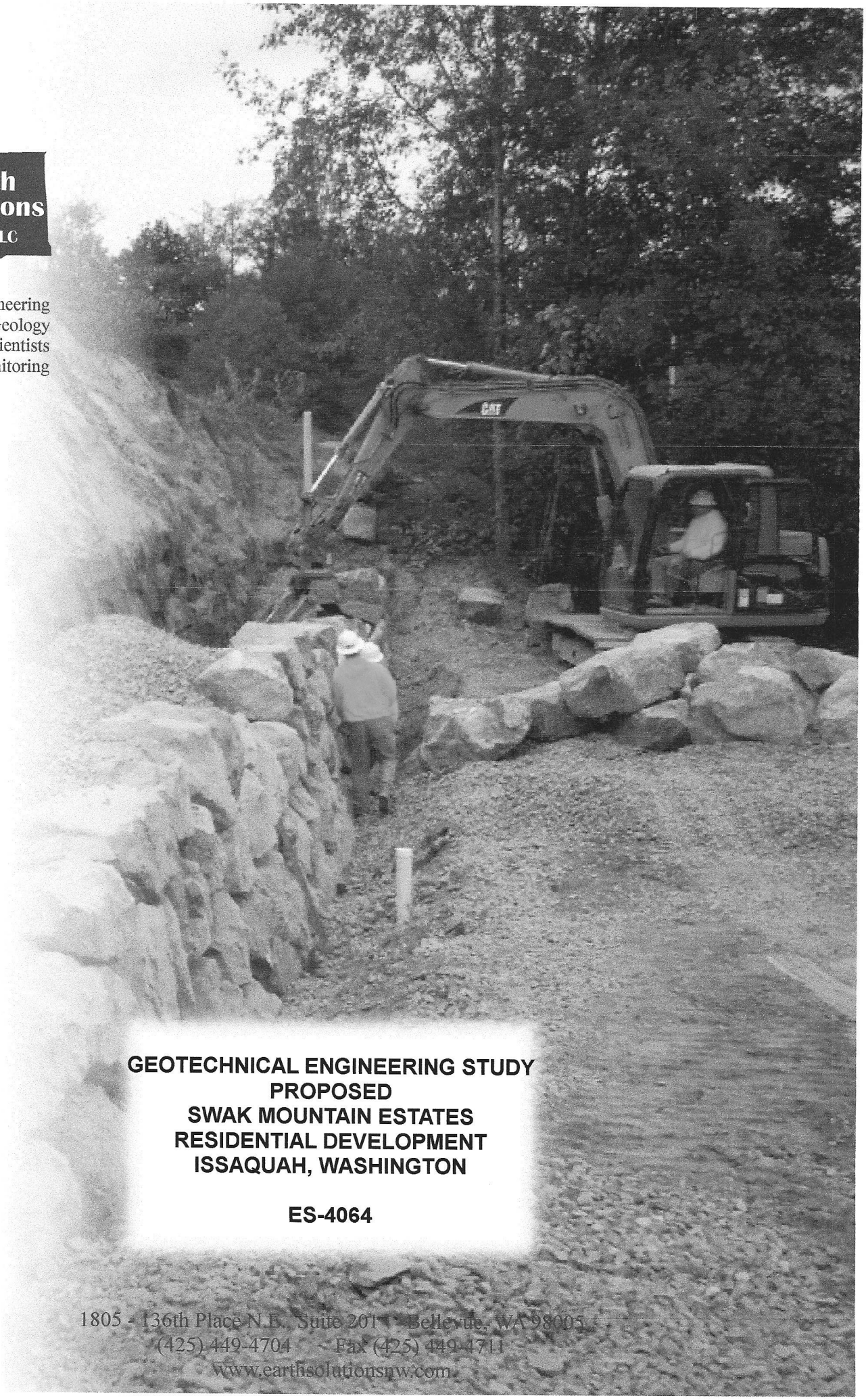

Earth Solutions NW LLC

Geotechnical Engineering
Geology
Environmental Scientists
Construction Monitoring

GEOTECHNICAL ENGINEERING STUDY
PROPOSED
SWAK MOUNTAIN ESTATES
RESIDENTIAL DEVELOPMENT
ISSAQUAH, WASHINGTON

ES-4064

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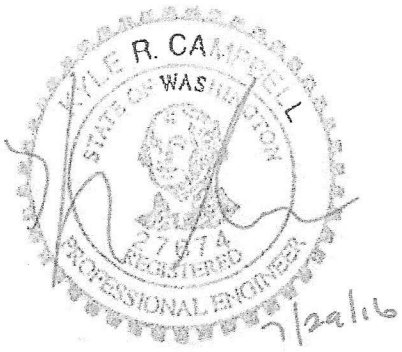
PREPARED FOR

CAW ISSAQUAH, LLC

July 28, 2016

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



Kyle R. Campbell, P.E.
Principal

GEOTECHNICAL ENGINEERING STUDY
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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 Geotechnical 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

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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July 28, 2016
ES-4064

Earth Solutions NW LLC

- Geotechnical Engineering
- Construction Monitoring
- Environmental Sciences

CAW Issaquah, LLC
8711 Ridge Road
Medina, Washington 98039

Attention: Mr. Chris Weymouth

Dear Mr. Weymouth:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, Proposed Swak Mountain Estates Residential Development, Issaquah, Washington." Based on review of fieldwork completed by Earth Consultants Inc. (ECI), subsurface conditions throughout the proposed development area of the site are comprised largely of loose colluvial soils and glacial till overlying bedrock. Groundwater seepage was encountered at several test pit locations.

In our opinion, provided the recommendations in this study are incorporated into the final design, the proposed development is feasible from a geotechnical standpoint. The proposed building structures may be supported on conventional foundations bearing on competent native soils or suitable structural fill material. Recommendations for earthwork, site preparation, foundations, and other pertinent geotechnical recommendations are provided in this study.

The opportunity to be of service to you is appreciated. If you have any questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

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

1805 - 136th Place N.E., Suite 201 • Bellevue, WA 98005 • (425) 449-4704 • FAX (425) 449-4711

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RESIDENTIAL DEVELOPMENT
ISSAQUAH, WASHINGTON

ES-4064

INTRODUCTION

General

This geotechnical engineering study was prepared for the proposed single-family residential development to be constructed off the south side of Sunrise Place Southwest in Issaquah, Washington. The purpose of this study was to provide updated geotechnical recommendations for the currently proposed development. Our scope of services for completing this geotechnical engineering study included the following:

- Characterization of the soil and groundwater conditions throughout the development areas of the site based on conditions encountered at test pit locations;
- Review of current drawings with respect to the planned site layout and grading activities;
- Preparation of this geotechnical engineering study.

The following documents were reviewed as part of the preparation of this geotechnical engineering study:

- Preliminary Geotechnical Engineering Study, prepared by Earth Consulting, Inc. (ECI), E-12741, dated June 26, 2007;
- Preliminary Site Plans, prepared by Speros Design, LLC, dated June 28, 2016.
- Issaquah Critical Areas Code (Section 18.10).
- National Resource Conservation Service, USDA Web Soil Survey.
- The Geologic Map of King County, Washington, Booth, 2006.

