Earth Solutions NW LLC

Geotechnical Engineering
Construction Observation/Testing
Environmental Services

GEOTECHNICAL ENGINEERING STUDY
PROPOSED CHEBUHAR SUBDIVISION
19785 – 137TH STREET SOUTHEAST
MONROE, WASHINGTON

ES-7734

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PREPARED FOR

PROSPECT DEVELOPMENT, LLC

April 23, 2021

Scott S. Riegel, L.G., L.E.G.
Senior Project Manager

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REGISTERED
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04/23/2021

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Principal Engineer

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Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
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Earth Solutions NW LLC
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

April 23, 2021
ES-7734

Prospect Development, LLC
2913 – 5th Avenue Northeast, Suite 201
Puyallup, Washington 98372

Attention: Mr. Justin Holland

Dear Mr. Holland:

Earth Solutions NW, LLC (ESNW) is pleased to present this report that supports the current project. Based on the results of our investigation, construction of the proposed residential subdivision is feasible from a geotechnical standpoint. Our study indicates the site is underlain primarily by medium dense to very dense glacial till deposits and shallow persistent perched groundwater is present across much of the site.

In general, the proposed residences may be supported on conventional continuous and spread footing foundations bearing on competent native soil, recompacted native soil, or new structural fill placed directly on competent native soil. Because no design details were available at the time of this report, ESNW should review the project details to confirm the recommendations in this report are applicable. In general, competent native soil, suitable for support of the new foundations, will likely be encountered beginning at depths of about two to four feet below the existing ground surface. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of soils to the specifications of structural fill, or overexcavation and replacement with suitable structural fill, will be necessary.

Infiltration on this site is not feasible from a geotechnical standpoint due, in part, to the variable but low infiltration capacity of the native soil deposits and relatively persistent shallow groundwater seepage.

We appreciate the opportunity to be of service to you on this project. If you have questions regarding the content of this geotechnical engineering study, please contact us.

Sincerely,

EARTH SOLUTIONS NW, LLC

Scott S. Riegel, L.G., L.E.G.
Senior Project Manager

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GEOTECHNICAL ENGINEERING STUDY
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INTRODUCTION

General

This geotechnical engineering study (study) was prepared for the proposed residential development to be constructed off the western terminus of 137th Street Southeast in Monroe, Washington. The purpose of this study was to develop geotechnical recommendations for the proposed project. The scope of services for completing this study included the following:

- Subsurface exploration consisting of test pit excavations;
- Laboratory testing of soil samples collected at the test pit locations;
- Engineering analyses and recommendations for the proposed development, and;
- Preparation of this report.

The following documents and maps were reviewed as part of preparing this study:

- Conceptual Site Plan undated;
- Geologic map of the Lake Roesiger 7.5-minute quadrangle, Snohomish County, Washington;
- Monroe Municipal Code Title 22 – Unified Development Regulations, and;
- Web Soil Survey (WSS), provided by the United States Department of Agriculture (USDA), Natural Resources Conservation Service.

Project Description

We understand the overall subject site will be developed with 33 detached residential lots, an access roadway, stormwater detention tract and utility improvements. Perimeter footing loads will likely be on the order of 1 to 2 kips per lineal foot. Slab-on-grade loading is anticipated to be approximately 150 pounds per square foot (psf). Based on existing grades, we anticipate mass grading activities will include cuts and fills of up to about five to eight feet. Landscape retaining walls may be used to accommodate grade transitions on some lots.

We understand stormwater will be conveyed to a storm tract delineated in the southeastern corner of the site on the referenced site plan. Typical vault excavations exceed 10 feet; however, plans were not provided to us for review at the time of this report.

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations provided in this report. ESNW should review final designs to confirm that our geotechnical recommendations have been incorporated into the plans.

SITE CONDITIONS

Surface

The subject site is located off the western terminus of 137th Street Southeast, roughly situated between 136th Place Southeast and Rainier View Road Southeast in Monroe, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map). The site consists of a single tax parcel (Snohomish County Parcel Number 28073100203800) about eight acres in size. The property is occupied by a residence and associated improvements. The site topography descends gently to the south and vegetation consists primarily of general landscaping and sparse trees.

Subsurface

A representative of ESNW observed, logged, and sampled six test pits excavated across the overall project area, on February 5, 2021 using a mini-trackhoe and operator provided by the client. The test pits were completed for purposes of assessing soil conditions, classifying site soils, and characterizing near-surface groundwater conditions within the overall development area. The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the test pit logs provided in Appendix A for a more detailed description of subsurface conditions. Representative soil samples collected at the test pit locations were analyzed in general accordance with Unified Soil Classification System (USCS) and USDA methods and procedures.

Topsoil and Fill

Topsoil generally extended to a depth of six inches below the existing ground surface (bgs). The topsoil was characterized by the observed dark brown color, the presence of fine organics, and root intrusions extending into the shallow, weathered soils.

Fill was encountered during our exploration at test pit location TP-1 that consisted of a loose silty sand with gravel (USCS: SM) extending to a depth of about three feet bgs and contained scattered debris. The relic topsoil layer was observed at the base of the fill. Fill is likely present near the existing development areas of the site as well.

Native Soil

Underlying topsoil, native soils encountered on the subject site were consisting primarily of silty sand with gravel (USCS: SM) and silty gravel with sand (USCS: GM) with scattered cobbles. A layer of sandy gravel (USCS: GP-GM) was encountered at test pit location TP-3 that began about five feet bgs and persisted to the termination depth of 11 feet bgs.

Native soils were encountered in a medium dense to dense condition beginning at about two to four feet bgs. Soils were observed to be in a moist to wet condition across the majority of the site to a maximum exploration depth of 11 feet bgs, which was the maximum depth afforded by the excavator.

Geologic Setting

The referenced geologic map resource identifies glacial till (Qtvg) deposits as the primary geologic unit underlying the site and surrounding areas. As reported on the geologic map resource, Vashon subglacial till consists primarily of a non-sorted mixture of silt, sand, and sub-rounded to well-rounded gravels, commonly referred to as “hardpan.” The till was deposited directly from the glacier as it advanced over bedrock and older Quaternary sediment.

