Earth Solutions NW LLC

Geotechnical Engineering
Geology
Environmental Scientists
Construction Monitoring

GEOTECHNICAL ENGINEERING STUDY
GERMAINE KORUM CENTER
611 & 703 - 33rd STREET SOUTHEAST
PUYALLUP, WASHINGTON

ES-4960

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PREPARED FOR

STEP BY STEP FAMILY SUPPORT CENTER
c/o JEFF BROWN ARCHITECTURE

April 12, 2017

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Important Information About Your

Geotechnical Engineering Report

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

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

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

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

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

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

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

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of 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 equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

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April 12, 2017
ES-4960

Step by Step Family Support Center
c/o Jeff Brown Architecture
12181 C Street South
Tacoma, Washington 98444

Earth Solutions NW LLC

- Geotechnical Engineering
- Construction Monitoring
- Environmental Sciences

Attention: Mr. Jeff Brown

Dear Mr. Brown:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, Germaine Korum Center, 611 & 703 – 33rd Street Southeast, Puyallup, Washington". Based on the results of our investigation, the proposed development is feasible from a geotechnical standpoint. Our study indicates the site is underlain by alluvium (silty sand and poorly graded sand). During our subsurface exploration completed on February 28, 2017, groundwater was encountered at depths of approximately 3 to 12.5 feet below existing grades at the test pit locations.

Where necessary, new structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil, recompacted native soil, or new structural fill. In general, competent bearing soil for new foundations will likely be encountered within the upper three to five feet of existing grades.

Construction of the stormwater detention pond within the northern site area is feasible from a geotechnical standpoint, provided adequate separation between the facility base and the seasonal high groundwater table can be incorporated into final designs. Based on our February 2017 field observations, we estimate the seasonal high groundwater table elevation occurs at about five to eight feet below existing grades. If a definitive groundwater elevation(s) is required, completion of a groundwater-monitoring program, through at least one wet season, is recommended. Additionally, the need to install a pond liner should be anticipated. It is noted that, given the presence of both relatively shallow groundwater and impermeable soils, native soils are not feasible for infiltration from a geotechnical standpoint.

Recommendations for foundation design, site preparation, drainage, and other pertinent development aspects are provided in this study. 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 call.

Sincerely,

EARTH SOLUTIONS NW, LLC

Keven D. Hoffmann, P.E.
Senior Project Engineer

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GEOTECHNICAL ENGINEERING STUDY
GERMAINE KORUM CENTER
611 & 703 – 33RD STREET SOUTHEAST
PUYALLUP, WASHINGTON

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INTRODUCTION

General

This geotechnical engineering study (study) was prepared for the proposed development to be completed at 611 & 703 – 33rd Street Southeast in Puyallup, Washington. The purpose of this study was to provide geotechnical recommendations for currently proposed development plans. Our scope of services for completing this study included the following:

- Completing test pits for purposes of characterizing site soils;
- Completing laboratory testing of soil samples collected at the test pit locations;
- Conducting engineering analyses, and;
- Preparation of this report.

The following documents and maps were reviewed as part of our study preparation:

- Conceptual Site Plan, prepared by Jeff Brown Architecture, dated October 10, 2016;
- Boundary and Topographic Survey, prepared by Barghausen Consulting Engineers, Inc., dated October 10, 2016;
- Liquefaction Susceptibility for Pierce County, incorporating data from the Washington State Department of Natural Resources, September 2004;
- Surficial Geologic Map of the Lake Tapps Quadrangle, Washington, by D. R. Crandell, published 1963, and;
- Online Web Soil Survey (WSS) resource, provided by the United States Department of Agriculture (USDA), Natural Resources Conservation Service.

Project Description

We understand the proposed development will be comprised of several one- or two-story structures, two greenhouses, parking areas and drive lanes, and related infrastructure improvements. Many of the existing structures will be retained. Ingress and egress will be provided chiefly by 8th Avenue Southeast. Future, paved overflow parking may be constructed off-site, near the southeastern corner of the property. At the time of report submission, specific grading and building loading plans were not available for review; however, based on our experience with similar projects, the proposed structures will likely be two to three stories in height and constructed utilizing relatively lightly loaded wood framing supported on conventional foundations. Perimeter footing loads will likely be 1 to 2 kips per lineal foot (klf). Slab-on-grade loading is anticipated to be approximately 150 pounds per square foot (psf).

Based on existing topographic relief across the site, we estimate grade cuts and fills of about 5 to 10 feet may be necessary to establish finish grades for the proposed improvements. We understand stormwater runoff will be managed primarily by a detention pond (pond) located within the northern site area.

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 been incorporated into the plans.

SITE CONDITIONS

Surface

The subject site is located on the northeast corner of the intersection between 33rd Street Southeast and 8th Avenue Southeast in Puyallup, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map). The property is comprised of two adjoining tax parcels (Pierce County Parcel Nos. 042025-3070 and -3071) totaling about 6.25 acres.

The site is bordered to the north and east by open farmland, to the south by 8th Avenue Southeast, and the west by 33rd Street Southeast. The Van Lierop Bulb Farm currently occupies the site and is comprised of a single-family residence, several outbuildings, and related improvements. We understand the majority of existing structures will be retained and repurposed as part of the proposed construction. Site topography is essentially level; about two feet of elevation change occurs across the property. Vegetation consists primarily of grass and landscaped features.

Subsurface

An ESNW representative observed, logged, and sampled six test pits, excavated at accessible locations within the property boundaries, on February 28, 2017 using a trackhoe and operator retained by our firm. The test pits were completed for purposes of assessment and classification of site soils as well as characterization of groundwater conditions within areas proposed for new development. 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. Select soil samples collected at the test pit locations were evaluated in accordance with both Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures.

Topsoil and Fill

Topsoil was encountered generally within the upper one to six inches of existing grades at the test pit locations. The topsoil was characterized by dark brown color, the presence of fine organic material, and small root intrusions. Based on our field observations, we estimate topsoil will be encountered across the site with an average thickness of four inches. Deeper pockets of topsoil, however, may be encountered locally throughout the site.