Project Description

We understand construction of 21 single-family residences, four townhome structures and associated improvements is planned for the subject property. The site is constrained by steep slope, landslide, erosion hazard areas, stream setbacks and wetland setbacks. Due to the moderate to steep slopes on the site, the proposed site layout has been clustered in areas that do not contain persistent steep slopes and includes wetland and stream setbacks. Based on the current topography, grading activities will likely include a series of cuts and fills to achieve finish grades throughout the building and driveway areas. Reinforced fill and native cut rockeries will be used to prepare the lots. The buildings will likely be two to three stories of relatively light weight wood framing over daylight basements. Perimeter wall loading of 1 to 2 kips per foot is estimated, with slab-on-grade loading on the order of 150 psf. The main access roadway will follow existing driveway alignment, where feasible, to reduce the disturbance required to construct. Cuts of up to about 46 feet may be required to construct the access roadway. Currently, it is planned to face the cuts with rockeries, some in tiered configurations. Two stormwater vaults are planned, located near the access roadways to the north of the proposed buildings.

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

SITE CONDITIONS

Surface

The subject property is comprised of a single, approximately 18.9-acre tax parcel (APN 3324069508) located off the southwest side of Sunrise Place Southwest and to the east of Ridgewood Place, Washington. The approximate location of the subject property is depicted on the Vicinity Map (Plate 1). The property is irregular in shape and is situated near the toe of a portion of the north flank of Squak Mountain. The slope across the site ascends some 400 feet to the south from the north frontage to the southern property boundary. Vegetation throughout the site is comprised primarily of a moderate to dense forest with a mixture or deciduous and coniferous trees.

Subsurface

ESNW reviewed the test pit logs included in the referenced report prepared by ECI in 2007. The approximate test pit locations are illustrated on the Test Pit Location Plan (Plate 2). Please refer to the test pit logs provided in Appendix A and laboratory sieve analysis in Appendix B for a more detailed description of the subsurface conditions.

Topsoil was encountered at all test pit locations. The topsoil and/or duff was characterized as a dark brown organic rich surficial layer typically 4 to 12 inches in thickness. The topsoil/duff is not suitable for foundation support, or for use as structural fill. However, the topsoil is suitable for use in landscaping areas, if desired. Fill was not encountered at the test pit locations. Underlying the topsoil, native soil deposits consisting primarily of loose to medium dense silty sand with gravel (Unified Soil Classification SM), silt (ML) and silty gravel with sand (GM) were encountered extending to depths ranging from a bout 3.5 feet (TP-8) to about 17 feet (TP-2). Siltstone bedrock from the Tukwila formation was encountered below the soil deposits.

Geologic Setting

The referenced geologic map identifies Tukwila formation bedrock on the upper portions of the site and mass wastage, advance outwash (Qva) and pre-Fraser glacial deposits (Qpf) toward the base of the slope. The soil survey (National Resource Conservation Service – USDA) indentifies Beausite series (BeD) across the majority of the site and Alderwood series soils (AgD) along eastern portions of the site. Based on review of the test pit data and the conditions observed onsite, in our opinion, the native soils encountered at the test pit locations are consistent with outwash/fan type soils.

Groundwater

Groundwater was reported at most of the test pits explored along the lower areas of the site during fieldwork (April 16, 2007). It should be noted that groundwater elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater levels are generally higher during the wetter, winter months. With respect to the proposed development activities, groundwater seepage should be expected in underground utility and vault excavation. Extensive measures for controlling groundwater and temporary dewatering are not anticipated to be required for this project. However, groundwater flow control during construction and on a permanent basis will be an important component of the development plans.

Critical Areas Review

As part of this study, the site and proposed development areas were evaluated for the presence of geologically hazardous areas. Landslide hazard, erosion hazard, and seismic hazard areas were the primary focus of our evaluation. As part of our evaluation, we reviewed the Issaquah Municipal Code Critical Areas Code section 18.10. Section 18.10.360 provides a discussion of the goals for critical area designation, protection and mitigation that must be addressed in proposed development plans.

Visual Site Reconnaissance

ESNW representatives conducted a visual site reconnaissance in July, 2015 of the steep slope areas located surrounding the proposed development envelope. Cabin Creek flows along the northwestern property boundary. The topography across the site is quite steep but appears stable with the majority of the mature fir trees showing slight to moderate signs of soil creep such as arched trunks and the surface consists primarily of native groundcover. The overall stability conditions observed during our 2015 site reconnaissance were consistent with those described in the referenced geotechnical report prepared in 2007.

Slope Stability Assessment

ESNW evaluated the stability of the slopes through the proposed development areas of the site using the SlopeW computer program. Slope inclination was based on topographic data prepared on the referenced plan and on previous survey work done for the site. The slope stability output is attached.

Soil strength parameters were developed based on the soil conditions described in the referenced report and WSDOT Geotechnical Design Manual Chapter 6.4.3.1 recommended design parameters for seismic analysis of slope stability. Following are the design parameters used in the analysis:

Soil	Coefficient of Friction	Cohesion
Loose colluvium	30	0
Medium dense silt (native)	28	100
Dense bedrock	40	200

The design peak ground acceleration (PGA) of 0.49g was determined using the USGS on-line seismic design mapping software. A horizontal pseudo-static coefficient of 0.245g, which equates to one-half of the design PGA was used to model the slope stability (Kramer 1996). The slip surface areas were defined using available topographic information and considered the impact that the proposed development will have on the existing slope. The project will be designed to protect the slopes from water intrusion.

The results of our stability analyses indicate the development proposal will not decrease the existing stability of the adjacent slopes. The analysis indicates that the loose surficial soil is susceptible to movement during a design earthquake event (Minimum FOS 0.847), but relatively resistant to deep-seated failure (calculated FOS 1.308). Minimum FOS for static conditions was calculated as 1.542, which is considered acceptable from a stability standpoint. Given the drainage improvements that will be incorporated into the development, in our opinion, the existing stability of the slopes will be enhanced by the collection and redirection of surface water.

Steep Slope Hazard Areas (IMC 18.10.580)

Steep slope hazard areas include slopes inclined at a gradient of at least 40 percent and are at least 10 feet in height. The site plan indicates areas that meet the criteria for steep slope hazard area. The proposed development envelope is clustered where steep slopes are less prevalent. However, some grading is proposed for areas where slopes are inclined 40 percent or greater.

Buffer Reduction

In our opinion, provided the recommendations below are followed, the buffer can be reduced to 10 feet, with a building setback (BSBL) of 15 feet, for a total structure setback of 25 feet from steep slopes over 10 feet in height as depicted on the site plan. The total setback of 25 feet should be measured horizontally from the edge of the foundation to the face of the slope. ESNW should be contacted to review the grading and site layout plans to confirm adequate buffer dimensions are incorporated.

The following provisions must be complied with as a part of the project plans:

- The lots must be graded to direct or otherwise convey surface water away from the top of steep slopes.
- All water collected in drainage systems must discharged to the existing storm system.
- Landscape retaining walls or rockeries should not exceed 12 feet in height.

Landslide Hazard Areas

Topography throughout the proposed development areas of the site can generally be characterized as moderately sloping. Existing grades throughout the sloping areas of the site range up to about 40 percent. The referenced site plan delineates the transition to 40 percent or steeper slopes on the subject site.

The slopes surrounding the property contain areas that meet the criteria for landslide hazard, i.e. those areas that are inclined at least 40 percent and where springs are known to exist. However, the proposed project includes design elements that will result in insignificant potential impacts to the adjacent landslide hazard areas. These elements include modifying surface water patterns such that slopes are protected and largely using engineered fill retaining walls for lot construction. Therefore, in our opinion, the proposed project will not increase the potential for instability along the descending slopes adjacent to the site.