The referenced WSS resource identifies Tokul gravelly medial loam (Map Unit Symbol: 72) across the majority of the site. Tokul series soils formed in glacial till.

Based on our field observations, on site soils generally correlate with glacial till deposits.

Groundwater

During our subsurface exploration completed on February 2021, groundwater seepage was encountered at the majority of the test pit locations. The groundwater flows were field characterized as moderate to heavy flows with emergent depths ranging from about two to six feet bgs. In general, groundwater flow rates and elevations are higher during the winter, spring, and early summer months. In our opinion, an interceptor trench drain system may be warranted along the up-slope perimeter of the project area to help mitigate or otherwise control shallow perched groundwater flows.

GEOLOGICALLY HAZARDOUS AREAS

Based on our review of the referenced plan, our site exploration and Monroe Municipal Code Title 22 – Unified Development Regulations, there are no geologic hazard areas (erosion, landslide, seismic, or mine hazards) on or within 300 feet of the subject site. Standard development BMPs may be used for this site development plans.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our investigation, construction of the proposed single-family residences is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include site grading, foundation support, slab-on-grade subgrade support, the suitability of using on-site soils as structural fill, and drainage.

The proposed residences can be supported on conventional continuous and spread footing foundations bearing on competent native soil, recompacted native soil, or new structural fill placed directly on competent native soil. In general, competent native soil, suitable for support of the new foundations, will likely be encountered beginning at depths of about two to four feet bgs. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of soils to the specifications of structural fill, or overexcavation and replacement with suitable structural fill, will be necessary. ESNW should review the proposed plans to confirm the recommendations in this report remain applicable.

Due to the low infiltration capacity of site soils, infiltration is not recommended for this project.

This study has been prepared for the exclusive use of Prospect Development, LLC, and their representatives. A warranty is neither expressed nor implied. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

Site Preparation and Earthwork

Initial site preparation activities will consist of installing temporary erosion control measures, establishing grading limits, removing structural improvements, and clearing and stripping the site. Subsequent earthwork activities will involve site grading and related infrastructure improvements.

Temporary Erosion Control

The following temporary erosion control measures are offered:

- Temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls, should be considered to both minimize off-site soil tracking and provide a stable access entrance surface. Placing geotextile fabric underneath the quarry spalls will provide greater stability, if needed.
- Silt fencing should be placed around the site perimeter.
- When not actively graded, soil stockpiles should be covered or otherwise protected.
- Temporary measures for controlling surface water runoff, such as interceptor trenches, sumps, or swales, should be installed prior to beginning earthwork activities.
- Dry soils disturbed during construction should be wetted to minimize dust and airborne soil erosion.

Additional Best Management Practices (BMPs), as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities. Temporary erosion control measures should be actively managed and may be modified during construction as site conditions require, to ensure proper performance.

Stripping

Topsoil was generally encountered within the upper approximately six inches at the test pit locations. The organic-rich topsoil should be stripped and segregated into a stockpile for later use on site or to haul off site. The material remaining immediately below the topsoil may have some root zones and will likely be variable in composition, density, and/or moisture content. The material exposed after initial topsoil stripping will likely not be suitable for direct structural support as is and will likely need to be compacted in place or stripped and stockpiled for reuse as fill; depending on the time of year stripping occurs, the soil exposed below the topsoil may be too wet to compact and may need to be aerated or treated. ESNW should observe initial stripping activities to provide recommendations regarding stripping depths and material suitability.

Excavations and Slopes

Based on the soil conditions observed at the subsurface exploration locations, the maximum allowable temporary slope inclinations provided below may be used. The applicable Federal Occupation Safety and Health Administration and Washington Industrial Safety and Health Act soil classifications are also provided.

- Areas exposing groundwater seepage 1.5H:1V (Type C)
- Loose soil; fill 1.5H:1V (Type C)
- Medium dense to dense native soil 1H:1V (Type B)

Permanent slopes should maintain a gradient of 2H:1V or flatter and should be planted with vegetation to both enhance stability and minimize erosion. The presence of perched groundwater may cause localized sloughing of temporary slopes. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions and to provide additional excavation and slope recommendations as necessary. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations.

In-situ and Imported Soils

The soils encountered during our subsurface exploration have a high sensitivity to moisture and were generally in a moist to wet condition at the time of the exploration (February 2021). The native soils on this site are not suitable for use as structural fill unless the moisture content is at or slightly above optimum (about 2 percent) at the time of placement and compaction. Exposed soils will degrade rapidly if exposed to wet weather and/or construction traffic. In general, soils encountered during site excavations that are excessively over the optimum moisture content will require aeration or treatment prior to placement and compaction. Conversely, soils that are substantially below the optimum moisture content will require moisture conditioning through the addition of water prior to use as structural fill. An ESNW representative should determine the suitability of in-situ soils for use as structural fill at the time of construction.

Imported soil intended for use as structural fill should consist of a well-graded, granular soil with a moisture content that is at (or slightly above) the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Wet-Season Grading

Because the site soils are highly sensitive to moisture, grading during the rainy season or when the soils are over the optimum moisture content will be very difficult. If grading takes place during the winter, spring, or early summer months, a contingency in the project budget should be included to allow for export of native soil and import of structural fill.

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, roadway, permanent slope, retaining wall, utility trench, and vault backfill areas. Soils placed in structural areas should consist of a granular material devoid of deleterious debris and organics, placed in loose lifts of 12 inches or less and compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D-1557).

Foundations

The proposed residential structures may be supported on conventional spread and continuous footings bearing on competent native soil, recompacted native soil, or new structural fill placed directly on competent native soil. In general, competent native soil suitable for the support of foundations will likely be encountered at depths of about two to four feet bgs. ESNW should evaluate the design subgrade conditions to confirm suitable conditions are exposed and to provide additional preparation recommendations, where necessary. Where loose, organic, or otherwise unsuitable soil conditions are observed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with granular structural fill, will likely be necessary.

