and the existing undocumented fill as Type C soils. For dense to very dense soils, we recommend considering them Type A soils.

We recommend that all permanent cut or fill slopes be designed at a 2H:1V (Horizontal:Vertical) inclination or flatter. All permanent cut and fill slopes should be adequately protected from erosion both temporarily and permanently.

Construction Dewatering

We observed slight groundwater seepage at the locations of test pits TP-02 and TP-04 at the time of the explorations as discussed previously. If groundwater is encountered during construction, excavations that extend below the groundwater table may require dewatering. The contractor should be responsible for dewatering means and methods. Based on our observations, we anticipate that dewatering, if required, would likely be fairly straightforward and likely employ sumps and pumps.

Foundation Recommendations

It is our understanding that the solar arrays will be supported by cast-in-place drilled pier foundations. Our recommendations are summarized below.

Drilled Pier End Bearing and Settlement

We understand that drilled piers have been selected as the preferred foundation type and that axial compressive loads in the range of 6 to 8 kips are expected, depending on spacing. For purposes of this report, we have considered that drilled pier foundations will extend to undisturbed native at least dense glacial till and have a minimum 1-foot diameter. Based on these criteria, we recommend using an allowable end bearing value of 8 kips per square foot (ksf) for drilled piers installed into the undisturbed native glacial till. This value incorporates a factor of safety of three and may be increased by one third for short-term transient loading. Foundation settlement is expected to be less than one-half inch.

Drilled Pier Uplift Capacity

Uplift forces acting on the drilled piers may be counteracted by the weight of the piers and skin friction between the piers and the surrounding soil. An allowable skin friction value of 200 pounds per square foot (psf) may be considered. This value incorporates a factor of safety of 3.

IBC Non-constrained Pole Design Recommendations

Section 1805.7.2.1 of the 2003 the *International Building Code* (IBC) describes the methodology for determining a drilled pier foundation or pole depth of embedment in cases where no constraint is provided at the surface to resist lateral forces. We have provided lateral bearing pressures for two site conditions: one in which the drilled pier foundations are constructed within native soils and compacted structural fill, and one in which the drilled piers are installed through existing fill material (such as that we observed at the locations of test pits TP-02 and TP-03). For the initial case where the drilled piers are installed in native soils and structural fill that was placed and compacted following removal of existing uncontrolled fill, we recommend an allowable lateral resistance of 160 $lbs/ft^2/ft$. For the second case where the drilled piers are constructed to bear in native glacial till but penetrate through the existing uncontrolled fill material, we recommend an allowable lateral resistance of 115 $lbs/ft^2/ft$. These values incorporate a factor of safety of 2.5. We recommend neglecting lateral resistance in the upper 1.5 feet of embedment.

Open Shaft Construction Considerations

Given the soil conditions encountered at the test pit locations, we anticipate that construction of the shafts can be accomplished with standard drilling equipment. We observed undocumented fill material at many of the test pit locations and the fill included wood waste and concrete clasts. The contractor should be prepared to deal with the presence of cobbles, concrete clasts, and wood over the drilled depth interval. In the event that obstructions cannot be removed, it will be necessary to excavate them and then backfill the excavation with either compacted structural fill or Controlled Density Fill prior to attempting to re-drill the shafts.

We anticipate that sidewall caving may occur while drilling through the existing fill. We recommend that the contractor be prepared to case the drilled shaft boreholes to reduce sidewall sloughing. We recommend that the contractor be required to have on site sufficient material to case the entire drilled depth of the drilled pier foundations. The drilling contractor should be prepared to clean out the bottom of the shafts if loose soil is observed or suspected. We recommend that the drilling contractor have a cleanout bucket on site to remove loose soils from the bottom of the boring.

Most of the drilling and caving difficulties described above may be mitigated if the existing uncontrolled fill material is removed and replaced with compacted structural fill as described previously in this report.

We recommend that the foundation concrete be tremied from the bottom of the hole to displace water and to reduce the risk of contaminating or segregating the concrete mix should any accumulate in the shafts. A minimum 5-foot head of concrete should be maintained above the tremie. The *Drilled Shaft Manual* published by the Federal Highway Administration recommends that concrete be placed by tremie methods if more than 3 inches of water has accumulated in the excavation.

We recommend that a ZGA representative observe construction of the drilled pier foundations. Our representative will be able to assist the contractor in verifying that the piers extend through the existing fill material and into the underlying native glacial till.

On-Grade Concrete Slabs

Subgrade Preparation

In the event that concrete slabs are used for support of transformers, batteries, inverters, or other solar array components, we recommend preparing slab subgrades in accordance with the Site Preparation section of this report. Prior to placement of slab reinforcement or form work, slab subgrades should be compacted to a firm and unyielding condition and to at least 95 percent of the modified proctor (ASTM D1557) maximum dry density.

Slab Base

To provide a uniform slab bearing surface, we recommend on-grade slabs be underlain by a minimum 4-inch thick layer of compacted, crushed rock meeting the requirements of WSDOT Standard Specification Section 9-03.9(3), Crushed Surfacing - Top Course gradation, with the modification of a maximum of 7 percent passing the U.S. No. 200 sieve. Alternatively, a clean angular gravel such as No. 7 aggregate per WSDOT: 9-03.1(4)C could be used for this purpose.

Stormwater Management Considerations

We understand that design of the stormwater management aspects of the project will need to comply with the 2019 Washington Department of Ecology (WDOE) *Stormwater Management Manual for Western Washington* (*Manual*). Drawings provided by CG Engineering for our review indicate that a small amount of new asphalt pavement is proposed for construction at the far north end of the site, and this will be the extent of impervious surfacing associated with the project.

Site Suitability Criteria

The explorations completed for this evaluation disclosed weathered and unweathered glacial till soils and some fill material of varied composition and thickness. The glacial till consisted of silty sand and sandy silt with a variable gravel content. Stormwater infiltration into unweathered glacial till (or densely compacted till fill) is generally not relied upon because of the soil's typical low permeability, and this was clearly evident at the site as we observed perched groundwater above and within the unweathered till at the test pit TP-02 and TP-04 locations and we also observed ponded surface water along the east side of the park access road immediately west of the solar facility in June 2022. We also observed that a water vault, the location of which is very near the southwest corner of the solar facility and is shown on Figure 1, was full of water up to within a few inches of the ground surface.

The lack of 3 feet of vertical separation between an infiltration feature and the observed shallow groundwater condition would appear to preclude conventional infiltration per the conditions described for Site Suitability Criteria SSC-5 *Depth to Bedrock, Water Table, or Impermeable Layer* as described in the *Manual*. SSC-5 indicates that the base of infiltration basins or infiltration trenches shall be greater than or equal to 5 feet above the seasonal high-water mark. Given the extremely wet spring of 2022, it is our opinion that the groundwater conditions (and standing surface water conditions) observed during our site visits be considered likely just slightly below the probable seasonal high groundwater condition.

Consequently, it appears that conventional stormwater infiltration is not a viable alternative from the geotechnical perspective as the City of Everett will not permit infiltration given the existing vertical separation condition.

Vehicle Access Recommendations

Flexible Pavement

We understand that some new asphalt pavement will be constructed at the north end of the site and that it is likely to be subject to relatively light loading conditions. Our recommendations are summarized below.