Grading Activities

Based on our understanding of the proposed project, the general grading sequence will be to fill the existing stormwater retention pond, rough grade the overall site, including reconfiguring the existing soils 'berm' areas near the margins, install utilities and begin construction.

Grading Near Steep Slopes

The steep slope areas on this site are not continuous and the current site layout proposes grading within some areas of steep slope hazard sections. Provided grading is limited, grading in these areas is acceptable from a geotechnical standpoint. Landscape retaining walls or rockeries should be limited to 12 feet in height in the steeper sloped areas. This should be considered when developing the grading plan. In no case should grading activities result in compromised stability of trees that might cause property damage or personal injury resulting from falling. This is particularly important along the proposed access roadway where numerous mature trees are located near the existing alignment and would be affected by the widening process.

Erosion Hazards

The areas proposed for development are underlain primarily by glacial till deposits mantling bedrock. Topography throughout the proposed development areas is moderately to steeply sloping. The NRCS database indicates the development area of the site is mapped as Beausite series (BeD) and Alderwood series (AgD) 15 – 30 percent slopes. These soil types meet the criteria for an erosion hazard soil type.

During construction, standard Best Management Practices (BMPs) should be implemented to minimize soil disturbance and offsite transport of sediment. In our opinion, the proposed project poses a low risk for sediment transport and erosion impacts to adjacent properties, given the clustered development layout.

Seismic Hazards

The development areas of the site are largely underlain by firm granular soil deposits. Groundwater seepage was observed during the fieldwork conducted by ECI (April 2007). Relative density of the native soil deposits generally increases with depth. In this respect, relatively deep deposits of loose submerged sands and gravels (more susceptible to liquefaction) are not present at the subject property. In our opinion, given the overall geologic setting and proposed grading activities, liquefaction susceptibility throughout the site would be characterized as low. With respect to faults, we are not aware of any shallow crustal fault lineaments or surface faults within 200 feet of the site. However, given the steeply inclined terrain and shallow bedrock, there is a moderate risk of seismically-induced landslide activity on this property.

Coalmine Hazards

A portion of the Jones Seam, Bed No. 6 coal mine workings was identified in the extreme northern portion of the site. This area is discussed in the referenced geotechnical report. Based on review, in our opinion, this coal mine does not present a hazard with respect to settlement and should be declassified.

Analysis of Proposal

The current proposal includes construction of a residential development and associated improvements. Critical areas and associated buffers have been included in the site layout. In our opinion, the most sensitive component of the proposal is the access roadway, which crosses steep slopes and will reconfigure some steep slope areas.

In our opinion, the currently proposed homesite layout represents the most favorable configuration with respect to environmentally critical areas. The majority of the lots are underlain by firm glacial deposits, with the exception of Lots 7 – 9. The proposed grading across Lots 7 – 9 includes cutting about 10 feet of existing soil which will effectively remove much of the loose colluvial deposits to expose firm granular native soil deposits.

The access roadway will follow the existing driveway, where practical. The proposal will widen the existing roadway and modify the gradient to the maximum allowed by current code. This will require cuts of up to about 40 to 50 feet in some locations. It is proposed to regrade portions of the existing slope below these deeper cuts. This will effectively remove the steep slope/landslide prone areas. From a geotechnical standpoint, this if favorable; however, we recommend borings be completed along portions of the proposed roadway to confirm the stability of the proposed grading plans.

Critical Area Functions and Values

The currently proposed project will not impact surface water flow or interflow conditions as these critical areas are protected, are outside the development envelope and will remain in tact. The proposed project scope includes construction of a residential development consistent with surrounding parcels. The proposed grading associated with the access roadway will strive to focus disturbance within the site, which will reduce off-site impacts. On this basis, the functions and values of these critical areas will not be impacted by the project plans.

DISCUSSION AND RECOMMENDATIONS

General

Based on the results of our study, construction of the proposed residential development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include structural fill placement and compaction, access roadway construction, controlling groundwater flow, foundation subgrade preparation, and underground utility installations. Significant grading will be required to construct this project and will require engineering and analyses to develop a feasible project. In our opinion, the proposed single-family structures can be supported on conventional foundations bearing on competent native soils or suitable structural fill material. Suitable onsite soils can generally be considered for use as structural fill provided the soil moisture content is at or near its optimum level at the time of placement and compaction. Recommendations for site preparation, structural fill placement, retaining wall design, foundations, and other pertinent geotechnical recommendations are provided in the following sections of this study.

This geotechnical engineering study has been prepared for the exclusive use of CAW Issaquah, LLC and their representatives. The study has been prepared specifically for the subject project. 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

The primary geotechnical considerations with respect to site preparation activities are related to structural fill placement and foundation subgrade preparation.

Grading activities and preparation of building subgrade areas will require cuts that will likely exceed eight feet. Prior to the mass grading activities, stripping of surface vegetation and organic rich topsoil deposits will be necessary. In general, stripping depths are expected to range to about 12 inches, but may likely vary at some locations. Areas of organic rich topsoil and existing fill debris may also be encountered and require removal, particularly near the existing structural improvements.

During the site stripping activities, the geotechnical engineer should observe subgrade areas where fill placement is proposed. Loose or unstable areas of subgrade exposed during the site stripping activities may require overexcavation. Where deeper overexcavation associated with unsuitable material is performed, use of a geotextile placed along the overexcavated surface may be recommended prior to restoring these areas with structural fill. Structural fill material should consist of a suitable granular soil compacted to structural fill specifications.

Structural Fill

Structural fill is defined as compacted soil in foundation, slab-on-grade, and roadway areas. Fills placed to construct permanent slopes and throughout retaining wall and utility trench backfill areas are also considered structural fill. Soils placed in structural areas should be placed in maximum 12-inch loose lifts and be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D-1557-02).

Erosion Control

During construction, surface water runoff will need to be controlled around the site perimeter and topographically lower margins of the site. In general, erosion control measures for the site should incorporate silt fencing, swales, temporary ponds, and plastic sheeting, as necessary. Additionally, exposed earth surfaces should be protected during construction to help reduce the potential for erosion and sediment transport. A construction entrance should consist of quarry spalls underlain by a non-woven filter fabric. Quarry spall thickness will depend on subgrade stability at the entrance, but should typically be at least six inches.

Foundations

Based on the results of our study, the proposed single-family residences can be supported on conventional spread and continuous footings bearing on competent, undisturbed native soils or structural fill. Where loose or unsuitable soils are exposed at the building pad subgrade elevation, the soil should be compacted to structural fill specifications or overexcavated and replaced with a suitable granular structural fill material.

Provided the foundation is supported on competent, undisturbed native soils or granular structural fill, the following parameters should be used for foundation design:

- Allowable bearing capacity — 2,500 psf
- Coefficient of friction — 0.40
- Passive resistance — 300 pcf (equivalent fluid)*

Assumes foundations backfilled with structural fill or poured neat against competent soils.

For short term wind and seismic loading, a one-third increase in the allowable soil bearing capacity can be assumed. A factor-of-safety of 1.5 has been applied to the friction and passive resistance values.

With structural loading as expected, total settlement in the range of one inch is anticipated, with differential settlement of about one-half inch or less over a typical building width. The majority of the settlements should occur during construction, as dead loads are applied.

Slab-On-Grade Floors

Slab-on-grade floors should be supported on competent native soil or a compacted structural fill subgrade. 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 (percent passing the #200 sieve, based on the minus three-quarter inch fraction). A vapor retarder should be installed below the slabs. The vapor retarder should consist of a material specifically designed for that use and be installed in accordance with the manufacturer's specifications.