Provided the structures will be supported as described above, the following parameters can be used for design of the new foundations:

- Allowable soil bearing capacity 2,500 psf
- Passive earth pressure 300 pcf (equivalent fluid)
- Coefficient of friction 0.40

The passive earth pressure and coefficient of friction values include a safety factor of 1.5. A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. With structural loading as expected, total settlement in the range of 1 inch is anticipated, with differential settlement of about 0.5 inch. The majority of settlement should occur during construction, as dead loads are applied.

Seismic Design

The 2015 International Building Code recognizes the American Society of Civil Engineers (ASCE) for seismic site class definitions. In accordance with Table 20.3-1 of the ASCE Minimum Design Loads for Buildings and Other Structures manual, Site Class D should be used for design. While the explorations were limited to the upper approximately eight feet across the site, dense glacial till deposits were identified. This geologic deposit is dense and is underlain by a sequence of similar deposits. On this basis, the exploration completed on this site adequately characterizes the depositional environment to support this seismic site class.

Please note that if this project will adhere to 2018 IBC design guidelines, due to updated site class characterization requirements, additional coordination with the structural engineer and potential additional work may be required to fully comply with the code requirements. On this basis, the Seismic Site Class D may be considered a preliminary classification.

Liquefaction is a phenomenon where saturated or loose soils suddenly lose internal strength and behave as a fluid. This behavior is in response to soil grain contraction and increased pore water pressures resulting from an earthquake or other intense ground shaking. In our opinion, the site soils would exhibit a low risk of susceptibility to liquefaction. The relative density of native soils and lack of a shallow groundwater table is the primary basis for this opinion.

Slab-on-Grade Floors

Slab-on-grade floors should be supported on a firm and unyielding subgrade consisting of competent native soil or new structural fill. Unstable or yielding areas of the subgrade should be recompacted or overexcavated and replaced with suitable structural fill prior to construction of the slab. A capillary break, consisting of a minimum of four inches of free-draining crushed rock or gravel, should be placed below the slab. The free-draining material should have a fines content of 5 percent or less defined as the percent passing the number 200 sieve based on the minus three-quarters inch fraction. In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If used, the vapor barrier should consist of a material specifically designed to function as a vapor barrier and should be installed in accordance with the manufacturer's specifications.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for design:

- Active earth pressure (unrestrained condition) — 35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 55 pcf
- Traffic surcharge (passenger vehicles) — 70 psf (rectangular distribution) *
- Passive earth pressure — 300 pcf (equivalent fluid)
- Coefficient of friction — 0.40
- Seismic surcharge — 8H psf**

* *Where applicable*
** *Where H equals the retained height (in feet)*

The above design parameters are based on a level backfill condition and level grade at the wall toe. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other relevant loads should be included in the retaining wall design, where applicable. A safety factor of 1.5 is included in the passive earth pressure and coefficient of friction values.

Retaining walls should be backfilled with free-draining material or suitable sheet drainage that extends along the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill can consist of a less permeable soil, if desired. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Landscape Retaining Walls

Based on the existing site grades, retaining walls may be used along the western portions of the lots to raise grades for new building pads. Final wall heights, alignments and facing materials have not been determined at the time of this report. Walls over four feet in total height, including toe embedment will require building permits supported by an engineered design. ESNW can prepare and engineered retaining wall design, upon request. ESNW should review the final grading plans to confirm the recommendations are incorporated and to provide additional recommendations where appropriate.

Drainage

Groundwater seepage was encountered at the majority of the test pit locations during our exploration; as such, groundwater seepage will likely be encountered within site excavations, particularly utility trenches and deeper excavations such as detention vault/pond areas. Temporary measures to control surface water runoff and groundwater during construction would likely involve passive elements, such as interceptor trenches and sumps. ESNW should be consulted during preliminary grading to identify areas of groundwater and to provide recommendations to reduce the potential for instability related to groundwater effects. Depending on the flow volumes encountered during grading, an interceptor trench drain system may be warranted along the up-slope perimeter of the work area to help mitigate or otherwise control shallow perched groundwater flows. We recommend conducting additional test pits under the observation of ESNW during the stripping process to further characterize the groundwater conditions on this site.

Finish grades must be designed to direct surface water away from the new structures and/or slopes for a distance of at least 10 feet or as setbacks allow. Water must not be allowed to pond adjacent to the new structures and/or slopes. A typical foundation drain detail is provided on Plate 4.

Preliminary Stormwater Vault Design Recommendations

Detention vault foundations should be supported on competent native soil or crushed rock placed directly on a competent native subgrade. Final stormwater vault designs must incorporate adequate space from property boundaries such that temporary excavations to construct the vault structure can be successfully completed or shoring will be required. Perimeter drains should be installed around the vault and conveyed to an approved discharge point. The presence of perched groundwater seepage should be anticipated during excavation activities for the vault.

The following parameters can be used for preliminary stormwater vault design:

- Allowable soil bearing capacity (dense native soil) 5,000 psf
- Active earth pressure 35 pcf
- Active earth pressure (hydrostatic) 80 pcf
- At-rest earth pressure (restrained) 55 pcf
- At-rest earth pressure (restrained, hydrostatic) 100 pcf
- Coefficient of friction 0.40
- Passive earth pressure 300 pcf
- Seismic surcharge 8H*

** Where H equals the retained height.*

Vault walls must be backfilled with at least 18 inches of free-draining material or suitable sheet drainage that extends along the height of the walls. The upper one foot of the wall backfill can consist of a less permeable soil, if desired. A perforated drain pipe should be placed along the base of the vault wall and connected to an approved discharge location. If the elevation of the vault bottom is such that gravity flow to an outlet is not possible, the portion of the vault below the drain should be designed to include hydrostatic pressure. Design values accounting for hydrostatic pressure are included above.