Asphalt Pavements: The following pavement sections represent our minimum recommendations for an average level of performance during a 20-year design life; therefore, an average level of maintenance will likely be required. A 20-year pavement life typically assumes that an overlay will be placed after about 12 years. Thicker asphalt, base, and subbase courses would offer better long-term performance, but would cost more initially. Conversely, thinner courses would be more susceptible to "alligator" cracking and other failure modes. As such, pavement design can be considered a compromise between a high initial cost and low maintenance costs versus a low initial cost and higher maintenance costs.

The native subgrade soils are anticipated to consist primarily of sand with gravel and a relatively high silt content. Based on our experience with similar soils, we have estimated a California Bearing Ration (CBR) value of 10 percent for this project.

We recommend that the upper 12 inches of pavement subgrades be prepared in accordance with the recommendations presented in the *Subgrade Preparation* section of this report.

We recommend that the crushed aggregate base course conform to Section 9-03.9(3) of the WSDOT Standard Specifications. All base material should be compacted to at least 95 percent of the maximum dry density determined in accordance with ASTM: D 1557.

Asphalt Pavement Section Recommendations: We recommend a minimum 3 inches of asphalt concrete over 4 inches of crushed rock base course. We recommend that the asphalt concrete conform to Section 9-02.1(4) for PG 58-22 or PG 64-22, Performance Graded Asphalt Binder as presented in the WSDOT Standard Specifications. We also recommend that the gradation of the asphalt aggregate conform to the aggregate gradation control points for ½-inch mixes as presented in Section 9-03.8(6), HMA Proportions of Materials. We recommend that asphalt be compacted to a minimum of 92 percent and a maximum of 96 percent of the Rice (theoretical maximum) density.

Soft Surfacing

We understand that soft-surfaced vehicle access along the east side of the site is planned. A material such as hog fuel is under consideration. Expected to support pickup trucks, for example, this areas will extend along the fence bordering the City's adjoining reservoir site. Considerations related to the soft-surface access are summarized below:

- We recommend preparing the subgrade by mowing existing vegetation very close to the ground. Leaving the existing root mass in the shallow soils will provide some degree of support for the soft surfacing material.

- We recommend proof rolling the subgrade with a moderately heavy rubber-tired vehicle, such as a single-axle dump truck, following mowing, under the observation of a ZGA representative. Should excessively yielding areas be observed, we recommend overexcavating the yielding soils and replacing them with compacted structural fill as described in the Site Preparation section of this report.

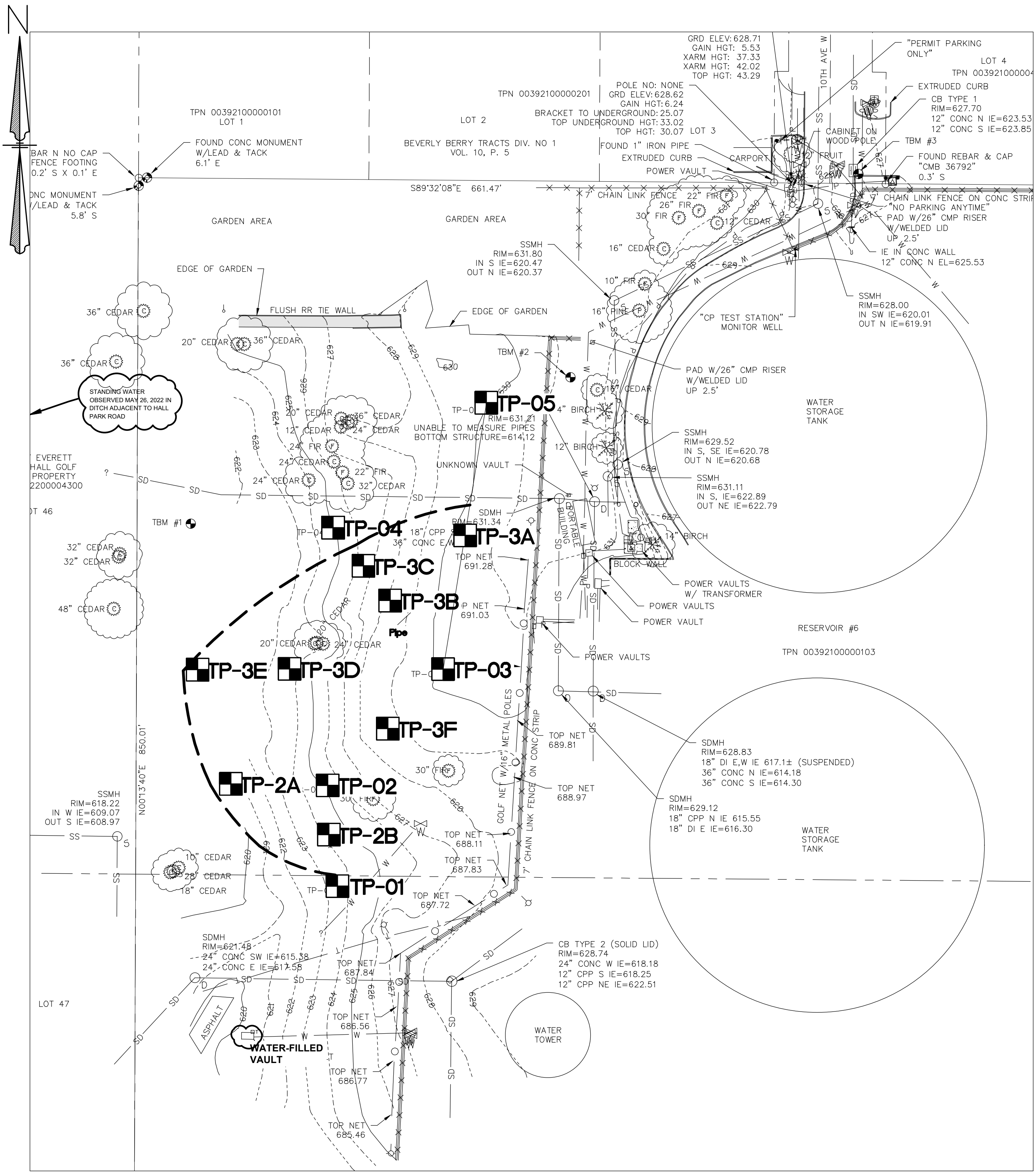
- We recommend placing a minimum 1 foot thickness of hog fuel along the access area. Please not that over time it will be necessary to add additional material to maintain the minimum 1 foot surfacing thickness due to breakdown and consolidation of the hog fuel.

CLOSURE

The analysis and recommendations presented in this report are based, in part, on the explorations completed for this study. The number, location, and depth of the explorations were completed within the constraints of budget and site access so as to yield the information to formulate our recommendations.

The performance of earthwork, structural fill, foundations, and pavements depends greatly on proper site preparation and construction procedures. We recommend that ZGA be retained to provide geotechnical engineering services during the earthwork-related and foundation construction phases of the project. If variations in subsurface conditions are observed at that time, a qualified geotechnical professional will be able to provide additional geotechnical recommendations to the contractor and design team in a timely manner as the project construction progresses.

This report has been prepared for the exclusive use of Snohomish County PUD No. 1, and its agents, for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Zipper Geo Associates, LLC reviews the changes and either verifies or modifies the conclusions of this report in writing.