Fill was encountered to a depth of approximately one foot below the existing ground surface (bgs) at TP-6 within a gravel parking area. The fill was characterized as medium dense, silty sand with gravel. Where encountered, fill will likely be suitable for re-use as structural fill, but should be evaluated at the appropriate time of construction by ESNW.

Native Soil

Underlying topsoil, native soils were encountered consisting primarily of medium dense, silty sand (USCS: SM), sandy silt (USCS: ML), and poorly graded sand (USCS: SP). The native soils were observed primarily in a moist to wet condition. Slight to heavy caving, as well as trace to abundant wood debris, was observed within the native soils. The maximum exploration depth was approximately 13.5 feet bgs.

Geologic Setting

The referenced geologic map resource identifies alluvium (Qa) across the site and surrounding areas. As reported on the geologic map resource, alluvium in the Puyallup Valley is chiefly sand. Alluvium is characteristic of modern floodplains and was deposited directly by streams and running water. The referenced WSS resource identifies Briscot loam and Sultan silt loam (Map Unit Symbols: 6A and 42A, respectively) as the primary soil units underlying the subject site. Briscot loam and Sultan silt loam were formed in floodplains. Based on our field observations, native soils on the subject site are generally consistent with the geologic setting outlined in this section.

Groundwater

During our subsurface exploration completed on February 28, 2017, groundwater was encountered at depths of approximately 3 to 12.5 feet bgs at the test pit locations. Soil mottling was identified within native deposits at about two to three feet bgs. In our opinion, groundwater will likely be encountered within site excavations, particularly within deeper excavations for new utilities and the pond (where necessary). Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches, sumps, and dewatering pumps. Seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the wetter, winter months.

Based on our February 2017 field observations, we estimate the seasonal high groundwater table elevation occurs at about five to eight feet bgs. If a definitive groundwater elevation(s) is required, completion of a groundwater-monitoring program (discussed in the *Preliminary Detention Pond Design* section of this report), through at least one wet season, is recommended.

Liquefaction Hazard Evaluation

Based on our review of the referenced liquefaction susceptibility map, the subject site is located within a moderate to high liquefaction susceptibility area. The mapped hazard susceptibility is based on the presence of Holocene alluvial deposits and the presence of abandoned channel and meander-bend cutoff features northeast of the subject site, in addition to relatively shallow groundwater. Holocene alluvial deposits are normally consolidated and consist primarily of silty fine to medium sand and relatively clean, fine to medium sand. The supporting documentation included in the referenced liquefaction susceptibility map suggests that, based on review of liquefaction caused by the Loma Prieta earthquake in the Monterey Bay region of California, liquefaction may be concentrated in areas mapped as abandoned channel fill and point-bars within younger fluvial deposits.

Liquefaction Susceptibility

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. Our field exploration indicates medium dense to dense, native silty sands, silts, and sands (consistent with Holocene alluvium deposits), as well as relatively shallow groundwater, underlie the site. In our opinion, the site presents a moderate susceptibility to liquefaction-induced settlement during a seismic event. Given our understanding that existing structures will largely remain in place, it is our opinion the proposed redevelopment will not increase site susceptibility to liquefaction.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our investigation, construction of the proposed development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include foundation support, slab-on-grade subgrade support, the suitability of using native soils as structural fill, construction of the detention pond, and installation of site utilities.

In our opinion, the proposed structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil, recompacted native soil, or new structural fill. In general, competent native soil, suitable for support of new foundations, will likely be encountered within the upper three to five feet of existing grades. 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 a suitable structural fill material, will be necessary.

Construction of the stormwater detention pond within the northern site area is feasible from a geotechnical standpoint, provided adequate separation between the facility base and the seasonal high groundwater table can be incorporated into final designs. Based on our February 2017 field observations, we estimate the seasonal high groundwater table elevation occurs at about five to eight feet below existing grades. If a definitive groundwater elevation(s) is required, completion of a groundwater-monitoring program, through at least one wet season, is recommended. Additionally, the need to install a pond liner should be anticipated. It is noted that, given the presence of both relatively shallow groundwater and impermeable soils, native soils are not feasible for infiltration from a geotechnical standpoint.

This study has been prepared for the exclusive use of the Step by Step Family Support Center and their representatives. No warranty, expressed or implied, is made. 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, performing site clearing and site stripping (as necessary), and removing select, existing structural improvements. Subsequent earthwork procedures will involve relatively minor grading and related infrastructure improvements.

Temporary Erosion Control

Prior to the installation of either initial or final pavement sections, temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls, should be considered in order to both minimize off-site soil tracking and provide a stable access surface for construction vehicles. Geotextile fabric may also be considered underlying the quarry spalls for greater stability of the temporary construction entrance. Erosion control measures should consist of silt fencing placed around appropriate portions of the site perimeter. Where generated, soil stockpiles should be covered or otherwise protected to reduce the potential for soil erosion during periods of wet weather. Temporary approaches for controlling surface water runoff should be established prior to beginning earthwork activities. Additional Best Management Practices (BMPs), as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities, as necessary.

Stripping

Topsoil was encountered generally within the upper one to six inches of existing grades at the test pit locations. While we do not anticipate topsoil stripping will be significant, ESNW should be retained to observe site stripping activities at the time of construction. Over-stripping may result in increased project development costs and should be avoided. Topsoil and organic-rich soil is neither suitable for foundation support nor for use as structural fill. Topsoil and organic-rich soil may be used in non-structural areas, if desired.

In-situ and Imported Soils

From a geotechnical standpoint, native soils may not be suitable for use as structural fill, unless the soils are at (or slightly above) the optimum moisture content at the time of placement and compaction. Based on relatively appreciable fines contents, native soils should be considered moisture sensitive. Successful use of native soils as structural fill will largely be dictated by the moisture content at the time of placement and compaction. In general, on-site soils that are at (or slightly above) the optimum moisture content at the time of placement and compaction may be used as structural fill. If the on-site soils cannot be successfully compacted, the use of an imported soil may be necessary. In our opinion, if grading activities take place during months of heavy rainfall activity, a contingency should be provided in the project budget for export of soil that cannot be successfully compacted as structural fill and subsequent import of granular structural fill. Soils with fines contents greater than 5 percent typically degrade rapidly when exposed to periods of rainfall.