ESNW should observe grading operations for the vault and the subgrade conditions prior to concrete forming and pouring to confirm conditions are as anticipated, and to provide supplemental recommendations as necessary. Additionally, ESNW should be contacted to review final vault designs to confirm that appropriate geotechnical parameters have been incorporated.

Utility Support and Trench Backfill

The native soils observed at the test pit locations are generally suitable for support of utilities; however, the native soils may not be suitable for use as structural backfill in the utility trench excavations unless the soil is at or near the optimum moisture content at the time of placement and compaction. Moisture conditioning or cement treatment of the soils may be necessary at some locations prior to use as structural fill. If utility backfill occurs during wet weather, cement treatment of native soils or import of a suitable material will be necessary. Utility trench backfill should be placed and compacted to the specifications of structural fill provided in this report, or to the applicable requirements of presiding jurisdiction.

Preliminary Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications detailed in the *Site Preparation and Earthwork* section of this report. It is possible that soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas of unsuitable or yielding subgrade conditions may require remedial measures such as overexcavation and replacement with structural fill or thicker crushed rock sections prior to pavement. Cement treatment of the subgrade soil can also be considered for stabilizing pavement subgrade areas.

For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

- A minimum of two inches of hot mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;

- A minimum of two inches of HMA placed over three inches of asphalt treated base (ATB).

Heavier traffic areas generally require thicker pavement sections depending on site usage, pavement life expectancy, and site traffic. For preliminary design purposes, the following pavement sections for occasional truck traffic areas may be considered:

- Three inches of HMA placed over six inches of crushed rock base (CRB), or;

- Three inches of HMA placed over four-and-one-half inches of ATB.

The HMA, CRB and ATB materials should conform to WSDOT specifications. While the pavement sections above will provide an adequate level of service for the traffic types and loading estimates, the city of Monroe minimum pavement requirements supersede our recommendations and may require thicker pavement sections.

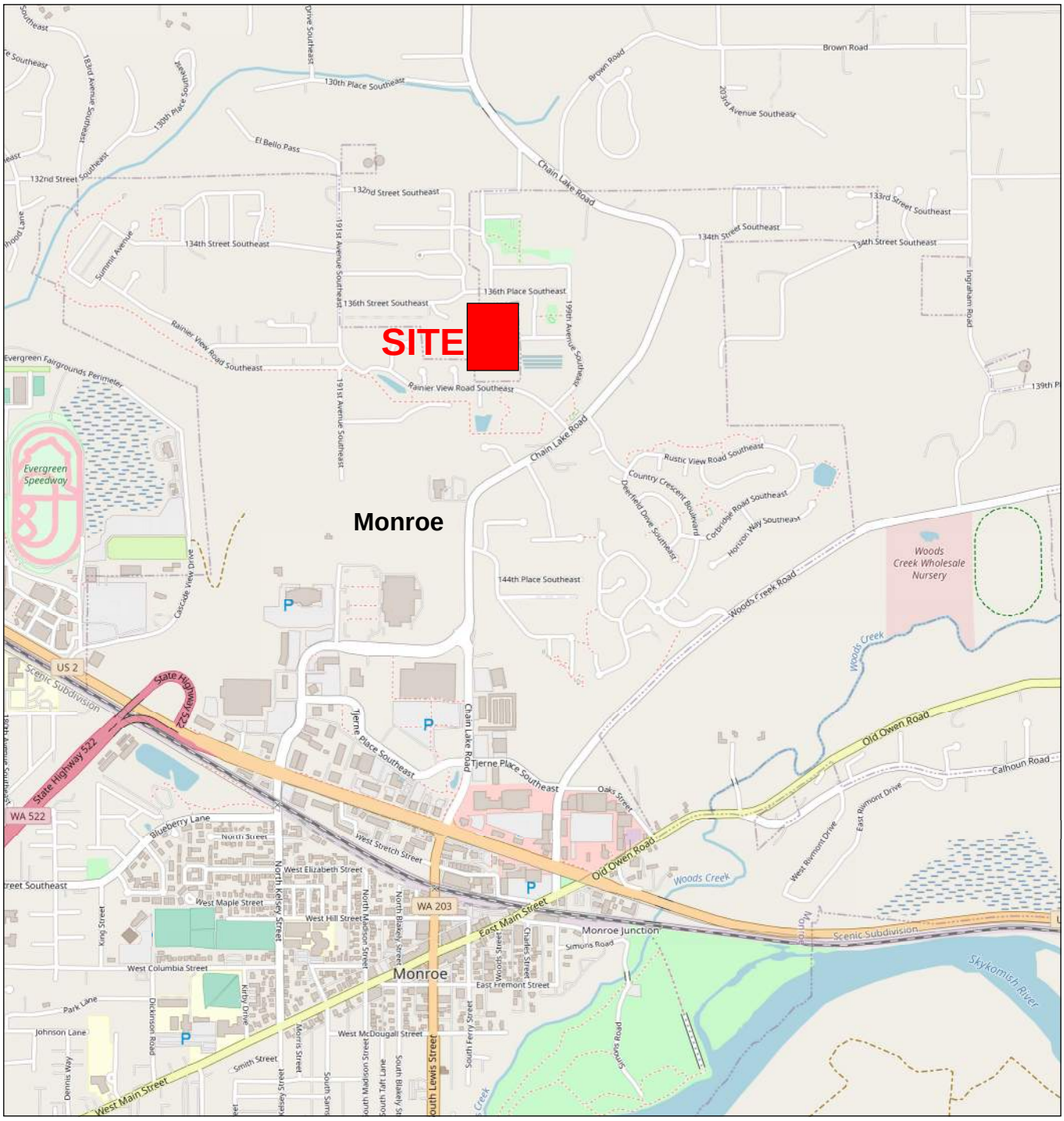
If pavement areas will include a reverse crown or if groundwater seepage is exposed at subgrade elevations, additional drainage should be used to effectively convey water that may enter the subgrade toward the storm drainage system. ESNW can provide recommendations for subgrade drainage upon request.