REFERENCE: FIGURE TAKEN FROM HARMSEN, LLC, DRAWING S1, DATED 18 JULY 2022 AND ZGA FIELD MEASUREMENTS. SCALE 1:100

LEGEND

TP-01 TEST PIT NUMBER AND APPROXIMATE LOCATION

— — — ESTIMATED EXTENT OF FILL SOILS

100 0 50 100

APPROXIMATE SCALE IN FEET

SOUTH EVERETT SOLAR
1226 CASINO ROAD
Everett, Washington

SITE AND EXPLORATION PLAN

JULY 2022	Job No.	2609.01
Zipper Geo Associates, LLC 19019 36th Ave. W., Suite E Lynnwood, WA	FIGURE SHT. 1 of 1	1

APPENDIX A
FIELD EXPLORATION PROCEDURES AND LOGS

FIELD EXPLORATION PROCEDURES AND LOGS

Our field exploration program for this project included completing a visual reconnaissance of the site and excavating five test pits on 6 July 2022 and eight additional test pits on 26 August 2022. The approximate exploration locations are presented on Figure 1, the *Site and Exploration Plan*. Exploration locations were determined in the field using a fiberglass tape by measuring distances from existing site features shown on the *South Everett Solar Exhibit B*, dated 9 September 2021, provided by the District. The original five test pit locations were subsequently surveyed and the locations shown on a topographic plan prepared by Harmsen, LLC, dated 18 July 2022 and this plan forms the basis of Figure 1. The ground surface elevation at each exploration location was interpolated from the topography shown on the topographic survey. As such, the exploration locations and elevations should be considered accurate to the degree implied by the measurement methods. The following sections describe our procedures associated with the explorations. Descriptive logs of the explorations are enclosed in this appendix.

Test Pit Procedures

An independent contractor (Northwest Excavation & Trucking) working under subcontract to ZGA excavated the test pits through the use of a tracked excavator. An engineering geologist from ZGA continuously observed the test pit excavations, logged the subsurface conditions, and obtained representative soil samples. The samples were stored in moisture tight containers and transported to our laboratory for further visual classification and testing.

The enclosed test pit logs indicate the vertical sequence of soils and materials encountered in each test pit, based primarily on our field classifications and supported by our subsequent laboratory testing. Where a soil contact was observed to be gradational or undulating, our logs indicate the average contact depth. We estimated the relative density and consistency of *in situ* soils by means of the excavation characteristics and by the sidewall stability. Our logs also indicate the approximate depths of any sidewall caving or groundwater seepage observed in the test pits, as well as all sample numbers and sampling locations.

Sample Screening

The test pit logs also include the results of sample container headspace measurements taken with a RAE Systems photoionization detector (PID). The measurements indicate the relative concentration of petroleum hydrocarbons in the headspace air, but do not identify the type of hydrocarbon. The sample headspace readings, recorded as hydrocarbon concentration in parts per million (ppm) are presented on the logs in this appendix. The sample screening did not detect hydrocarbon levels of concern.

EXPLANATION OF EXPLORATION LOGS

SOIL DESCRIPTION: Soil descriptions presented on the borings logs are based on visual observations. Soil descriptions include density (coarse-grained soils) or consistency (fine-grained soils), moisture, color, major soil type, and grain size modifiers and should not be interpreted to suggest laboratory or field testing unless indicated on the logs. Soil descriptions include the following: Density/consistency, moisture, color, grain size modifier (adjective implying 31-49 percent), major soil type (CAPITALIZED implying 50+ percent), minor grain size modifier (some implying 6-12 percent, with implying 13-30 percent, and trace implying 0-5 percent), descriptive modifiers (i.e. roots, fill debris, cemented, etc.), and interpreted general geologic description. Descriptions may also include comments describing geologic properties such as dilatancy, toughness, structure, plasticity, and angularity of coarse-grained particles. Additional information regarding geologic properties is presented in the report text as applicable.

DENSITY/CONSISTENCY: Soil density/consistency in borings is related to the blow count number in blows per foot using the sampling method indicated on the logs. Soil density/consistency in test pits is related to a "Field Test" as described below. Soil consistency in test pits or borings may be augmented by field Torvane or Pocket Penetrometer testing.

Coarse-Grained Soils

Density Descriptor	SPT (# blows/ft)	Field Test
Very Loose	0 – 4	Easily penetrated with ½ -inch steel rod pushed by hand.
Loose	5 – 10	Difficult to penetrate with ½ - inch steel rod pushed by hand.
Medium Dense	11 – 30	Easily penetrated a foot with ½-inch steel rod driven with 5-lb hammer.
Dense	31 – 50	Difficult to penetrate a foot with ½-inch steel rod driven with 5-lb hammer.
Very Dense	>50	Penetrated only a few inches with ½-inch steel rod driven with 5-lb hammer.

Fine-Grained Soils

Consistency Descriptor	SPT (# blows/ft)	Torvane	Pocket Penetrometer	Field Test
		Undrained shear strength (tsf)	Unconfined Compressive Strength (tsf)	
Very Soft	0 – 2	<0.125	<0.25	Easily penetrates several inches by thumb.
Soft	3 – 4	0.125 – 0.25	0.25 – 0.5	Easily penetrates one inch by thumb.
Medium Stiff	5 – 8	0.25 – 0.5	0.5 – 1.0	Penetrated over ½ inch by thumb with moderate effort.
Stiff	9 – 15	0.5 – 1.0	1.0 – 2.0	Indented by thumb but penetrated only with great effort.
Very Stiff	16 – 30	1.0 – 2.0	2.0 – 4.0	Readily indented by thumbnail.
Hard	>30	>2.0	>4.0	Indented by thumbnail with difficult effort.

MOISTURE

Descriptor	Field Test
Dry	Absence of moisture, dusty, dry to the touch.
Damp	Too low to achieve compaction
Moist	Appears near optimum moisture content for compaction
Wet	Too wet to achieve compaction
Saturated	Below the groundwater table, visible free moisture.

MAJOR SOIL TYPE: Coarse-grained soils with over 50% of the material retained on the U.S. No. 200 sieve. Coarse-grained soils include boulders, cobbles, gravels and sands. Fine-grained soils with over 50% of the material passing the U.S. No. 200 sieve. Fine-grained soils include silts and clays.

GRAIN SIZE

Descriptor	Sieve Size	Grain Size
Boulder	>12"	>12"
Cobble	3 – 12"	3 – 12"
Gravel	3" – #4	3" – 0.19"
Sand	>#4 – #200	<0.19" – >0.0029"
Silt/Clay	Passing #200	<0.0029"

GRAIN SIZE MODIFIERS

Descriptor	Approximate Percentage
Trace	0 – 5
Some	6 – 12
With	13 – 30
Adjective (silty, clayey, sandy, gravelly)	31 – 50

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Test Pit TP-01

Location: See Figure 1
Approx. Ground Surface Elevation: 623 feet

Project: South Everett Solar
Project No: 2609.01
Date Excavated: July 6, 2022

Depth (ft)	Material Description	Sample	PID (ppm)	%M	Testing
1	6 inches of topsoil (brown sandy SILT) and fine roots over stiff to hard, moist, light gray SILT with sand, gravel, and cobbles, weathered (Qvt)				
2					
3	Hard, moist, gray sandy SILT with gravel, with cobbles, mottled iron oxide, mostly weathered (Qvt)	S-1 @ 2 ft.	1.8	24	
4					
5					
6					
7	Very dense, moist, gray silty SAND with gravel and cobbles (Qvt)	S-2 @ 6.5 ft.	1.0	11	
8					
9	Test pit completed at approximately 8 feet. No groundwater seepage at the time of excavation. No caving observed.				
10					
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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	Test Pit TP-02 **Location:** See Figure 1 **Approx. Ground Surface Elevation**: 625 feet	**Project:** South Everett Solar **Project No:** 2609.01 **Date Excavated:** July 6, 2022