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).

Subgrade Preparation

Foundation and slab subgrade surfaces should be placed on competent bearing subgrades. Loose or unsuitable soil conditions encountered below areas of footing and slab elements should be remedied as recommended in this report. Uniform compaction of the foundation and slab subgrade areas (where necessary) will establish a relatively consistent subgrade condition below the foundation and slab elements. ESNW should observe the foundation and slab subgrade prior to placing formwork. Supplementary recommendations for subgrade improvement may be provided at the time of construction and would likely include further mechanical compaction effort and/or overexcavation and replacement with suitable structural fill.

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, and roadway areas. Fill placed to construct permanent slopes and throughout retaining wall and utility trench backfill areas is considered structural fill as well. Soils placed in structural areas should be 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 D1557). More stringent compaction specifications may be required for utility trench backfill zones depending on the responsible utility district or jurisdiction.

Foundations

In our opinion, the proposed structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil, recompacted native soil, or new structural fill. In general, competent native soil, suitable for support of new foundations, should be encountered within the upper three to five feet of existing grades. Where necessary, loose or unsuitable soil conditions exposed at foundation subgrade elevations should be compacted to the specifications of structural fill or overexcavation and replaced with a suitable structural fill. Organic material encountered at structural subgrade elevations should be removed, and grades should be restored with structural fill.

Provided the foundations will be supported as described above, the following parameters may be used for design:

- Allowable soil bearing capacity 2,500 psf
- Passive earth pressure 300 pcf (equivalent fluid)
- Coefficient of friction 0.35

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of about one-half inch is anticipated. The majority of the settlements 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 E should be used for design. Please refer to the *Liquefaction Susceptibility* section of this report for an assessment of liquefaction risk during a seismic event.

Lateral Spread

Lateral spread is a form of liquefaction where soil is mobilized laterally, usually towards a free-face such as a riverbank. However, there are no creeks or rivers in proximity to the subject site. The Puyallup River is located approximately 2,200 feet to the northeast of the subject site. In our opinion, there is negligible potential for lateral spread to occur at the subject site. As such, the risk of lateral spread affecting the proposed construction is negligible.

Slab-on-Grade Floors

Slab-on-grade floors for the proposed structures should be supported on a well-compacted, firm and unyielding subgrade. Where feasible, native soils exposed at the slab-on-grade subgrade level can likely be compacted in situ to the specifications of 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 crushed rock or gravel should have 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). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

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 (yielding 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	0.35
• Seismic surcharge	7H**

* *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 loads should be included in the retaining wall design, where applicable.

Retaining walls should be backfilled with free-draining material 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.

Drainage

During our subsurface exploration completed on February 28, 2017, groundwater was encountered at depths of approximately 3 to 12.5 feet bgs at the test pit locations. Soil mottling was identified within native deposits at about two to three feet bgs. We estimate the seasonal high groundwater table elevation occurs at about five to eight feet bgs, with the shallower groundwater intrusion and soil mottling indicative of an upper seepage zone(s). As such, groundwater should be anticipated within site excavations, particularly in excavations at depth for utilities and the pond. Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and to provide recommendations to reduce the potential for instability related to seepage effects. Based on the soil and groundwater conditions observed at the test pit locations, dewatering of excavations extending below five feet bgs would be necessary, particularly if grading occurs during the wetter winter season.

Finish grades must be designed to direct surface drain water away from structures. Water must not be allowed to pond adjacent to structures, slopes or walls. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4.

Infiltration Feasibility

As indicated in the *Subsurface* section of this report, native soils encountered at depth during our fieldwork were characterized primarily as sandy silt, sandy silt, and poorly graded sand. Based on the results of USDA textural analyses, the native soils were classified primarily as sand, sandy loam, and loam. Irrespective of gravel content, fines contents of the native sand and loam were about 4 to 14 percent and 33 to 64 percent, respectively, at the tested locations.

From a geotechnical standpoint, it is our opinion the native soils are not feasible for design and construction of new infiltration facilities. The native, relatively impermeable deposits and the presence of relatively shallow groundwater intrusion were the primary bases for this opinion. Based on our field observations, groundwater would likely interfere with the successful design, construction, and function of on-site infiltration facilities.

Preliminary Detention Pond Design

We understand a stormwater detention pond is proposed within the northern site area. Groundwater was encountered at depths of approximately 3 to 12.5 feet bgs at the test pit locations, and we estimate the seasonal high groundwater table elevation occurs at about five to eight feet bgs. If a definitive groundwater elevation(s) is required, it is our opinion a groundwater-monitoring program should be completed. The program would include installation of one or two piezometers within the proposed pond footprint and subsequent monitoring through at least one wet season. The information would be used to definitively assess seasonal high groundwater levels. ESNW can prepare a groundwater-monitoring program upon request.

Based on the native soil makeup, the need to install a pond liner should be anticipated. The pond liner should consist of a suitable low-permeability option and may include compacted till, clay, a geomembrane material, or concrete. Given the relative permeability of native soils, the need for imported pond-liner material should be anticipated. Where utilized, the impermeable soil liner should be at least 24 inches in thickness and installed around the entire bottom and sides of the pond. The pond-liner material should be installed in loose lifts of six inches or less and compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557.

The functionality of a pond is largely related to successful construction methods. In our experience, inadequate or poor construction techniques typically result in pond failure (due to leakage). Leakage repairs are difficult to detect and remediate, and as such, are costly and time-consuming to complete. ESNW should observe construction activities for the pond on a full-time basis to verify adequate soil compaction and installation methods and to provide supplementary recommendations, as necessary.

Excavations and Slopes

The Federal Occupation Safety and Health Administration (OSHA) and the Washington Industrial Safety and Health Act (WISHA) provide soil classification in terms of temporary slope inclinations. Soils that exhibit high compressive strengths are allowed steeper temporary slope inclinations than are soils that exhibit lower strength characteristics.