Retaining Walls

Retaining walls should be designed to resist earth pressures and any applicable surcharge loads. The following values should be used for concrete retaining and foundation wall design:

- Active earth pressure (yielding wall) — 35 pcf (equivalent fluid / granular fill)
- At-rest earth pressure (restrained wall) — 55 pcf
- Traffic surcharge (passenger vehicles) — 70 psf (rectangular distribution)
- Passive resistance — 300 pcf (equivalent fluid)
- Coefficient of Friction — 0.40
- Lateral Seismic Surcharge — 6H (where H equals wall height in feet)

Additional surcharge loading from foundations, sloped backfill, or other loading should be included in the retaining wall design. Drainage should be provided behind retaining walls such that hydrostatic pressures do not develop. If drainage is not provided, hydrostatic pressures should be included in the wall design. The geotechnical engineer should review retaining wall designs to confirm that appropriate earth pressure values have been incorporated into the design and to provide additional recommendations.

Concrete retaining and foundations 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 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 wall, and connected to an approved discharge location. A typical retaining drainage detail is provided as Plate 3 of this study.

Access Roadway

It is currently planned to use the existing driveway alignment where feasible and widen to about 30 feet. Given the existing topography, cuts and fills will be required to construct the access roadway. Maximum proposed cuts are on the order of 46 feet and it is proposed to face deeper cuts with tiered rockeries.

Because the proposed grading is rather extensive and no previous information is available regarding the soil conditions along the roadway alignment, we recommend conducting additional explorations at targeted locations along the roadway alignment. The borings will provide soil and groundwater conditions that might impact the proposed grading plans and will be used to develop a cross-section to evaluate the stability of the proposal and mitigation recommendations. It is likely that some form of permanent shoring will be required along portions of the access roadway.

Excavations and Slopes

The Federal and state Occupation Safety and Health Administration (OSHA/WISHA) classifies soils in terms of minimum safe slope inclinations. Based on the soil conditions observed at the test pit locations, the weathered native soil or where groundwater is exposed would generally be classified by OSHA/WISHA as Type C. Temporary slopes over four feet in height in Type C soils should be sloped no steeper than 1.5H:1V (horizontal:vertical). Dense native soil and weathered bedrock where groundwater is not exposed would generally be classified by OSHA/WISHA as Type A. Temporary slopes over four feet in height in Type A soils should be sloped no steeper than 0.75H:1V. ESNW should observe the excavations to confirm the appropriate allowable temporary slope inclination and soil type.

If the above slope gradients cannot be achieved, temporary shoring may be required. Permanent slopes should maintain a gradient of 2H:1V, or flatter, and should be planted with an appropriate species of vegetation to enhance stability and to minimize erosion.

Seismic Considerations

The 2012 IBC recognizes ASCE for seismic site class definitions. If the project will be permitted under the 2012 IBC, in accordance with Table 20.3-1 of ASCE, Minimum Design Loads for Buildings and Other Structures, Site Class D, should be used for design.

In our opinion, liquefaction susceptibility at this site is low. The relative density of the site soils and the absence of a uniform, shallow groundwater table is the primary basis for this designation.

Drainage

Perimeter foundation drains should be installed around the outside of the building structures. Plate 4 depicts a typical drain detail for a conventional shallow footing condition. Final grades should slope away from the building perimeter areas such that ponding does not develop adjacent to the structure.

Due to the presence of relatively shallow groundwater seepage, in our opinion, installing interceptor drains along the uppermost development envelope should be considered during the design phase of this project. Configuration and construction can be determined after clearing has been completed and before mass grading commences.

Detention Vault Walls

Based on review of the conceptual site plan, stormwater management plans may include construction of two detention vaults to be located in the lower areas of the site. Given the likelihood of exposing seepage during the grading for the vaults, stabilization of the base should be expected. ESNW should review the vault design to confirm the recommendations provided in this report are followed and provide supplemental recommendations. The presence of moderate to heavy perched groundwater seepage should be expected in the detention vault excavations, depending on the time of year grading takes place. Dewatering of the vault excavation areas should be anticipated and included in the project plans.

With respect to temporary slopes required to construct the vault, in our opinion, the upper loose colluvial soil should be sloped at a 1.5H:1V inclination or flatter. Slopes which expose dense native glacial till or weathered bedrock and where no groundwater is encountered can be sloped at a 0.75H:1V inclination provided ESNW representatives observe the slope conditions while the vault is being constructed. ESNW should review detention vault designs, particularly with respect to location relative to sensitive site features and property lines. The following values can be used for design of the vault:

• Allowable soil bearing capacity	5,000 psf*
• Active earth pressure (yielding condition)	35 pcf (equivalent fluid)
• At-rest earth pressure (restrained condition)	55 pcf
• Traffic surcharge for passenger vehicles (where applicable)	70 psf (rectangular distribution)
• Passive earth pressure	350 pcf (equivalent fluid)
• Coefficient of friction	0.40
• Seismic surcharge (active condition)	6H (where H equals retained height)
• Seismic surcharge (restrained condition)	11H

* Value is for dense native soil.

The lateral seismic surcharge value provided earlier in this report can be used for detention vault designs, if applicable. The geotechnical engineer should observe the vault excavation to confirm soil and groundwater conditions. It is likely that significant shallow groundwater will be exposed during vault excavations. A perimeter drain system should be installed around the vault perimeter to reduce possible hydrostatic pressures around the structures. If adequate perimeter drains are not practical, the walls should be designed to include hydrostatic pressures.

Slope Fill Placement

Grading of existing sloped areas of this site will be required to construct this project. In general, placing fill on a sloped area is acceptable provided a key and bench system is included in the grading plans. A schematic slope fill detail is provided on Plate 5 that depicts the recommended configuration of placing fill on a sloped area.

Rockeries and Retaining Walls

Rockeries and/or retaining walls will be used to create level building pads and driveway areas for this site. Rockeries and retaining walls will also be used along the access drive. In our opinion, the use of rockeries constructed against native cuts and retaining walls on this site is feasible. A native cut rockery detail with construction recommendations is provided on Plate 6. Rockeries or retaining walls should be limited to 12 feet in height.

Utility Trench Backfill

In our opinion, the soils described in the referenced geotechnical report are generally suitable for support of utilities. Loose, unstable, or organic soil conditions encountered in the trench excavations should not be used for supporting utilities. Areas of existing fill should be re-compacted or overexcavated, as necessary. In general, suitable onsite till and existing fill reported and observed at the test sites should be suitable for use as structural backfill in the utility trench excavations, provided they are at or near the optimum moisture content at the time of placement and compaction. Moisture conditioning of the soils may be necessary at some locations prior to use as structural fill. Utility trench backfill should be placed and compacted to the specifications of structural fill provided in this report, or to the applicable specifications of the county jurisdictions.

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. In addition, the upper one foot of pavement subgrade should be compacted to a relative compaction of at least 95 percent. It is possible that soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions may require remedial measures such as overexcavation and thicker crushed rock or structural fill sections prior to pavement.