Depth (ft)	Material Description	Sample	PID (ppm)	%M	Testing
1	6 inches topsoil(brown silty SAND) and fine roots over medium dense, moist, brown silty SAND with gravel, some boulder-sized concrete, some wood (Fill)				
2					
3					
4	Stiff, moist, yellow-brown, sandy SILT, some gravel, some mottled iron oxide, (Relic Topsoil)				
5		S-1 @4 ft.	2.0	25	ACM
6	Dense to very dense, moist reddish-gray silty SAND with gravel, with cobbles, with iron oxide mottling, mostly weathered (Qvt)				
7	Slight caving; slight seep				
8	Very dense, moist, gray silty SAND with gravel and cobbles (Qvt)				
9		S-2 @ 8 ft.	0.5	12	
10	Test pit completed at approximately 8.5 feet. Slight groundwater seepage at the time of excavation at approximately 7.5 feet. Slight caving at approximately 7.5 feet.				
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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	Test Pit TP-02A **Location:** See Figure 1 **Approx. Ground Surface Elevation**: 625 feet	**Project:** South Everett Solar **Project No:** 2609.01 **Date Excavated:** August 26, 2022			
Depth (ft)	**Material Description**	**Sample**	**PID (ppm)**	**%M**	**Testing**
1	3 inches grass sod above medium dense, damp, light gray, silty SAND with gravel (crushed rock Fill)				
2	Medium dense, damp, red-brown, silty SAND with gravel and cobbles (FILL)				
3					
4	Dense, moist, gray, silty SAND with gravel and cobbles (Till)				
5					
6	Test pit completed at approximately 4.5 feet. No groundwater seepage at the time of excavation. No caving observed.				
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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Test Pit TP-02B

Location: See Figure 1
Approx. Ground Surface Elevation: 625 feet

Project: South Everett Solar
Project No: 2609.01
Date Excavated: August 26, 2022

Depth (ft)	Material Description	Sample	PID (ppm)	%M	Testing
1	3 inches grass sod above dense, damp, light gray, silty SAND with gravel (FILL)				
2					
3	Medium dense, moist, red-brown silty SAND with gravel, scattered wood fragments (FILL)				
4					
5					
6	Med. dense to dense, moist, gray, silty SAND with gravel and boulders (Weathered till)				
7	Test pit completed at approximately 6 feet.				
8	No groundwater seepage at the time of excavation. No caving observed.				
9					
10					
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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	Test Pit TP-03 **Location:** See Figure 1 **Approx. Ground Surface Elevation**: 630 feet	**Project:** South Everett Solar **Project No:** 2609.01 **Date Excavated:** July 6, 2022			
Depth (ft)	**Material Description**	**Sample**	**PID (ppm)**	**%M**	**Testing**
1	6 inches topsoil (brown silty SAND) and roots over damp, gray, coarse angular GRAVEL (Fill)				
2	Dense, moist, light-brown silty SAND with gravel, with cobbles, wood/roots, iron oxide mottling (Fill)				
3					
4	Very dense, moist, gray silty SAND with gravel, with cobbles, iron oxide (Fill)	S-1 @3 ft.	1.2	19	ACM
5					
6	Loose to medium dense, moist, dark brown, poorly graded SAND with silt, with gravel, some wood/charcoal, with organics (Fill)				
7		S-2 @ 6 ft.	4.1	35	ACM
8	Tree limbs/branches				
9	Medium dense, moist, yellow-brown silty SAND with gravel heavily weathered (Relic Topsoil)				
10	Very dense, moist, gray silty SAND with gravel, trace cobbles, trace iron oxide mottling (Qvt)	S-3 @10 ft.	2.1	12	
11	Test pit completed at approximately 10 feet. No groundwater seepage at the time of excavation. No caving observed.				
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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<u>Test Pit TP-03A</u>

Location: See Figure 1
Approx. Ground Surface Elevation: 630 feet

Project: South Everett Solar
Project No: 2609.01
Date Excavated: August 26, 2022

Depth (ft)	Material Description	Sample	PID (ppm)	%M	Testing
1	4 inches grass sod above dense, damp, tan, silty SAND with gravel, cobbles, and boulders (Fill)				
2					
3					
4	Loose to medium dense, moist, brown to dark brown, moist, sandy SILT with organics (Relic topsoil)				
5					
6	Medium dense, moist, blue-gray, silty SAND with gravel (Weathered till) Red-green mottling				
7	Dense, blue-gray silty SAND with gravel (Till)				
8	Test pit completed at approximately 7 feet. No groundwater seepage at the time of excavation. No caving observed.				
9					
10					
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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	Test Pit TP-03B **Location:** See Figure 1 **Approx. Ground Surface Elevation**: 630 feet	**Project:** South Everett Solar **Project No:** 2609.01 **Date Excavated:** August 26, 2022			
Depth (ft)	**Material Description**	**Sample**	**PID (ppm)**	**%M**	**Testing**
1	4 inches grass sod				
2	Dense, damp, tan, silty SAND with gravel and cobbles; gray plastic pipe, golf balls, and tree bark (Fill)				
3					
4					
5					
6					
7					
8	Gray silty SAND with gravel (weathered till)				
9	Test pit completed at approximately 8 feet. No groundwater seepage at the time of excavation. No caving observed.				
10					
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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Test Pit TP-03C

Location: See Figure 1
Approx. Ground Surface Elevation: 630 feet

Project: South Everett Solar
Project No: 2609.01
Date Excavated: August 26, 2022

Depth (ft)	Material Description	Sample	PID (ppm)	%M	Testing
1	3 inches grass sod above dense, damp, tan, silty SAND with gravel and cobbles (Fill)				
2	Loose to medium dense, moist, brown, silty SAND with roots (Relic topsoil)				
3					
4	Medium dense,moist, reddish brown, silty SAND with gravel and scattered organics (Fill)				
5					
6	Dense, moist, gray, silty SAND with gravel (Till)				
7	Test pit completed at approximately 6.5 feet. No groundwater seepage at the time of excavation. No caving observed.				
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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	Test Pit TP-03D **Location:** See Figure 1 **Approx. Ground Surface Elevation**: 630 feet	**Project:** South Everett Solar **Project No:** 2609.01 **Date Excavated:** August 26, 2022			
Depth (ft)	**Material Description**	**Sample**	**PID (ppm)**	**%M**	**Testing**
1	4 inches grass sod above ense, damp, tan, silty SAND with gravel and cobbles (Fill)				
2					
3	Medium dense, moist, brown, silty SAND with gravel with scattered wood roots (Fill)				
4					
5					
6					
7	Medium dense to dense, moist, red-brown mottled, silty SAND, with gravel (Weathered till)				
8	Medium dense to dense, moist to wet, gray, silty SAND with gravel				
9	Test pit completed at approximately 7 feet. No groundwater seepage at the time of excavation. No caving observed.				
10					
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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	<u>**Test Pit TP-03E**</u> **Location:** See Figure 1 **Approx. Ground Surface Elevation**: 630 feet	**Project:** South Everett Solar **Project No:** 2609.01 **Date Excavated:**			
Depth (ft)	**Material Description**	**Sample**	**PID (ppm)**	**%M**	**Testing**
1	4 inches grass sod above medium dense,damp, red-brown, silty SAND with gravel and wood pieces (Fill)				
2					
3					
4	Dense, moist, gray, silty SAND with gravel (Till)				
5	Test pit completed at approximately 4 feet. No groundwater seepage at the time of excavation. No caving observed.				
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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	Test Pit TP-03F **Location:** See Figure 1 **Approx. Ground Surface Elevation**: 630 feet				**Project:** South Everett Solar **Project No:** 2609.01 **Date Excavated:** August 26, 2022
Depth (ft)	**Material Description**	**Sample**	**PID (ppm)**	**%M**	**Testing**
1	3 inches grass sod above very dense, damp, gray, silty SAND with gravel and boulders (Fill)				
2					
3	Light brown, moist, silty SAND with gravel and cobbles, plastic pipe (Fill)				
4	Soft/loose, moist, dark brown, fine and fibrous ORGANICS MATERIAL with wood fragments, bark, and golf balls (Fill)				
5					
6					
7					
8	Dense, moist to wet, poorly graded SAND with gravel and boulder (Weathered till)				
9					
10	Test pit completed at approximately 8 feet. No groundwater seepage at the time of excavation. No caving observed.				
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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19019 36th Avenue West, Suite E, Lynnwood, Washington 98036