Based on the soil conditions encountered at the test pit locations, native soils would be classified as Type C by OSHA and WISHA. Temporary slopes over four feet in height in Type C soils must be sloped no steeper than one-and-one-half horizontal to one vertical (1.5H:1V). The presence of perched groundwater may cause localized sloughing of the temporary slopes due to excess seepage forces. ESNW should observe site excavations to confirm soil types and allowable slope inclinations. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations.

Permanent slopes should be planted with vegetation to enhance stability and to minimize erosion, and should maintain a gradient of 2H:1V or flatter. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions. Supplementary excavation and slope recommendations may be provided at the time of construction, as necessary.

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 previously detailed in this report. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions will require remedial measures, such as overexcavation and/or placement of thicker crushed rock or structural fill sections, prior to pavement.

We anticipate new pavement sections will be subjected primarily to passenger vehicle traffic. 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).

The HMA, ATB and CRB materials should conform to WSDOT specifications. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557. Final pavement design recommendations, including recommendations for heavy traffic areas, main access roads, and frontage improvement areas, can be provided once final traffic loading has been determined. Road standards utilized by the City of Puyallup may supersede the recommendations provided in this report.

Utility Support and Trench Backfill

In our opinion, native soils may generally be suitable for support of utilities. Organic-rich soils are not considered suitable for direct support of utilities and may require removal at utility grades if encountered. Remedial measures, such as overexcavation and replacement with structural fill and/or installation of geotextile fabric, may be necessary in some areas in order to provide support for utilities. Groundwater may be encountered within utility excavations, and caving of trench walls may occur where groundwater is encountered. Temporary construction dewatering, as well as temporary trench shoring, may be necessary during utility excavation and installation as conditions warrant.

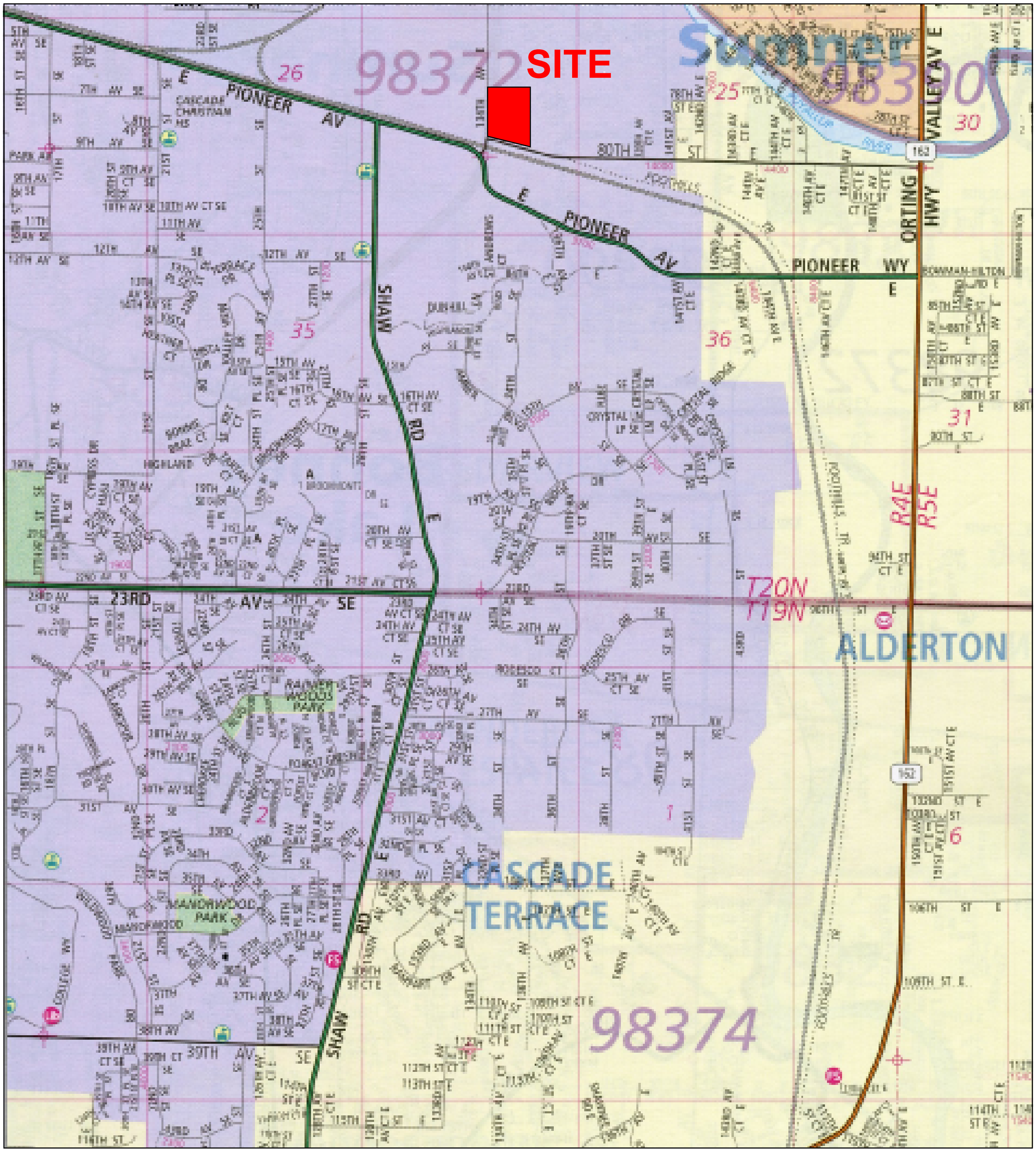
In general, native soils may not be suitable for use as structural backfill throughout utility trench excavations, unless the soils are at (or slightly above) the optimum moisture content at the time of placement and compaction. Structural trench backfill should not be placed dry of the optimum moisture content. Each section of the site utility lines must be adequately supported in appropriate bedding material. Utility trench backfill should be placed and compacted to the specifications of structural fill as previously detailed in this report, or to the applicable specifications of the City of Puyallup or other responsible jurisdiction or agency.