For relatively lightly loaded pavements subjected to automobiles and occasional truck traffic, the following sections can be considered:

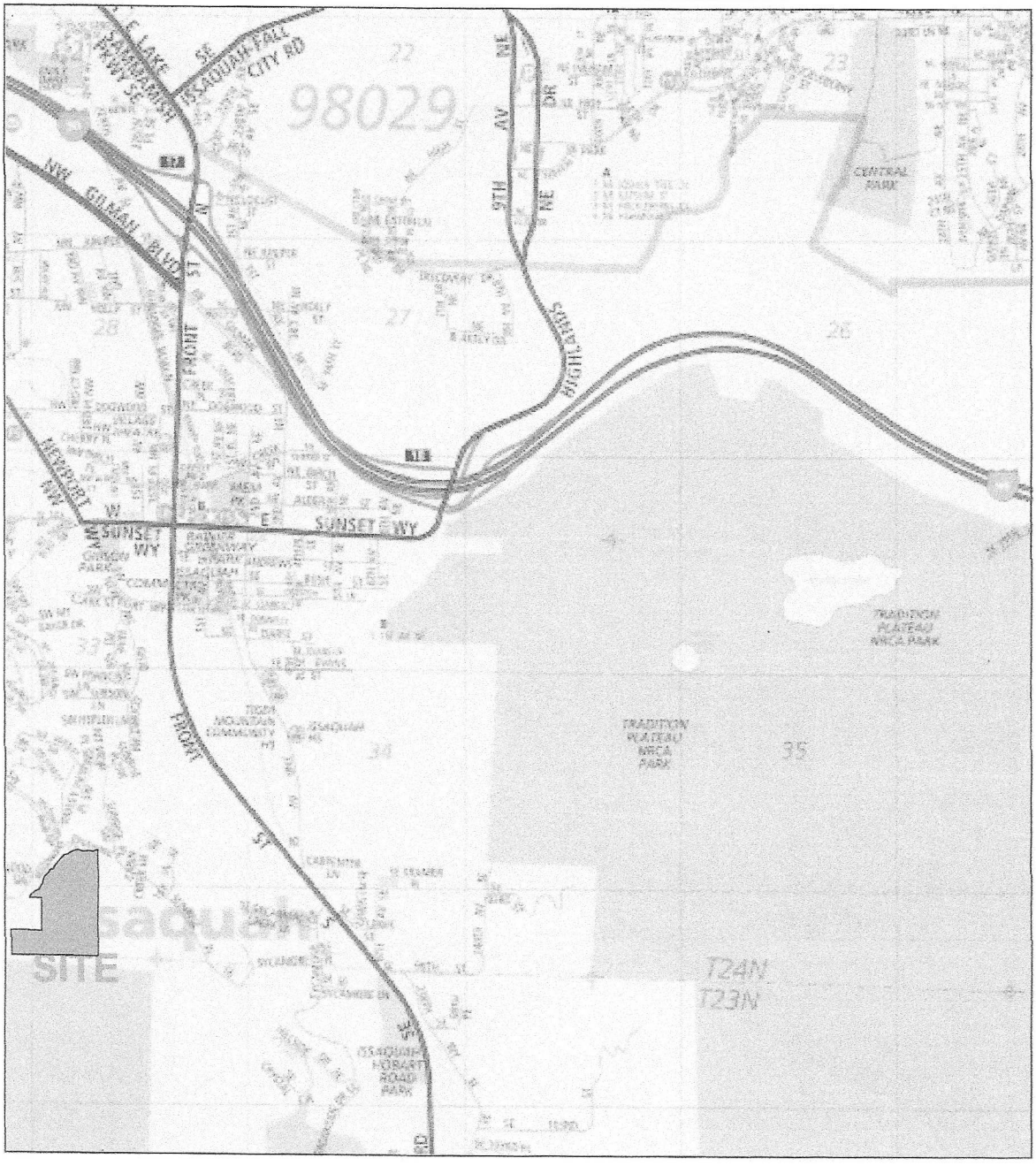
- Two inches of asphalt concrete (AC) placed over four inches of crushed rock base (CRB), or;
- Two inches of AC placed over three inches of asphalt treated base (ATB).

LIMITATIONS

The recommendations and conclusions provided in this geotechnical engineering 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 not expressed or 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 in this geotechnical engineering study if variations are encountered.

Additional Services

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



Reference:
Issaquah, Washington
Map 628
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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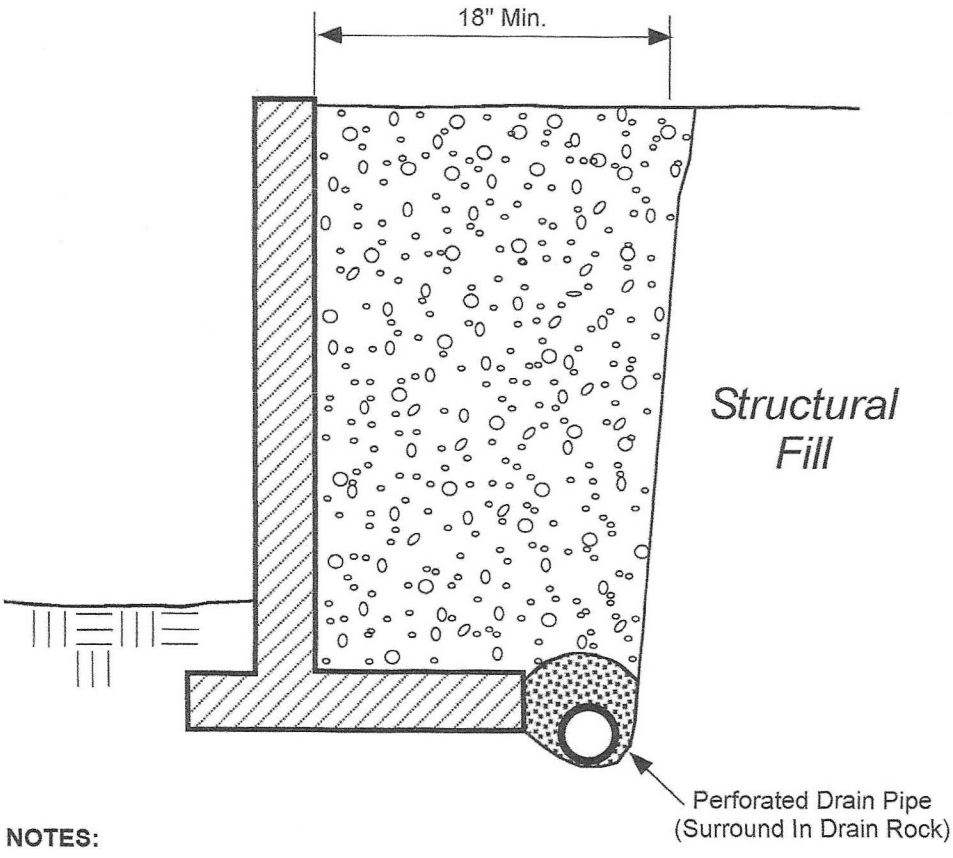
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