Test Pit TP-04

Location: See Figure 1
Approx. Ground Surface Elevation: 625 feet

Project: South Everett Solar
Project No: 2609.01
Date Excavated: July 6, 2022

Depth (ft)	Material Description	Sample	PID (ppm)	%M	Testing
1	6 inches topsoil (brown sandy SILT) and fine roots over medium dense, moist, reddish-brown mottling, silty SAND with gravel with organics, weathered (Qvt)				
2					
3		S-1 @2.5 ft.	2.0	27	
4	Very dense, moist to wet, gray with iron oxide mottling at 3.5 feet, silty SAND, some gravel, with cobbles (Qvt)	S-2 @ 3.5 ft.	0.7	12	GSA
5					
6					
7	Medium dense, moist, gray SAND with silt, with gravel, sand lens (Qvt) Slight caving, slight seep @ 8 feet	S-3 @6.5 ft.	1.6	17	
8					
9	Very dense, moist, gray silty SAND with gravel, with cobbles (Qvt)	S-4 @8.5 ft.	2.4	10	
10	Test pit completed at approximately 9 feet. Slight groundwater seepage at the time of excavation at approximately 8 feet. Slight caving observed at approximately 8 feet.				
11					
12					
13					
14					
15					
16					
17					
	Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).				

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Test Pit TP-05

Location: See Figure 1
Approx. Ground Surface Elevation: 630 feet

Project: South Everett Solar
Project No: 2609
Date Excavated: July 6, 2022

Depth (ft)	Material Description	Sample	PID (ppm)	%M	Testing
1	6 inches topsoil (brown sandy SILT) and fine roots over medium stiff, moist, brown SILT with sand, trace gravel, trace to some cobbles; with larger roots to 1 foot; weathered (Qvt)				
2		S-1 @1.5 ft.	0.9	23	
3	Medium dense to dense, moist, gray silty SAND some gravel, trace to some cobbles, iron oxide mottling at 3.5 feet (Qvt)	S-2 @ 2 ft.	0.9	13	GSA
4					
5					
6					
7	Very dense, moist, gray with iron oxide mottling, silty SAND some gravel, trace cobbles (Qvt)				
8	Boulder @ 8 feet	S-3 @7 feet	0.3	10	GSA
9	Test pit completed at approximately 8.5 ft. No groundwater seepage at the time of excavation. No caving observed.				
10					
11					
12					
13					
14					
15					
16					
17					

Note: PID is the displayed hydrocarbon concentration in parts per million (ppm).

APPENDIX B
LABORATORY TESTING PROCEDURES AND RESULTS

LABORATORY PROCEDURES AND RESULTS

A series of laboratory tests were performed during the course of this study to evaluate the index and geotechnical engineering properties of the subsurface soils. Descriptions of the types of tests performed are given below.

Visual Classification

Samples recovered from the exploration locations were visually classified in the field during the exploration program. Representative portions of the samples were carefully packaged in moisture tight containers and transported to our laboratory where the field classifications were verified or modified as required. Visual classification was generally done in accordance with ASTM D 2488. Visual soil classification includes evaluation of color, relative moisture content, soil type based upon grain size, and accessory soil types included in the sample. Soil classifications are presented on the exploration logs in Appendix A.

Moisture Content Determinations

Moisture content determinations were performed on representative samples obtained from the explorations in order to aid in identification and correlation of soil types. The determinations were made in general accordance with the test procedures described in ASTM D 2216. The results are shown on the exploration logs in Appendix A.

Grain Size Analysis

A grain size analysis indicates the range in diameter of soil particles included in a particular sample. Grain size analyses were performed on representative samples in general accordance with ASTM D 6913. The results of the grain size determinations for the samples were used in classification of the soils, and are presented in this appendix.

Laboratory Maximum Density Test

The laboratory maximum density represents the highest degree of density which can be obtained from a particular soil type by imparting a predetermined compaction effort. The test determines the "optimum" moisture content of the soil at the laboratory maximum density. The laboratory maximum density test was performed on a bulk sample of material in general accordance with ASTM D 1557. The test result is shown in this appendix and presented as a plot of compacted soil dry density as a function of moisture content.

Asbestos Containing Material (ACM)

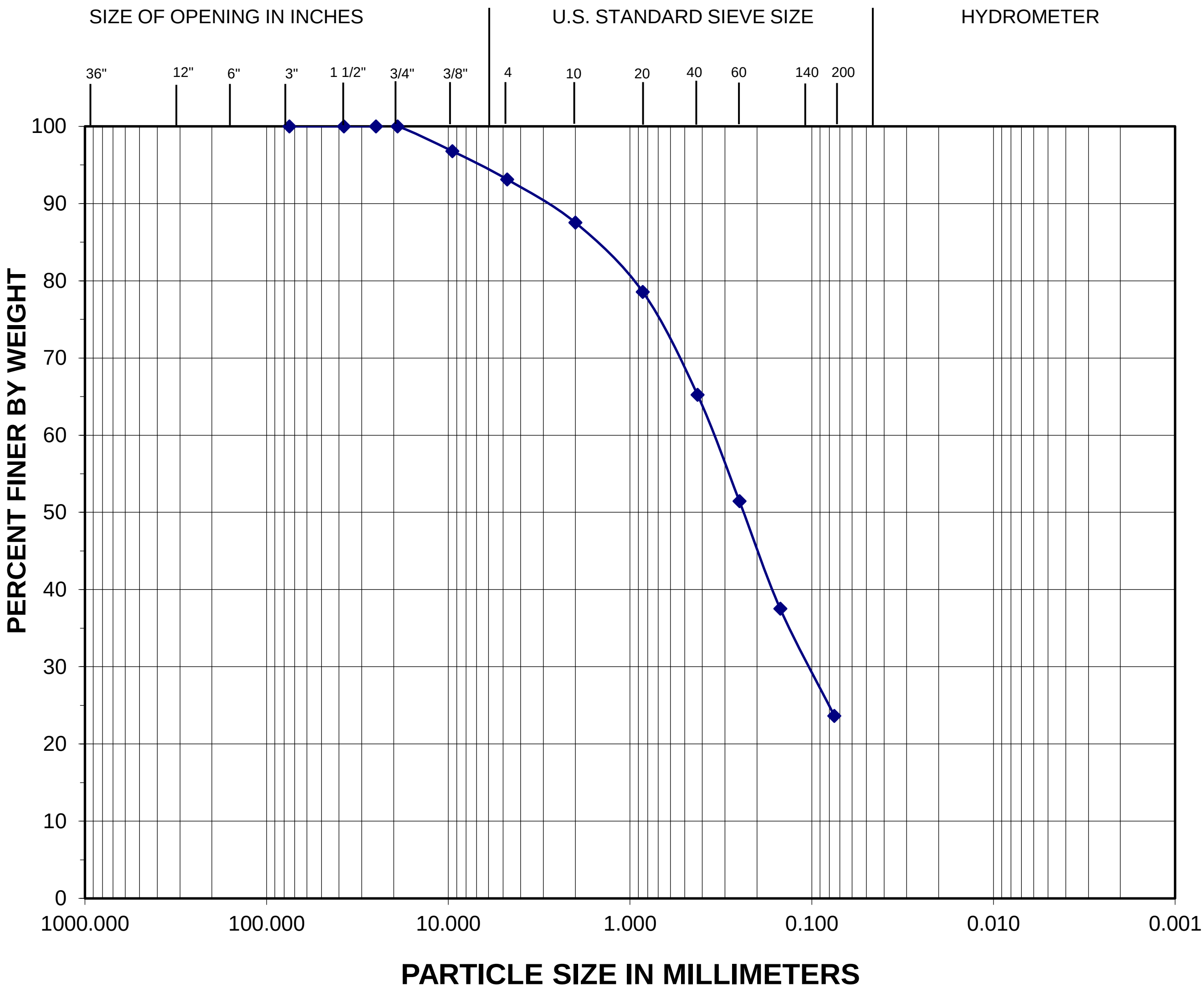
Three samples of existing fill material were collected from the test pits in order to test for the presence of ACM. Examination of these samples was conducted for the presence of identifiable asbestos fibers using polarized light microscopy (PLM) with dispersion staining in accordance with both EPA 600/M4-82-020, Interim Method for the Determination of Asbestos in Bulk Insulation Samples and EPA 600/R-93/116