LIMITATIONS

The recommendations and conclusions provided in this study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is neither expressed nor implied. Variations in the soil and groundwater conditions observed at the test locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this study if variations are encountered.

Additional Services

ESNW should have an opportunity to review final project plans with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services during construction.



Reference:
Snohomish County, Washington
OpenStreetMap.org

NORTH

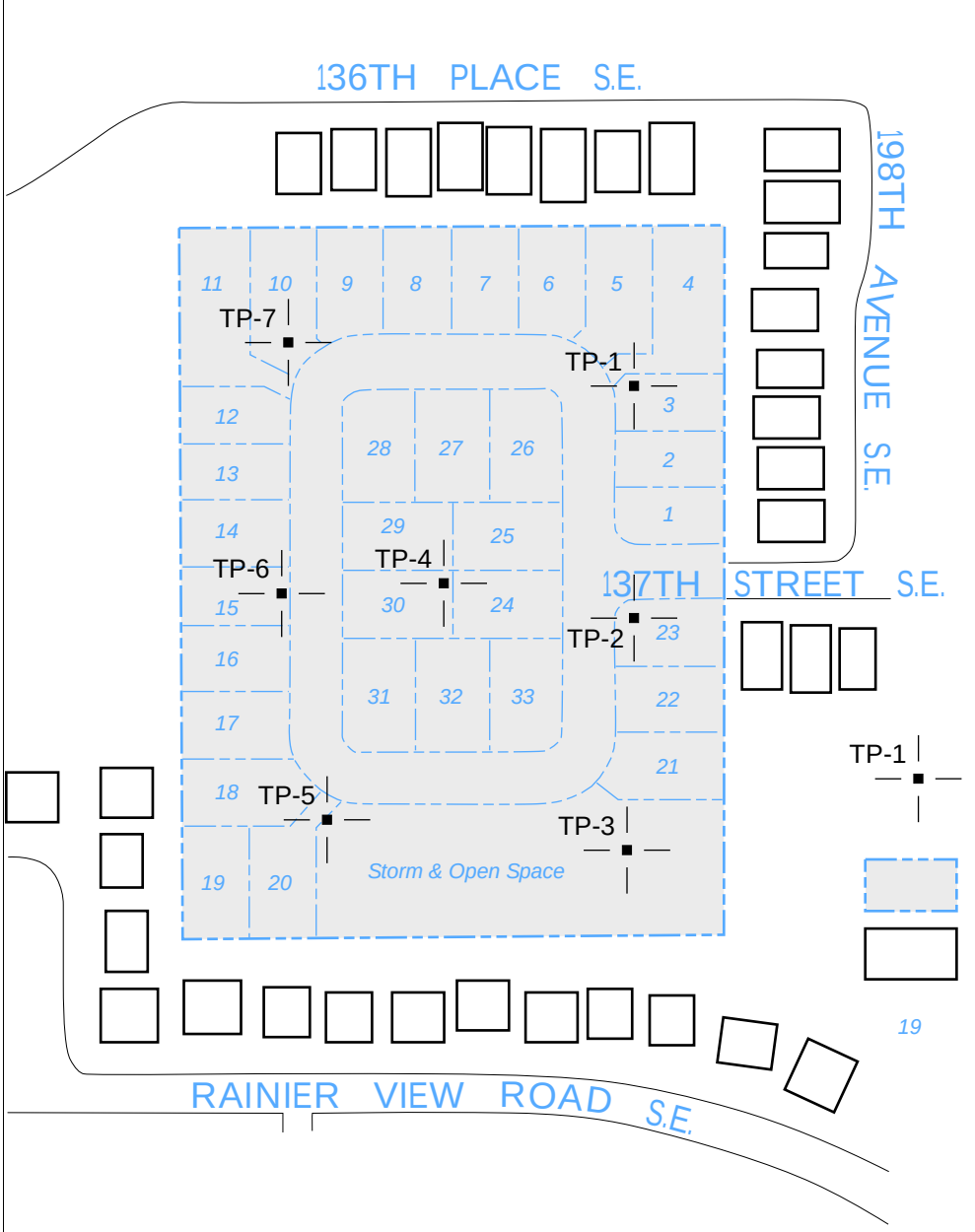
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Chebuhar Short Plat
Monroe, Washington