Vicinity Map
Issaquah Terraces
Issaquah, Washington

Drwn. MRS	Date 09/10/2015	Proj. No. 4064
Checked SSR	Date Sept. 2015	Plate 1



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

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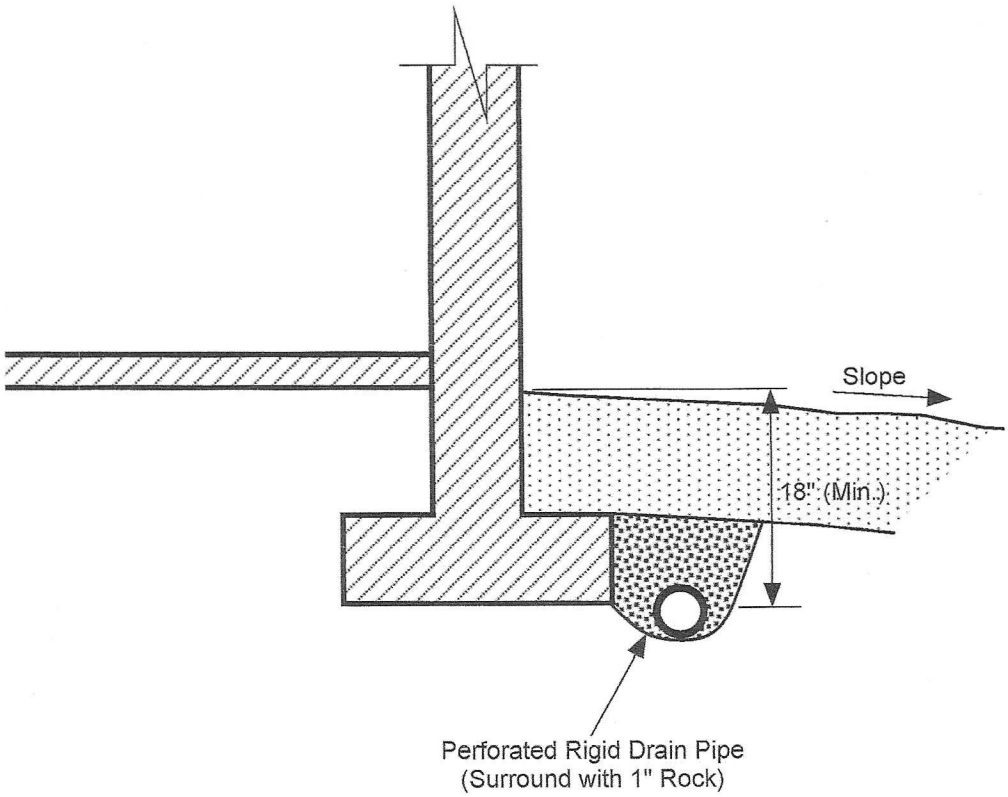
RETAINING WALL DRAINAGE DETAIL
Issaquah Terraces
Issaquah, Washington

Drwn. MRS	Date 09/09/2015	Proj. No. 4064
Checked SSR	Date Sept. 2015	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.

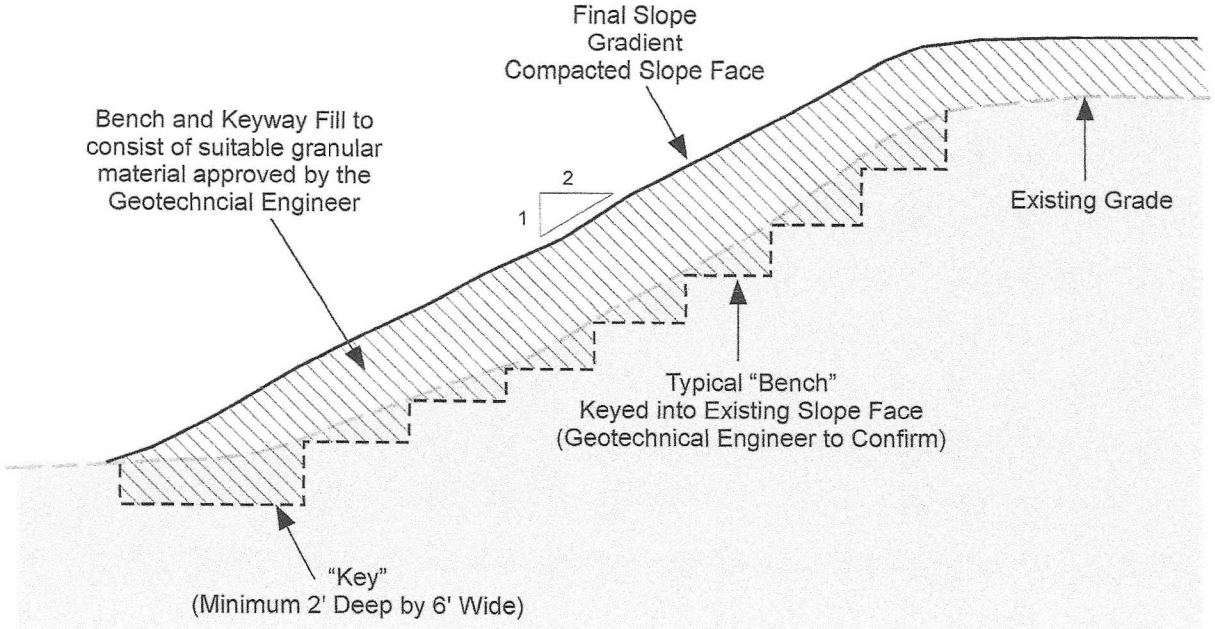
1" Drain Rock

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

FOOTING DRAIN DETAIL
Issaquah Terraces
Issaquah, Washington

Drwn. MRS	Date 09/09/2015	Proj. No. 4064
Checked SSR	Date Sept. 2015	Plate 4

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING



NOTES:

- Slope should be stripped of topsoil and unsuitable materials prior to excavating Keyway or benches.
- Benches will typically be equal to a bulldozer blade width of approximately 8 feet but shall be at least 4 feet.
- Final slope gradient should be 2H : 1V.
- Final slope face should be densified by over-building with compacted fill and trimming back to shape or by compaction with a bulldozer or vibratory drum roller.
- Planting or hydroseeding slope face with a rapid growth deep-rooted vegetative mat will reduce erosion potential of slope area.
- Use of pegged-in-place jute matting or geotechnical fabric will help maintain the seed and mulch in place until the root system has an opportunity to germinate.
- Structural fill should be placed in thin loose lifts not exceeding 12 inches in thickness. Each lift should be compacted to no less than the degree specified in the "Site Preparation and Earthwork" section of this report. No additional lift should be placed until compaction is achieved.

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Geotechnical Engineering, Construction Monitoring and Environmental Sciences

SLOPE FILL DETAIL
Issaquah Terraces
Issaquah, Washington

Drwn. MRS	Date 09/09/2015	Proj. No. 4064
Checked SSR	Date Sept. 2015	Plate 5

GENERAL NOTES:

Rockery construction is a craft and depends largely on the skill and experience of the builder. A rockery is a protective system which helps retard the weathering and erosion process on an exposed soil face. While by its nature (mass, size and shape of rocks) it will provide some degree of retention, it is not a designed or engineered system in the sense a reinforced concrete retaining wall would be considered designed or engineered. The degree of retention achieved is dependent on the size of the rock used; that is, the mass or weight, and the height of the wall being constructed. The larger the rock, the more competent the rockery should be.

Rockeries should be considered maintenance items that will require periodic inspection and repair. They should be located so that they can be reached by a contractor if repairs become necessary.

...Maximum inclination of the slopes above and behind rockeries should be 2:1 (Horizontal : Vertical).
...Minimum thickness of rock filter layer behind rockery is 18 inches.
...Minimum of 12 inch embedment into undisturbed native soil or compacted fill placed in accordance with report recommendations.
...Maximum rockery height H = 12 feet.
...Rockeries greater than 8 feet in height to be installed under periodic or full time observation of the geotechncial engineer.

Unless otherwise specified in writing by the rockery "designers", all rocks placed in the lower two-thirds of the wall should be 5 to 6 man rock, 4,000 lbs. or larger. Rocks placed above this level should gradually decrease in size with increasing wall height using 3 to 5 man rock, 700 to 6,000 lbs.

The long dimension of the rocks should extend back towards the cut or fill face to provide maximum stability. Rocks should be placed to avoid continuous joint planes in vertical or lateral directions. Each rock should bear on two or more rocks below it, with good flat-to-flat contact.