Method for the Determination of Asbestos in Bulk Building Materials. Results of the tests are presented in the attached NVL report in this appendix. ACM was not detected in any of the samples.

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



BOULDERS	COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		GRAVEL		SAND			FINE GRAINED	

Comments:

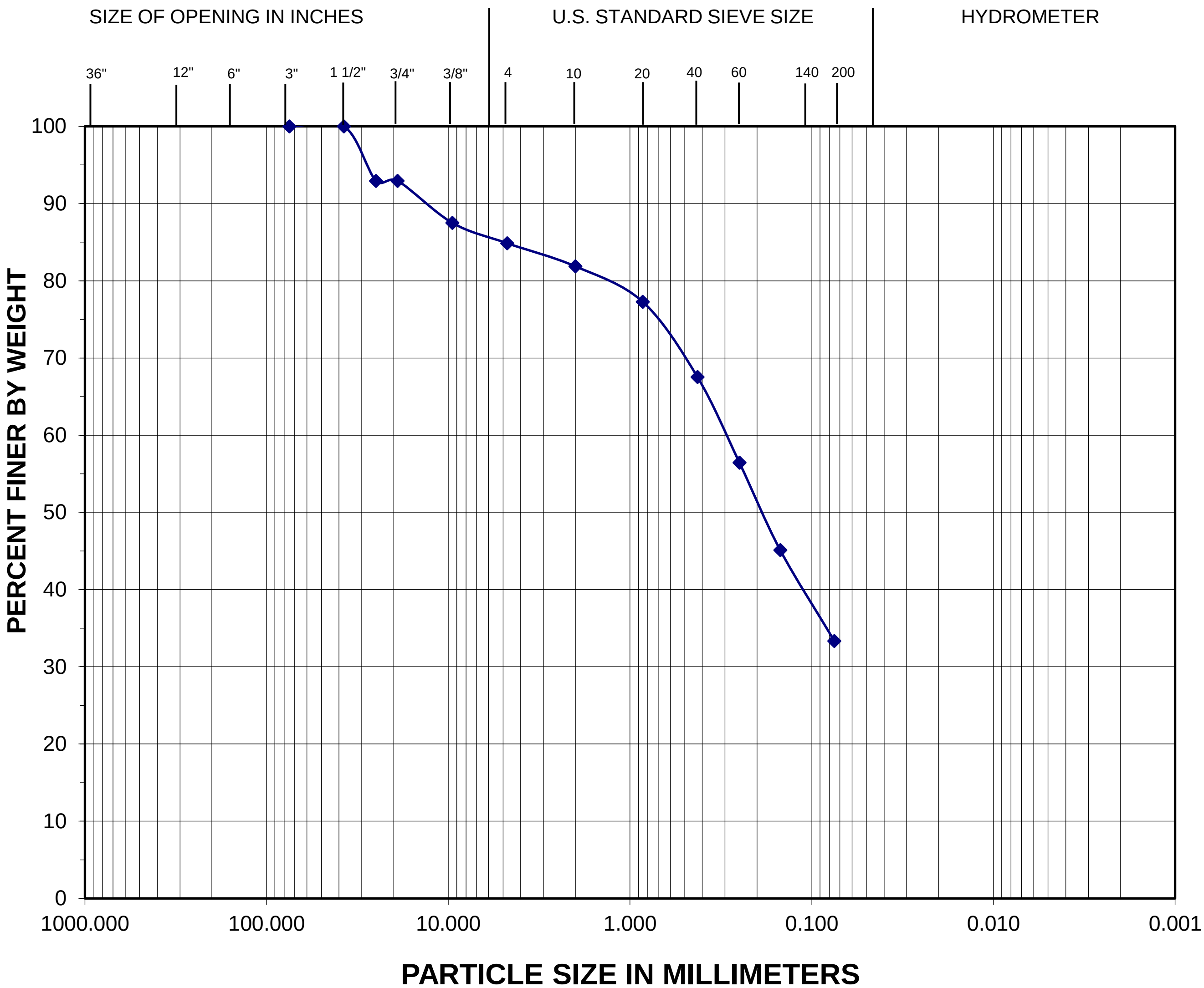
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
TP-04	S-2	3.5	11.7	23.6	Silty SAND, some gravel

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2609.01 DATE OF TESTING: 7/7/2022	PROJECT NAME: south everett solar

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



BOULDERS	COBBLES	GRAVEL: Coarse	GRAVEL: Fine	SAND: Coarse	SAND: Medium	SAND: Fine	FINE GRAINED: Silt	FINE GRAINED: Clay

Comments:

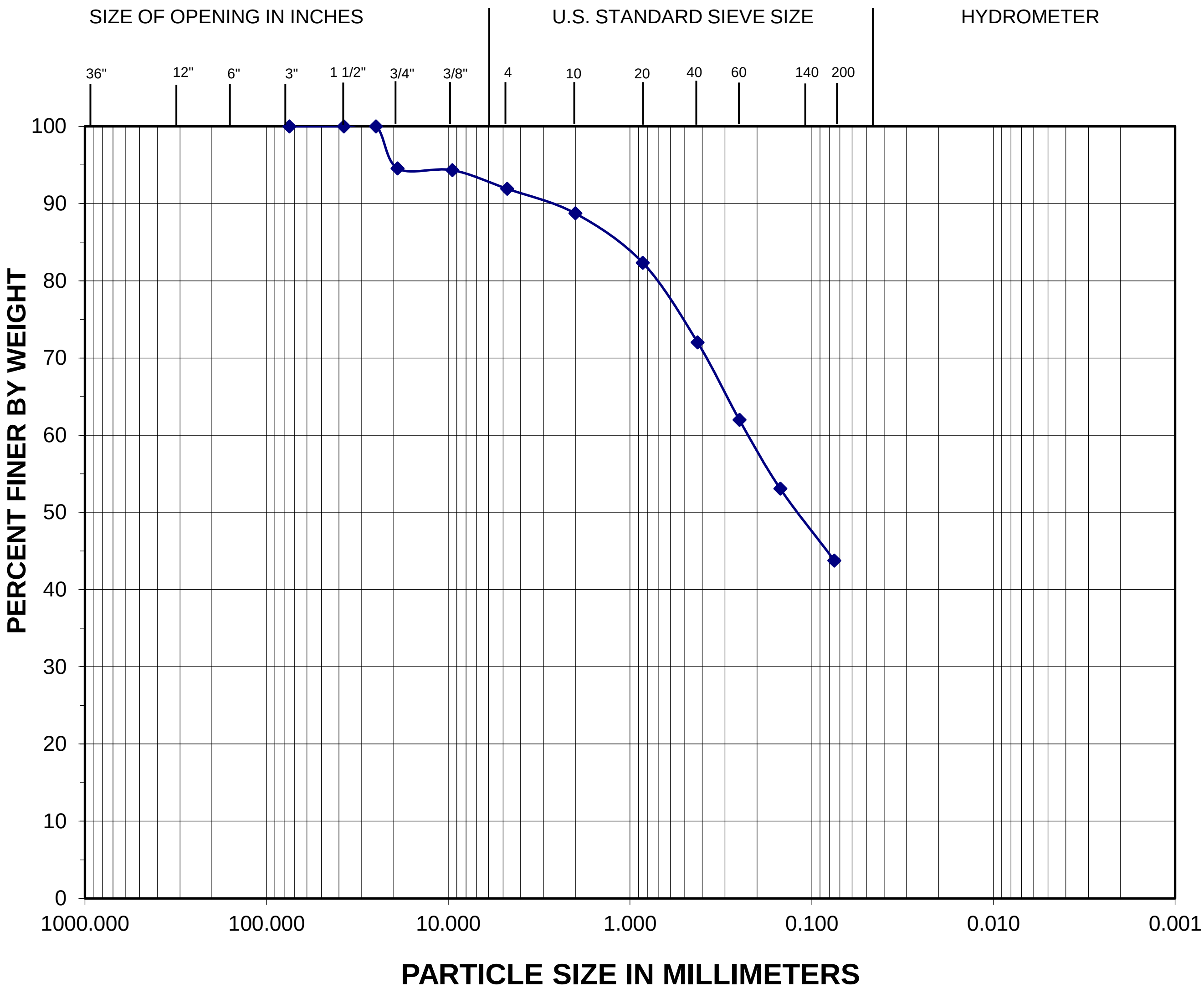
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
TP-05	S-2	2.1	12.6	33.3	Silty SAND, some gravel

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2609.01 DATE OF TESTING: 7/7/2022	PROJECT NAME: south everett solar

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

Comments:

Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
TP-05	S-3	7	9.5	43.8	Silty SAND, some gravel

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2609.01 DATE OF TESTING: 7/7/2022	PROJECT NAME: South Everett Solar

Job No. 2609.01

Job Name South Everett Solar

Date Tested 7/7/2022

LABORATORY COMPACTION CURVE

Sample No. 70622

Location TP-1

Depth / Elevation 2 feet

Test Results

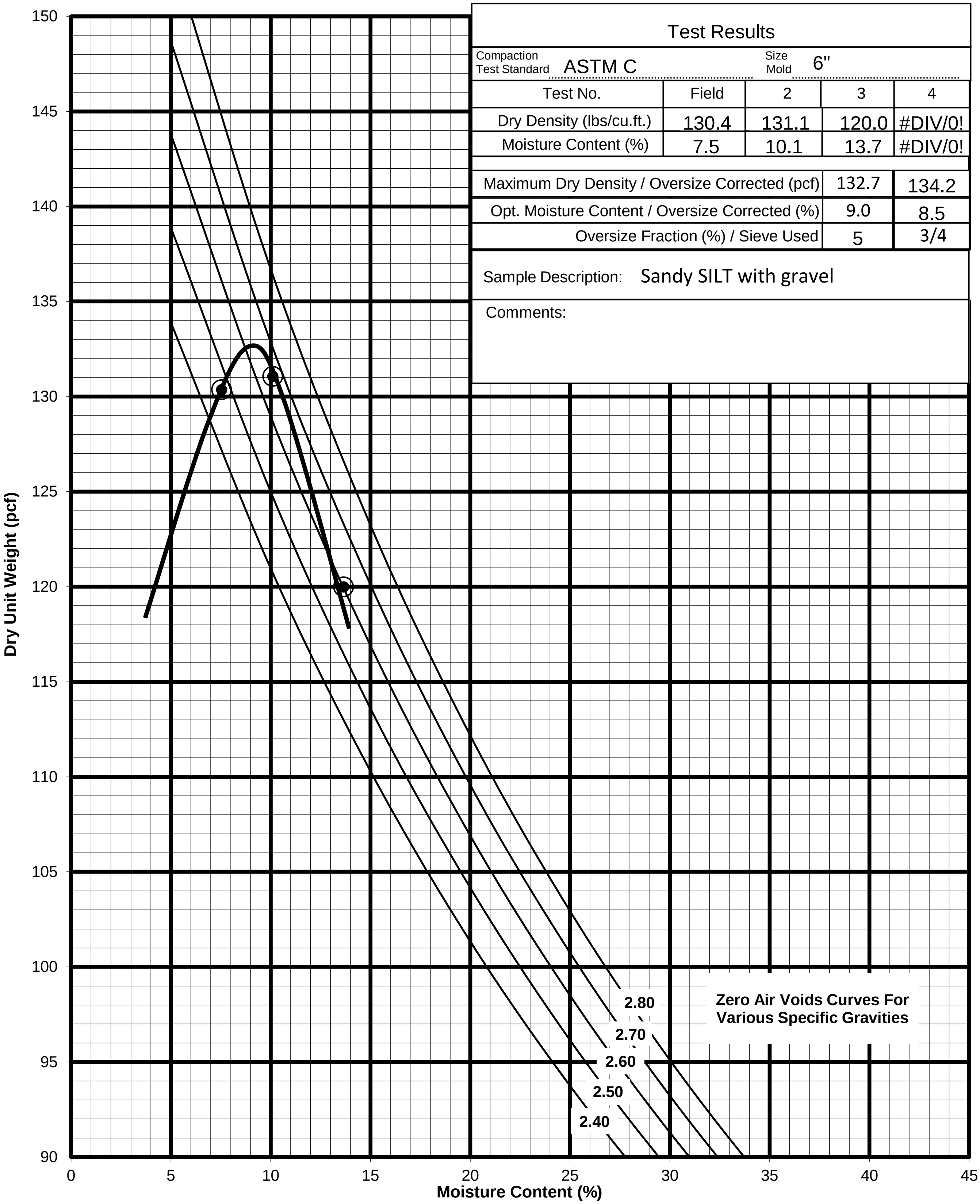
Compaction Test Standard: ASTM C   Size Mold: 6"

Test No.	Field	2	3	4
Dry Density (lbs/cu.ft.)	130.4	131.1	120.0	#DIV/0!
Moisture Content (%)	7.5	10.1	13.7	#DIV/0!