Drwn. CAM	Date 04/14/2021	Proj. No. 7734
Checked SSR	Date Apr. 2021	Plate 1



NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

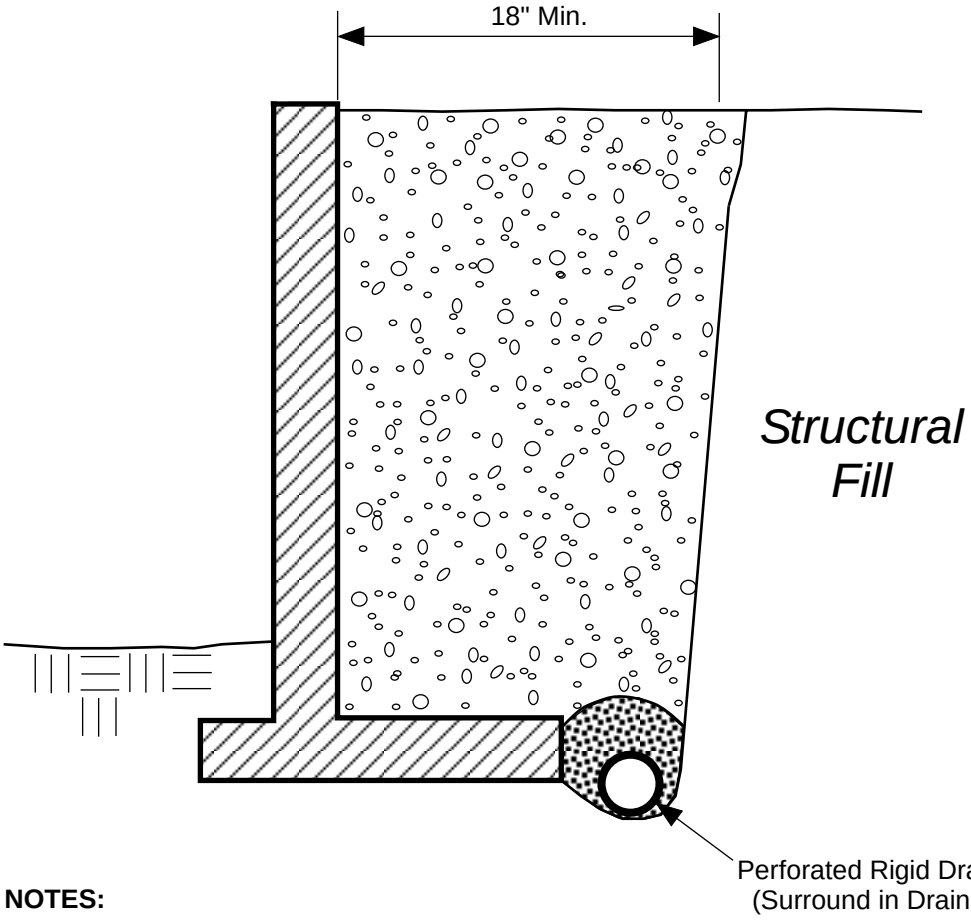
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Test Pit Location Plan
Chebuhar Short Plat
Monroe, Washington

Drwn. CAM	Date 04/14/2021	Proj. No. 7734
Checked SSR	Date Apr. 2021	Plate 2



NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

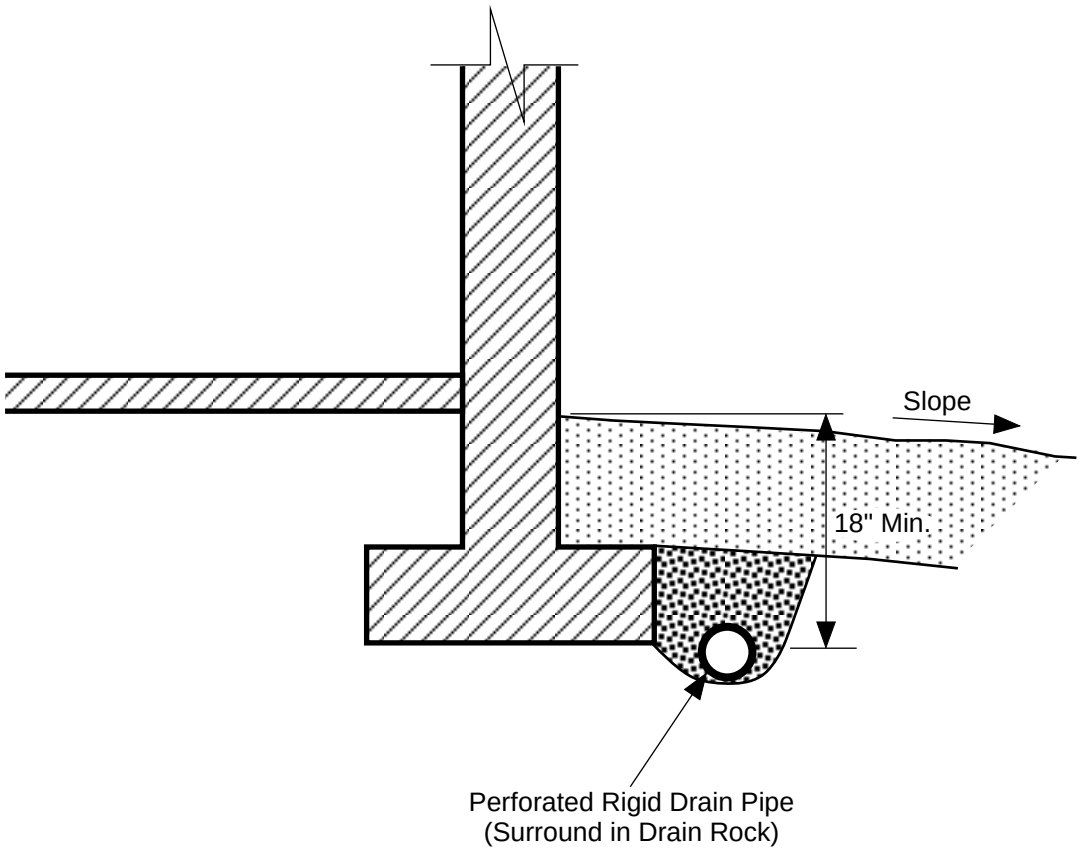
Free-draining Structural Backfill

1-inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Retaining Wall Drainage Detail
Chebuhar Short Plat
Monroe, Washington

Drwn. CAM	Date 04/14/2021	Proj. No. 7734
Checked SSR	Date Apr. 2021	Plate 3



NOTES:

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Footing Drain Detail
Chebuhar Short Plat
Monroe, Washington

Drwn. CAM	Date 04/14/2021	Proj. No. 7734
Checked SSR	Date Apr. 2021	Plate 4

Appendix A

Subsurface Exploration
Test Pit Logs

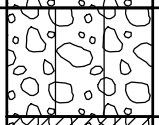
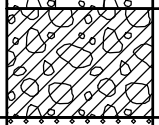
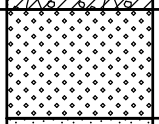
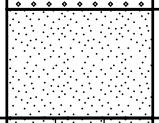
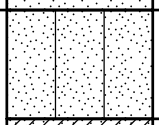
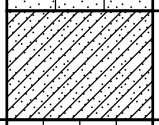
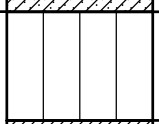
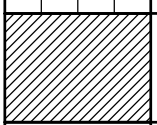
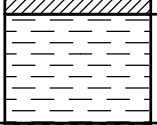
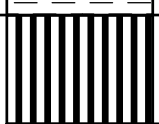
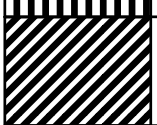
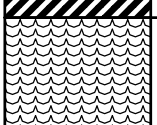
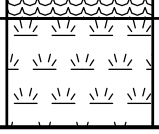
ES-7734