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 pit 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 study. ESNW should also be retained to provide testing and consultation services during construction.



Reference:
Pierce County, Washington
Map 835
By The Thomas Guide
Rand McNally
32nd Edition

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.

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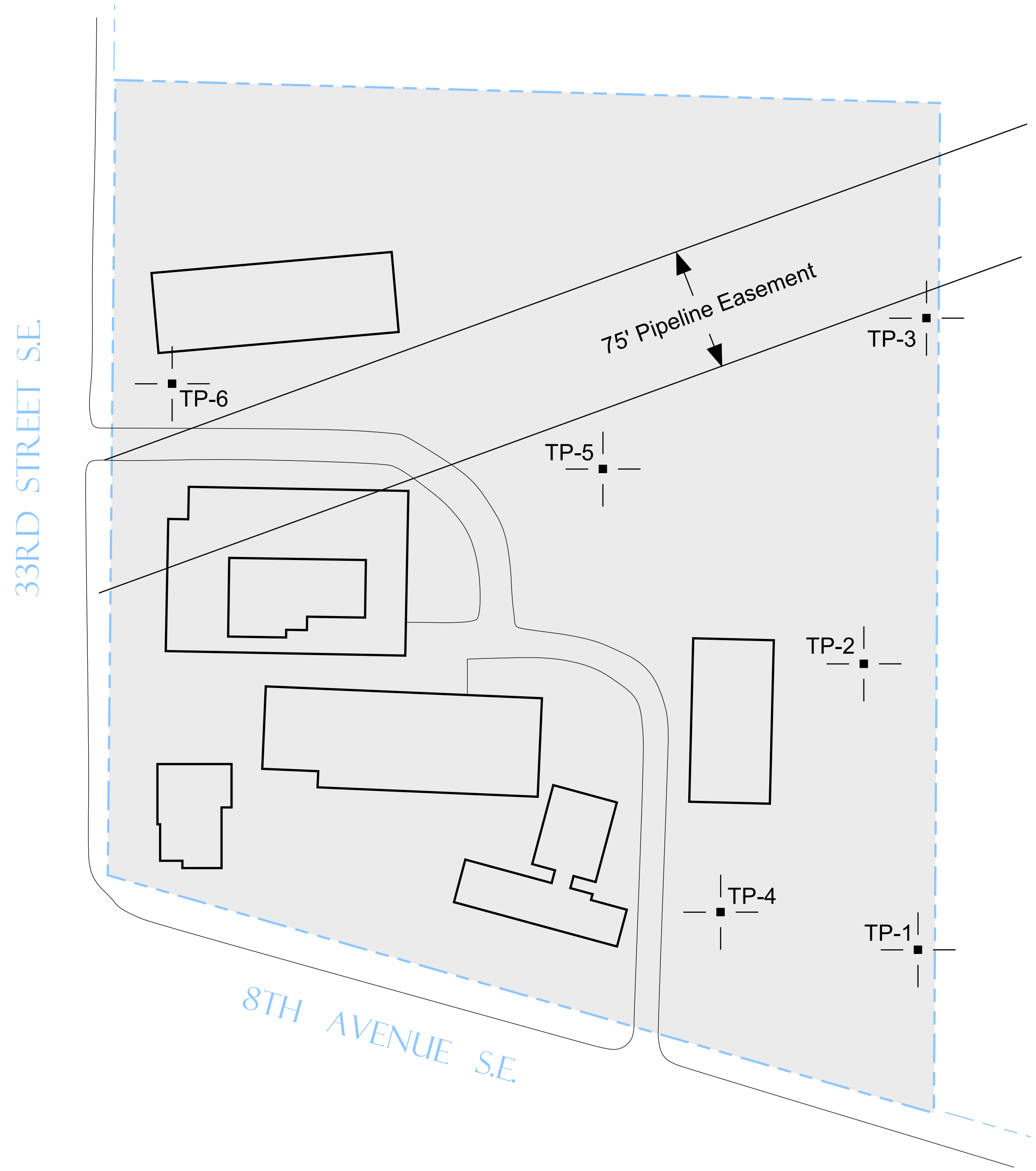
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Vicinity Map
Germaine Korum Center
Puyallup, Washington