Maximum Dry Density / Oversize Corrected (pcf)	132.7	134.2
Opt. Moisture Content / Oversize Corrected (%)	9.0	8.5
Oversize Fraction (%) / Sieve Used	5	3/4

Sample Description: Sandy SILT with gravel

Comments:



August 5, 2022

INDUSTRIAL HYGIENE SERVICES
LABORATORY + MANAGEMENT + TRAINING

Justin Brooks
Zipper Geo Associates, LLC
19019 36th Avenue West, Suite E
Lynnwood, WA 98036

RE: Bulk Asbestos Fiber Analysis; NVL Batch # 2213769.00

Client Project: 2609 S Everett Solar
Location: Waiter Hall GC Everett, WA

Dear Mr. Brooks,

Enclosed please find test results for the 3 sample(s) submitted to our laboratory for analysis on 7/29/2022.

Examination of these samples was conducted for the presence of identifiable asbestos fibers using polarized light microscopy (PLM) with dispersion staining in accordance with **U. S. EPA 40 CFR Appendix E to Subpart E of Part 763**, Interim Method for the Determination of Asbestos in Bulk Insulation Samples and **EPA 600/R-93/116**, Method for the Determination of Asbestos in Bulk Building Materials.

For samples containing more than one separable layer of materials, the report will include findings for each layer (labeled Layer 1 and Layer 2, etc. for each individual layer). The asbestos concentration in the sample is determined by calibrated visual estimation.

For those samples with asbestos concentrations between 1 and 10 percent based on visual estimation, the EPA recommends a procedure known as point counting (NESHAPS, 40 CFR Part 61). Point counting is a statistically more accurate means of quantification for samples with low concentrations of asbestos.

The detection limit for the calibrated visual estimation is <1%, 400 point counts is 0.25% and 1000 point counts is 0.1%

Samples are archived for two weeks following analysis. Samples that are not retrieved by the client are discarded after two weeks.

Thank you for using our laboratory services. Please do not hesitate to call if there is anything further we can assist you with.

Sincerely,

Nick Ly, Technical Director

Testing

Lab Code: 102063-0

Enc.: Sample Results

Phone: 206 547.0100 | Fax: 206 634.1936 | Toll Free: 1.888.NVL.LABS (685.5227)
4708 Aurora Avenue North | Seattle, WA 98103-6516

Bulk Asbestos Fibers Analysis
By Polarized Light Microscopy

Client: Zipper Geo Associates, LLC
Address: 19019 36th Avenue West, Suite E
Lynnwood, WA 98036

Attention: Mr. Justin Brooks
Project Location: Waiter Hall GC Everett, WA

Batch #: 2213769.00
Client Project #: 2609 S Everett Solar
Date Received: 7/29/2022
Samples Received: 3
Samples Analyzed: 3
Method: EPA/600/R-93/116

Lab ID: 22385109 **Client Sample #: TP 2 S1-A**
Location: Waiter Hall GC Everett, WA
Comments: Qualitative analysis was conducted for the presence of asbestos fibers in this sample.
Layer 1 of 1 **Description:** Tan loose soil and debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Fine grains, Fine particles, Sand	Cellulose	**None Detected ND**
Organic debris		

Lab ID: 22385110 **Client Sample #: TP 03 S1**
Location: Waiter Hall GC Everett, WA
Comments: Qualitative analysis was conducted for the presence of asbestos fibers in this sample.
Layer 1 of 1 **Description:** Gray loose moist soil and debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Fine grains, Fine particles, Sand	Cellulose	**None Detected ND**
Organic debris		

Lab ID: 22385111 **Client Sample #: TP 03 S2**
Location: Waiter Hall GC Everett, WA
Layer 1 of 1 **Description:** Dark gray loose moist soil and debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Fine grains, Fine particles, Sand	Cellulose	**None Detected ND**
Organic debris		

Sampled by: Client
Analyzed by: Munaf Khan **Date:** 08/04/2022
Reviewed by: Nick Ly **Date:** 08/05/2022

Nick Ly, Technical Director

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector.

ASB-02

ASBESTOS LABORATORY SERVICES

NVL

Company	Zipper Geo Associates, LLC	**NVL Batch Number**	**2213769.00**
Address	19019 36th Avenue West, Suite E Lynnwood, WA 98036	**TAT**	5 Days **AH** No
		Rush TAT	
Project Manager	Mr. Justin Brooks	**Due Date**	8/5/2022 **Time** 1:00 PM
Phone	(425) 582-9928	**Email**	jbrooks@zippergeo.com
Cell	(813) 205-3481	**Fax**	(425) 582-9930

Project Name/Number: 2609 S Everett Solar **Project Location:** Waiter Hall GC Everett, WA

Subcategory PLM Bulk

Item Code ASB-02 EPA 600/R-93-116 Asbestos by PLM <bulk>

Total Number of Samples 3

Rush Samples

	Lab ID	Sample ID	Description	A/R
1	22385109	TP 2 S1-A		A
2	22385110	TP 03 S1		A
3	22385111	TP 03 S2		A

	Print Name	Signature	Company	Date	Time
Sampled by	Client				
Relinquished by	Client				

Office Use Only	Print Name	Signature	Company	Date	Time
Received by	Hilary Crumley		NVL	7/29/22	1300
Analyzed by	Munaf Khan		NVL	8/4/22	
Results Called by					
☐ **Faxed** ☐ **Emailed**					

Special Instructions:

Date: 7/29/2022
Time: 1:30 PM
Entered By: Kelly AuVu

2213769

NVL
INDUSTRIAL HYGIENE SERVICES
LABORATORY • MANAGEMENT • TRAINING

ASBESTOS CHAIN OF CUSTODY

Turn Around Time
- ☐ 1 Hour ☐ 24 Hours ☐ 4 Days
- ☐ 2 Hours ☐ 2 Days ☒ 5 Days
- ☐ 4 Hours ☐ 3 Days ☐ 10 Days

Please call for TAT less than 24 Hours

Company: Zipper GeoAssociates
Address: 19019 36th AVE W STE, Lynnwood, WA 98036
Phone: 813-205-3481

Project Manager: Justin L Brooks
Cell: (813) 205-3481
Email: JBrooks @ zipperGeo.com
Fax: ( ) -

Project Name/Number: 2609 S. Everett Solar | Project Location: Walter Hall GC EVERETT, WA

- ☐ PCM Air (NIOSH 7400)
- ☐ TEM (NIOSH 7402)
- ☐ TEM (AHERA)
- ☐ TEM (EPA Level II Modified)
- ☒ PLM (EPA 600/R-93-116)
- ☐ EPA 400 Points (600/R-93-116)
- ☐ EPA 1000Points (600/R-93-116)
- ☐ PLM Gravimetry (600/R-93-116)
- ☐ Asbestos in Vermiculite (EPA 600/R-04/004)
- ☐ Asbestos in Sediment (EPA 1900 Points)
- ☐ Asbestos Friable/Non-Friable (EPA 600/R-93/116)
- ☐ Other

Reporting Instructions
☐ Call ( ) - ☐ Fax ( ) - ☐ Email

Total Number of Samples ______

	Sample ID	Description	A/R
1	TP. 2 S1-A	0.5FT tan silty SAND FILL	
2	TP 03 S1	3FT red brown silty SAND FILL	
3	TP 03 S2	6 FT DARK BROWN sand w silt & organics	
4		FILL	
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

	Print Name	Signature	Company	Date	Time
Sampled by	Justin L Brooks	[signature]	Zipper GeoAssoc	7.6.22	1200
Relinquish by	Justin L Brooks	[signature]	Zipper GeoAssoc	7.29.22	1300

Office Use Only

	Print Name	Signature	Company	Date	Time
Received by	Hilary Cruz	[signature]	NL	7/29/22	1308
Analyzed by					
Called by					
Faxed/Email by					