Subsurface conditions at the subject site were explored on February 5, 2021 by excavating seven test pits using a mini-trackhoe and operator provided by the client. The approximate locations test pits are illustrated on Plate 2 of this study. The test pit logs are provided in this Appendix. The maximum exploration depth was approximately 11 feet bgs and were terminated in firm native soils.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

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

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

PROJECT NUMBER ES-7734 **PROJECT NAME** Chebuhar Short Plat

DATE STARTED 2/5/21 **COMPLETED** 2/5/21 **GROUND ELEVATION** _____ **TEST PIT SIZE** _____

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD _____ **AT TIME OF EXCAVATION** ---

LOGGED BY SES **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Surface Conditions: grass on fill **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND with gravel, medium dense, moist (Fill)
					-asphalt chunks in upper 1'
					-topsoil horizon at 3'
				3.0	
		MC = 10.5% Fines = 20.1%			Brown silty SAND with gravel, medium dense, wet
					-moderate groundwater seepage
					-becomes gray, dense to very dense [USDA Classification: very gravelly coarse sandy LOAM]
5			SM		-becomes very dense
		MC = 7.5%		8.5	

Test pit terminated at 8.5 feet below existing grade. Groundwater seepage encountered at 3.5 feet during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-2

PROJECT NUMBER ES-7734 **PROJECT NAME** Chebuhar Short Plat

DATE STARTED 2/5/21 **COMPLETED** 2/5/21 **GROUND ELEVATION** _____ **TEST PIT SIZE** _____

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD _____ **AT TIME OF EXCAVATION** ---

LOGGED BY SES **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 6": grass **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, minimal root intrusions
				0.5	Brown silty SAND with gravel, medium dense, damp
			SM		-moderate groundwater seepage -becomes gray, very dense, moist
5				5.0	Gray silty GRAVEL with sand, very dense, damp
			GM		
		MC = 7.3% Fines = 12.9%		9.0	[USDA Classification: extremely gravelly coarse sandy LOAM]
					Test pit terminated at 9.0 feet below existing grade. Groundwater seepage encountered at 2.0 feet during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-3

PROJECT NUMBER ES-7734 **PROJECT NAME** Chebuhar Short Plat

DATE STARTED 2/5/21 **COMPLETED** 2/5/21 **GROUND ELEVATION** _____ **TEST PIT SIZE** _____

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD _____ **AT TIME OF EXCAVATION** ---

LOGGED BY SES **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 6": grass **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL
				0.5	Brown silty SAND with gravel, medium dense, wet
		MC = 54.7%	SM		-minor groundwater seepage
					-becomes gray, very dense, moist
5				5.0	
					Gray poorly graded GRAVEL with silt and sand, very dense, damp
					-minor caving to BOH
		MC = 9.2%	GP-GM		
10					
		MC = 5.8%		11.0	[USDA Classification: extremely gravelly sandy LOAM]
		Fines = 7.7%			

Test pit terminated at 11.0 feet below existing grade. Groundwater seepage encountered at 2.5 feet during excavation. Caving observed from 5.0 feet to BOH.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-4

PROJECT NUMBER ES-7734 **PROJECT NAME** Chebuhar Short Plat

DATE STARTED 2/5/21 **COMPLETED** 2/5/21 **GROUND ELEVATION** _____ **TEST PIT SIZE** _____

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD _____ **AT TIME OF EXCAVATION** ---

LOGGED BY SES **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 6": grass **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, minimal root intrusions
				0.5	Brown silty SAND with gravel, medium dense, damp
					-minor groundwater seepage
					-becomes gray, very dense, moist
5			SM		
		MC = 9.6%		8.5	

Test pit terminated at 8.5 feet below existing grade. Groundwater seepage encountered at 2.0 feet during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-5

PROJECT NUMBER ES-7734 **PROJECT NAME** Chebuhar Short Plat

DATE STARTED 2/5/21 **COMPLETED** 2/5/21 **GROUND ELEVATION** _____ **TEST PIT SIZE** _____

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD _____ **AT TIME OF EXCAVATION** ---

LOGGED BY SES **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 6": grass **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, minimal root intrusions
			SM		Brown silty SAND with gravel, medium dense, wet
					-heavy groundwater seepage
					-becomes gray, dense
5		MC = 17.3%		5.0	

Test pit terminated at 5.0 feet below existing grade due to seepage. Groundwater seepage encountered at 3.0 feet during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-6

PROJECT NUMBER ES-7734 **PROJECT NAME** Chebuhar Short Plat

DATE STARTED 2/5/21 **COMPLETED** 2/5/21 **GROUND ELEVATION** _____ **TEST PIT SIZE** _____

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD _____ **AT TIME OF EXCAVATION** ---

LOGGED BY SES **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 6": grass **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, minimal root intrusions
0.5					Brown silty SAND with gravel, medium dense, wet
			SM		-heavy groundwater seepage
		MC = 41.4% Fines = 35.5%			[USDA Classification: gravelly LOAM]
3.5					Test pit terminated at 3.5 feet below existing grade due to heavy seepage. Groundwater seepage encountered at 2.0 feet during excavation. No caving observed.

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-7

PROJECT NUMBER ES-7734 **PROJECT NAME** Chebuhar Short Plat

DATE STARTED 2/5/21 **COMPLETED** 2/5/21 **GROUND ELEVATION** _____ **TEST PIT SIZE** _____

EXCAVATION CONTRACTOR Client Provided **GROUND WATER LEVELS:**

EXCAVATION METHOD _____ **AT TIME OF EXCAVATION** ---

LOGGED BY SES **CHECKED BY** SSR **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 6": grass **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, minimal root intrusions
				0.5	Brown silty SAND with gravel, medium dense, damp
		MC = 22.1%			-minor groundwater seepage
					-becomes gray, very dense
5			SM		
		MC = 9.4% Fines = 17.7%		9.0	[USDA Classification: very gravelly coarse sandy LOAM]
					Test pit terminated at 9.0 feet below existing grade. Groundwater seepage encountered at 1.5 feet during excavation. No caving observed.