Drwn. MRS	Date 03/14/2017	Proj. No. 4960
Checked BJP	Date Mar. 2017	Plate 1

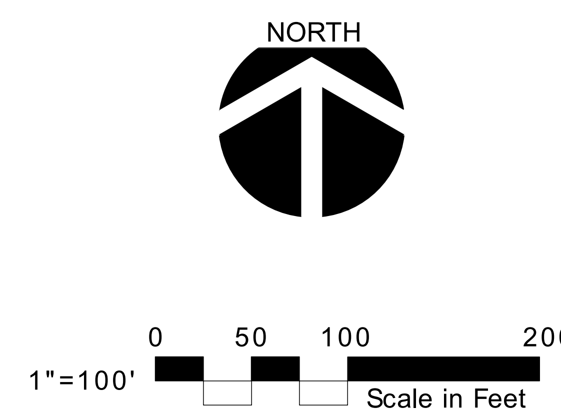


LEGEND

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-4960, Feb. 2017

Subject Site

Existing Building



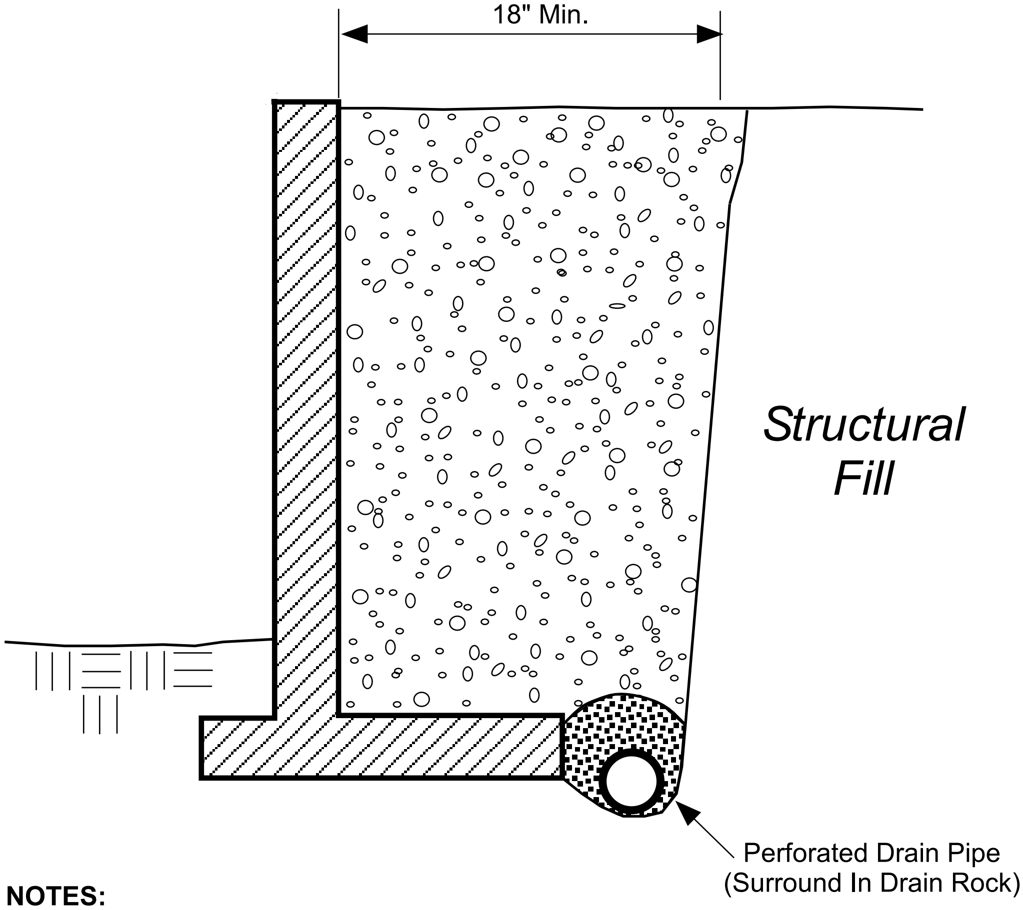
NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided 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.

Test Pit Location Plan
Germaine Korum Center
Puyallup, Washington

Earth Solutions NWLLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Drwn. By	MRS
Checked By	BJP
Date	04/07/2017
Proj. No.	4960
Plate	2



NOTES:

- Free Draining Backfill should consist of soil having less than 5 percent fines. Percent passing #4 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" Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

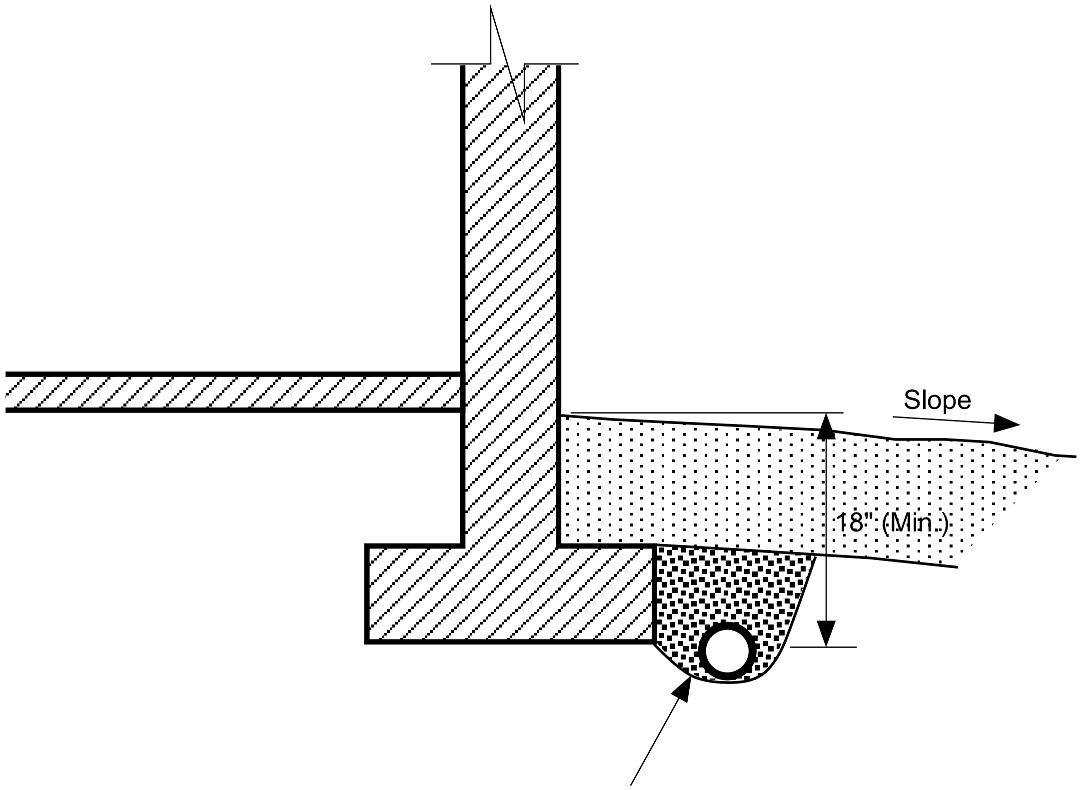
Free Draining Structural Backfill

1 inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

RETAINING WALL DRAINAGE DETAIL
Germaine Korum Center
Puyallup, Washington

Drwn. MRS	Date 03/14/2017	Proj. No. 4960
Checked BJP	Date Mar. 2017	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.

LEGEND:

Surface Seal; native soil or other low permeability material.

1" Drain Rock

SCHEMATIC ONLY - NOT TO SCALE
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Earth Solutions NW LLC
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FOOTING DRAIN DETAIL
Germaine Korum Center
Puyallup, Washington

Drwn. MRS	Date 03/14/2017	Proj. No. 4960
Checked BJP	Date Mar. 2017	Plate 4

Appendix A

Subsurface Exploration
Test Pit Logs

ES-4960

Subsurface conditions at the subject site were explored on February 28, 2017 by excavating six test pits using a trackhoe and operator provided by our firm. The approximate locations of the test pits are illustrated on Plate 2 of this study. The test pit logs are provided in this Appendix. The test pits were advanced to a maximum depth of approximately 13.5 feet bgs.