All rockeries over 4 feet in height should be constructed on basis of wall mass, not square footage of face.

Size	Approximate Weight - lbs.	Approximate Diameter
1 man	50-200	12-18"
2 man	200-700	18-28"
3 man	700-2,000	28-36"
4 man	2,000-4,000	36-48"
5 man	4,000-6,000	48-54"
6 man	6,000-8,000	54-60"

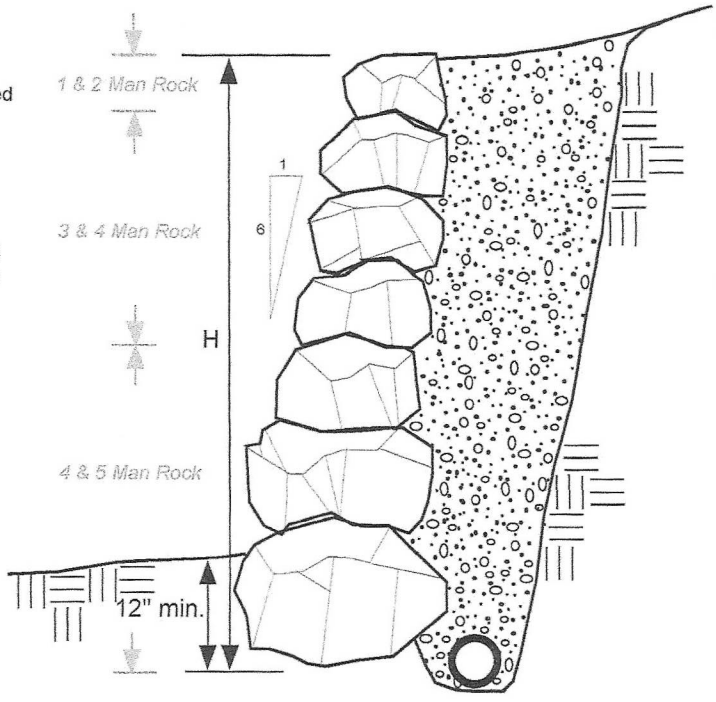
Reference: Local quarry weight study using average weights of no less than six rocks of each man size conducted in January 1988.

LEGEND:

Drainage materials to consist of clean angular well-graded quarry spalls, with 4-inch maximum size, or other material approved by the geotechnical engineer.

Undisturbed firm Native Soil.

Drain pipe; 4-inch minimum diameter, perforated or slotted rigid plastic PVC pipe, laid with a positive gradient to discharge under control, well away from the rockery.



NOT TO SCALE - SCHEMATIC ONLY
NOT A CONSTRUCTION DRAWING

NOTES:

Rockery construction to be completed in accordance with ARC Guidelines.
Earth Solutions NW representative to observe rockery construction and prepare final report.

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

NATIVE CUT ROCKERY DETAIL
Issaquah Terraces
Issaquah, Washington

Drwn. MRS	Date 09/09/2015	Proj. No. 4064
Checked SSR	Date Sept. 2015	Plate 6

Appendix A

Subsurface Exploration

ES-4064

The subsurface exploration at the site was conducted by ECI at the approximate locations illustrated on Plate 2 of this report. The test pit logs are provided in this Appendix. The subsurface exploration was completed on April 16, 2007. The test pits were excavated to a maximum depth of eight feet below existing grade.

Logs of the test pit observations by ESNW are presented in this Appendix. 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.

Test Pit Log

Project Name: Issaquah Short Plat			Sheet 1 of 1
Job No. 12741	Logged by: ELW	Date: 4/16/07	Test Pit No.: TP-1
Excavation Contractor: NW Excavating			Approx. Ground Surface Elevation: 616'
Notes:			

Surface Conditions: Depth of topsoil and sod 10"; ferns, moss

General Notes	W (%)	Depth Ft.	USCS Symbol	
			TPSL	Black TOPSOIL
	10.8	1–5	SP-SM	Brown poorly graded SAND with silt and gravel, loose, moist -contains roots and organics -12.0% fines -moderate caving
	18.4			
	35.2	6–10	ML	Tan SILT with sand, medium dense, moist -contains weathered volcanic rock -increase in moisture; iron oxide staining
	12.2	11–13	SM	Brown to tan silty SAND, medium dense, moist to wet -contains angular chunks of weathered volcanic rock -light groundwater seepage; becomes wet 12' to 14'
		14–15	BDRK	Dark brown VOLCANIC ROCK, very dense, moist (Tukwila Formation) -moderately to highly weathered Test pit terminated at 15' below existing grade. Groundwater seepage encountered at 12' to 14' during excavation.

Earth Consulting Incorporated

Test Pit Log
Issaquah Short Plat
Issaquah, Washington

Proj. No. 12741	Dwn. DNM	Date 6/21/07	Checked ELW	Date 6/21/07	Plate A2

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

BV TEST PIT LOG 12741.GPJ ECI.GDT 6/22/07

Test Pit Log

Project Name:				Sheet	of
Issaquah Short Plat				1	1
Job No. 12741	Logged by: ELW	Date: 4/16/07	Test Pit No.: TP-2		
Excavation Contractor: NW Excavating			Approx. Ground Surface Elevation: 622'		
Notes:					

Surface Conditions: Depth of topsoil and sod 2"; ferns

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
			1		SM	Brown silty SAND, loose, moist to wet (Colluvium) -contains gravel
	28.4		2			
			3		SM	Brown silty SAND with gravel, medium dense, moist to wet (Colluvium) -subrounded gravel -iron oxide staining
	9.0		4			
			5			-becomes loose, wet -reduced gravel
			6			
			7			
			8			
	29.1		9			-light groundwater seepage 9' to 10'
	47.3		10		ML	Tan SILT with sand, medium dense, wet -iron oxide staining
			11			
	44.3		12			-becomes light tan; mottled -moderate groundwater seepage at 13'
			13		ML	Tan sandy SILT with gravel, medium dense, moist to wet -contains interbed of rounded cobbles
			14			-becomes dense
	31.3		15			
			16			-contains subrounded cobbles -subrounded gravel, mottled -contains angular weathered volcanic rock
			17		BDRK	Tan VOLCANIC ROCK, dense, moist (Tukwila Formation) -highly weathered
			18			Test pit terminated at 18' below existing grade. Groundwater seepage encountered at 9' to 10' and 13' during excavation.

Earth Consulting Incorporated

Test Pit Log
Issaquah Short Plat
Issaquah, Washington

Proj. No. 12741	Dwn. DNM	Date 6/21/07	Checked ELW	Date 6/21/07	Plate A3

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

BV TEST PIT LOG 12741.GPJ ECI.GDT 6/22/07

Test Pit Log

Project Name: Issaquah Short Plat			Sheet 1 of 1
Job No. 12741	Logged by: ELW	Date: 4/16/07	Test Pit No.: TP-3
Excavation Contractor: NW Excavating			Approx. Ground Surface Elevation: 624'
Notes:			

Surface Conditions: Depth of topsoil and sod 12"; ferns, mixed brush

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
					TPSL	Black TOPSOIL
			1		SM	Brown silty SAND, loose, moist -contains gravel, occasional cobble
	16.3		2			
			3			
			4		GM	Tan silty GRAVEL with sand, medium dense, moist (Glacial Till) -iron oxide staining -18.8% fines
	19.9		5			
			6		SM	Tan silty SAND with gravel, very dense, moist (Glacial Till) -well-cemented
			7			
	12.4		8			
			9			
			10			-reduced fines; increase in gravel
	8.7		11			
			12			Test pit terminated at 12' below existing grade. No groundwater encountered during excavation.