Appendix B

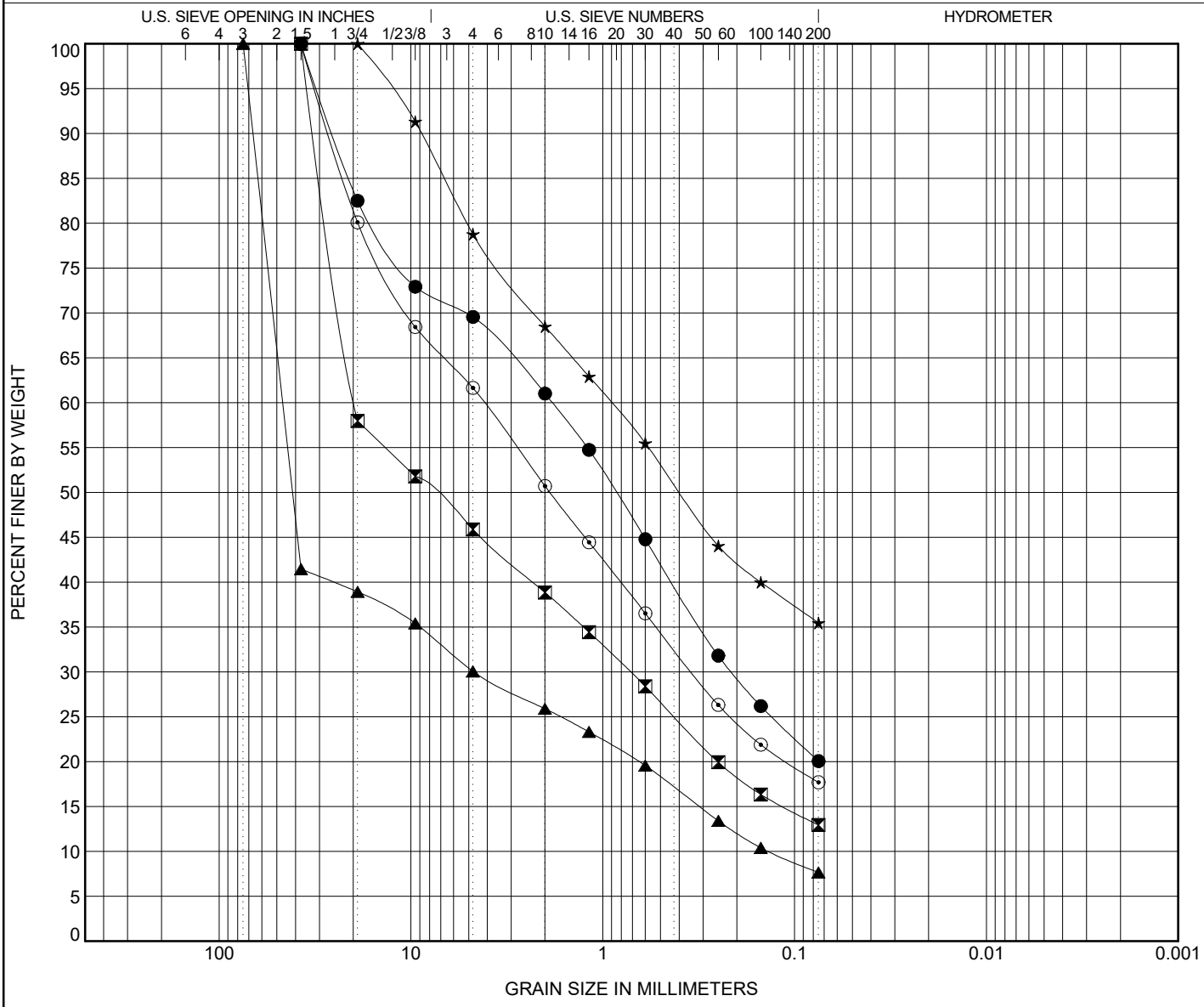
Laboratory Test Results

ES-7734

Earth Solutions NW, LLC
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-7734 **PROJECT NAME** Chebuhar Short Plat



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
●	TP-01	4.00ft.	USDA: Brown Very Gravelly Coarse Sandy Loam. USCS: SM with Gravel.		
⊠	TP-02	9.00ft.	USDA: Gray Extremely Gravelly Coarse Sandy Loam. USCS: GM with Sand.		
▲	TP-03	11.00ft.	USDA: Gray Extremely Gravelly Sandy Loam. USCS: GP-GM with Sand.	3.48	343.88
★	TP-06	3.50ft.	USDA: Brown Gravelly Loam. USCS: SM with Gravel.		
⊙	TP-07	9.00ft.	USDA: Brown Very Gravelly Coarse Sandy Loam. USCS: SM with Gravel.		

Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-01	4.0ft.	37.5	1.836	0.212					20.1	
⊠	TP-02	9.0ft.	37.5	19.63	0.719					12.9	
▲	TP-03	11.0ft.	75	46.707	4.696	0.136				7.7	
★	TP-06	3.5ft.	19	0.905						35.5	
⊙	TP-07	9.0ft.	37.5	4.172	0.343					17.7	

GRAIN SIZE USDA ES-7734 CHEBUHAR SHORT PLAT.GPJ GINT US LAB.GDT 2/19/21

Report Distribution

ES-7734

EMAIL ONLY

Prospect Development, LLC
2913 – 5th Avenue Northeast, Suite 201
Puyallup, Washington 98372

Attention: Mr. Justin Holland

EMAIL ONLY

Mr. Clay Loomis