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 GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	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
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	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
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture
PROJECT NAME Germaine Korum Center
PROJECT NUMBER 4960
PROJECT LOCATION Puyallup, Washington
DATE STARTED 2/28/17 **COMPLETED** 2/28/17
GROUND ELEVATION 74 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION —
LOGGED BY BJP **CHECKED BY** KDH
AT END OF EXCAVATION —
NOTES Surface Conditions: bare soil
AFTER EXCAVATION —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND, loose, moist -heavy caving to BOH
		MC = 21.50% Fines = 14.00%			-becomes dark brown -mottled texture, increased sand content to BOH [USDA Classification: SAND]
5		MC = 26.60%			-becomes dark gray -becomes medium dense, moist to wet -moderate groundwater seepage -heavily mottled texture
		MC = 56.10%			-silt lenses -abundant wood debris
		MC = 35.20%		9.0	65.0
					Test pit terminated at 9.0 feet below existing grade. Groundwater encountered at 5.0 feet during excavation. Caving observed from TOH to BOH. Bottom of test pit at 9.0 feet.

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TEST PIT NUMBER TP-2

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture
PROJECT NAME Germaine Korum Center
PROJECT NUMBER 4960
PROJECT LOCATION Puyallup, Washington
DATE STARTED 2/28/17 **COMPLETED** 2/28/17
GROUND ELEVATION 74 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY BJP **CHECKED BY** KDH
AT END OF EXCAVATION ---
NOTES Surface Conditions: bare soil
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0		MC = 24.20% Fines = 62.90%	ML		Brown sandy SILT, loose, moist -heavy caving to BOH [USDA Classification: LOAM]	
2.5						71.5
5		MC = 24.50% MC = 45.40% MC = 27.70%	SM		Gray silty SAND, loose, moist -mottled texture, increased sand content to BOH -light groundwater seepage -becomes dark gray, medium dense, wet -silt lenses -becomes gray	
9.0						65.0
					Test pit terminated at 9.0 feet below existing grade. Groundwater encountered at 4.0 feet during excavation. Caving observed from TOH to BOH. Bottom of test pit at 9.0 feet.	

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Fax: 425-449-4711

TEST PIT NUMBER TP-3

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture
PROJECT NAME Germaine Korum Center
PROJECT NUMBER 4960
PROJECT LOCATION Puyallup, Washington
DATE STARTED 2/28/17 **COMPLETED** 2/28/17
GROUND ELEVATION 74 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION —
LOGGED BY BJP **CHECKED BY** KDH
AT END OF EXCAVATION —
NOTES Surface Conditions: bare soil
AFTER EXCAVATION —

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND, loose, moist
					-heavy caving to BOH
		MC = 23.60% Fines = 50.00%			-mottled texture [USDA Classification: fine sandy LOAM]
5		MC = 21.40%			-becomes dark gray, medium dense, moist -light groundwater seepage -increased sand content to BOH
					-gray silt lenses
		MC = 34.00%			-becomes gray, medium dense to dense, moist to wet
10					-trace wood debris
				13.0	-light groundwater seepage (61.0)
		MC = 30.40%			Test pit terminated at 13.0 feet below existing grade. Groundwater encountered at 5.0 and 12.5 feet during excavation. Caving observed from TOH to BOH. Bottom of test pit at 13.0 feet.

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TEST PIT NUMBER TP-4

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture **PROJECT NAME** Germaine Korum Center
PROJECT NUMBER 4960 **PROJECT LOCATION** Puyallup, Washington
DATE STARTED 2/28/17 **COMPLETED** 2/28/17 **GROUND ELEVATION** 75 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**
EXCAVATION METHOD **AT TIME OF EXCAVATION** —
LOGGED BY BJP **CHECKED BY** KDH **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	74.5
		MC = 29.00%	SM			Brown silty SAND, loose, moist -mottled texture -light groundwater seepage -becomes dark gray, medium dense, moist -increased sand content to BOH	
5		MC = 29.60%					
		MC = 48.20%				-becomes moist to wet -moderate groundwater seepage -abundant wood debris	
10		MC = 27.50% Fines = 32.30%			10.0	[USDA Classification: very fine sandy LOAM]	65.0
						Test pit terminated at 10.0 feet below existing grade. Groundwater encountered at 3.0 and 8.0 feet during excavation. No caving observed. Bottom of test pit at 10.0 feet.	

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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-5

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture
PROJECT NAME Germaine Korum Center
PROJECT NUMBER 4960
PROJECT LOCATION Puyallup, Washington
DATE STARTED 2/28/17 **COMPLETED** 2/28/17
GROUND ELEVATION 74 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY BJP **CHECKED BY** KDH
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 1": light gravel and grass
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0			SM		Brown silty SAND, loose, moist -moderate to heavy caving to BOH	
				2.0		72.0
5		MC = 29.20% MC = 31.70% Fines = 3.50% MC = 31.70%	SP		Dark gray poorly graded SAND, loose, moist to wet -mottled texture -becomes medium dense [USDA Classification: SAND] -moderate groundwater seepage	
				9.5		64.5
					Test pit terminated at 9.5 feet below existing grade. Groundwater encountered at 8.0 feet during excavation. Caving observed from TOH to BOH. Bottom of test pit at 9.5 feet.	

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Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-6

CLIENT Step by Step Family Support Center c/o Jeff Brown Achitecture **PROJECT NAME** Germaine Korum Center
PROJECT NUMBER 4960 **PROJECT LOCATION** Puyallup, Washington
DATE STARTED 2/28/17 **COMPLETED** 2/28/17 **GROUND ELEVATION** 73 ft **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**
EXCAVATION METHOD **AT TIME OF EXCAVATION** ---
LOGGED BY BJP **CHECKED BY** KDH **AT END OF EXCAVATION** ---
NOTES Surface Conditions: gravel **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) -cobbles	
1.0						72.0
		MC = 21.90% MC = 32.10%	SM		Brown silty SAND, medium dense, moist -heavy caving to BOH -becomes dark gray, medium dense -mottled texture, intermittent sand lenses to BOH -becomes moist to wet	
5						
					-moderate groundwater seepage	
7.5		MC = 29.50%				65.5

Test pit terminated at 7.5 feet below existing grade. Groundwater encountered at 7.5 feet during excavation. Caving observed from 2.0 feet to BOH.
Bottom of test pit at 7.5 feet.

Appendix B

Laboratory Test Results

ES-4960

Earth Solutions NW, LLC
1805 - 136th PL N.E., Suite 201
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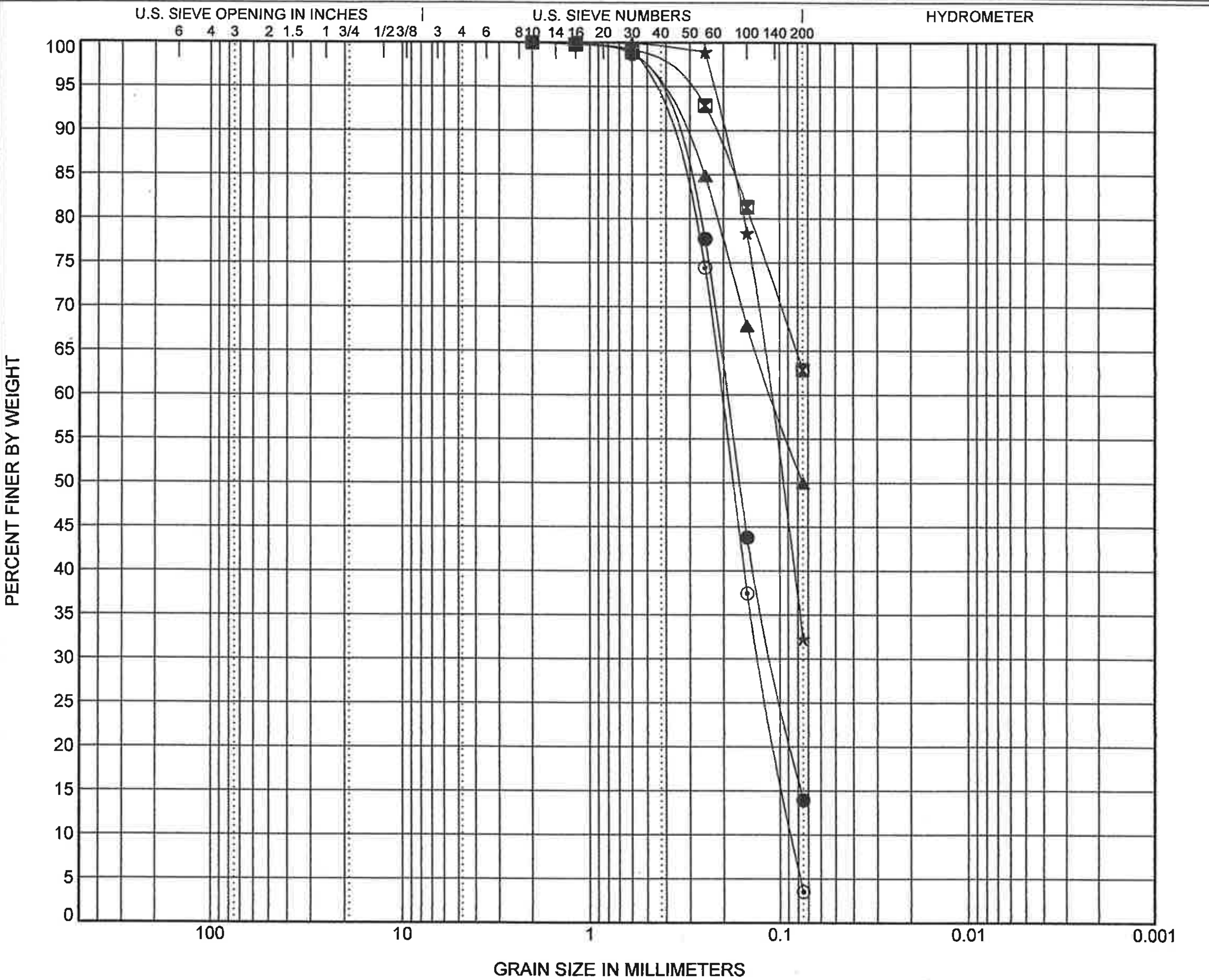
Telephone: 425-449-4704
Fax: 425-449-4711

GRAIN SIZE DISTRIBUTION

CLIENT Step by Step Family Support Center c/o Jeff Brown Architecture **PROJECT NAME** Germaine Korum Center

PROJECT NUMBER ES-4960 **PROJECT LOCATION** Puyallup



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
●	TP-1	3.00ft.	USDA: Gray Sand. USCS: SM.		
⊠	TP-2	1.50ft.	USDA: Brown Loam. USCS: Sandy ML.		
▲	TP-3	2.50ft.	USDA: Brown Fine Sandy Loam. USCS: SM.		
★	TP-4	10.00ft.	USDA: Gray Very Fine Sandy Loam. USCS: SM.		
⊙	TP-5	6.00ft.	USDA: Gray Sand. USCS: SP.	0.95	2.39

	Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-1	3.0ft.	2	0.191	0.109					14.0	
⊠	TP-2	1.5ft.	2							62.9	
▲	TP-3	2.5ft.	2	0.111						50.0	
★	TP-4	10.0ft.	2	0.114						32.3	
⊙	TP-5	6.0ft.	2	0.205	0.129	0.086				3.5	

Report Distribution

ES-4960

<u>**EMAIL ONLY**</u>

Step by Step Family Support Center
c/o Jeff Brown Architecture
12181 C Street South
Tacoma, Washington 98444

Attention: Mr. Jeff Brown