Earth Consulting Incorporated

Test Pit Log
Issaquah Short Plat
Issaquah, Washington

Proj. No. 12741	Dwn. DNM	Date 6/21/07	Checked ELW	Date 6/21/07	Plate A4

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

BV TEST PIT LOG 12741.GPJ ECI.GDT 6/22/07

Test Pit Log

Project Name: Issaquah Short Plat				Sheet 1 of 1
Job No. 12741	Logged by: ELW		Date: 4/16/07	Test Pit No.: TP-4
Excavation Contractor: NW Excavating				Approx. Ground Surface Elevation: 596'
Notes:				

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of topsoil and sod 12"; ferns, mixed brush
					TPSL	Black TOPSOIL
			1		SM	Brown silty SAND with gravel, loose, moist
			2			
	20.8		3		SM	Tan silty SAND with gravel, medium dense, moist to wet (Weathered Till) -iron oxide staining
	5.8		4			
			5			
			6		SM	Tan silty SAND with gravel, dense, moist (Possible Till) -angular chunks of sandstone and siltstone in silty sand matrix -contains occasional subrounded cobble -light groundwater seepage at 8'
			7			
			8			
			9		BDRK	Tan VOLCANIC ROCK, very dense, moist (Tukwila Formation) -highly weathered
			10			Test pit terminated at 10' below existing grade. Groundwater seepage encountered at 8' during excavation.

BV TEST PIT LOG 12741.GPJ ECI.GDT 6/22/07

Earth Consulting Incorporated				**Test Pit Log** Issaquah Short Plat Issaquah, Washington		
Proj. No. 12741	Dwn. DNM	Date 6/21/07		Checked ELW	Date 6/21/07	Plate A5

Test Pit Log

Project Name:				Sheet	of
Issaquah Short Plat				1	1
Job No.	Logged by:	Date:	Test Pit No.:		
12741	ELW	4/16/07	TP-5		
Excavation Contractor:			Approx. Ground Surface Elevation:		
NW Excavating			532'		
Notes:					

Surface Conditions: Depth of topsoil and sod 12"; mixed brush

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
					TPSL	Black TOPSOIL
			1		SM	Brown silty SAND with gravel, loose, moist
	30.7		2			
			3		ML	Tan SILT with sand, medium dense, moist -iron oxide staining
	56.0		4		BDRK	Purplish gray VOLCANIC ROCK, dense, moist (Tukwila Formation) -highly weathered
			5			
			6			
			7			-becomes greenish gray -light groundwater seepage at 7.5'
			8			
			9			
			10			-becomes dark gray
			11			
						Test pit terminated at 11.5' below existing grade. Groundwater seepage encountered at 7.5' during excavation.

BV TEST PIT LOG 12741.GPJ ECI.GDT 6/22/07

Earth Consulting Incorporated

Test Pit Log
Issaquah Short Plat
Issaquah, Washington

Proj. No. 12741	Dwn. DNM	Date 6/21/07	Checked ELW	Date 6/21/07	Plate A6

Test Pit Log

Project Name: Issaquah Short Plat				Sheet 1 of 1
Job No. 12741	Logged by: ELW		Date: 4/16/07	Test Pit No.: TP-6
Excavation Contractor: NW Excavating				Approx. Ground Surface Elevation: 562'
Notes:				

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of topsoil and sod 12"; ferns
					TPSL	Black TOPSOIL
			1		SM	Brown silty SAND, loose, moist
			2			
			3		GW-GM	Brown well-graded GRAVEL with silt and sand, medium dense, moist -contains subrounded cobbles
			4			
			5			
			6			
	7.8		7			-9.6% fines
			8			
			9			
	7.9		10			-becomes moist to wet
			11			-granite boulders
			12			
			13			-light groundwater seepage
					BDRK	Purplish gray VOLCANIC ROCK, dense, moist (Tukwila Formation) -highly weathered
			14			
			15			-becomes purple, fractured with iron oxide staining along fractures
			16			Test pit terminated at 16' below existing grade. Groundwater seepage encountered at 13' during excavation.

Earth Consulting Incorporated			**Test Pit Log** Issaquah Short Plat Issaquah, Washington			
Proj. No. 12741	Dwn. DNM	Date 6/21/07	Checked ELW	Date 6/21/07	Plate A7	

BV TEST PIT LOG 12741.GPJ ECI.GDT 6/22/07

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name:			Sheet	of
Issaquah Short Plat			1	1
Job No. 12741	Logged by: ELW	Date: 4/16/07	Test Pit No.: TP-7	
Excavation Contractor: NW Excavating			Approx. Ground Surface Elevation: 572'	
Notes:				

Surface Conditions: Depth of topsoil and sod 10"; ferns, mixed brush

General Notes	W (%)	Depth Ft.	USCS Symbol	
			TPSL	Black TOPSOIL
		1	SM	Brown silty SAND with gravel, loose, moist
	29.5	2		
		3	ML	Tan mottled SILT, medium dense, moist to wet -fractured in areas; iron oxide staining along fractures
	27.2	4		
		5		
		6		
		7		
		8	BDRK	Reddish brown fractured CONGLOMERATE, dense, moist (Tukwila Formation) -heavy iron oxide staining
		9		
		10		
		11		
		12		
		13		
		14	BDRK	Gray VOLCANIC ROCK, very dense, moist (Tukwila Formation)
		15		
		16	SILTSTONE	Dark gray SILTSTONE, very dense, moist (Tukwila Formation) -fractured with iron oxide staining
		17		Test pit terminated at 17' below existing grade. No groundwater encountered during excavation.

BV TEST PIT LOG 12741.GPJ ECI.GDT 6/22/07

Earth Consulting Incorporated

Test Pit Log
Issaquah Short Plat
Issaquah, Washington

Proj. No. 12741	Dwn. DNM	Date 6/21/07	Checked ELW	Date 6/21/07	Plate A8

Test Pit Log

Project Name:				Sheet	of
Issaquah Short Plat				1	1
Job No.	Logged by:	Date:	Test Pit No.:		
12741	ELW	4/16/07	TP-8		
Excavation Contractor:			Approx. Ground Surface Elevation:		
NW Excavating			562'		
Notes:					

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of topsoil and sod 12"; ferns
					TPSL	Black TOPSOIL
			1		SM	Brown silty SAND with gravel, loose, moist -subrounded gravel
	11.6		2			
			3			
			4		BDRK	Tan VOLCANIC ROCK, very dense, moist -fractured, iron oxide staining along fractures -highly weathered
			5			
			6			
			7			
			8			Test pit terminated at 8' below existing grade. No groundwater encountered during excavation.

Earth Consulting Incorporated	Test Pit Log Issaquah Short Plat Issaquah, Washington				
Proj. No. 12741	Dwn. DNM	Date 6/21/07	Checked ELW	Date 6/21/07	Plate A9

BV TEST PIT LOG 12741.GPJ ECI.GDT 6/22/07

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name:				Sheet	of
Issaquah Short Plat				1	1
Job No.	Logged by:	Date:	Test Pit No.:		
12741	ELW	4/16/07	TP-9		
Excavation Contractor:			Approx. Ground Surface Elevation:		
NW Excavating			529'		
Notes:					

Surface Conditions: Depth of topsoil and sod 10"; moss

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
					TPSL	Black TOPSOIL
			1		SM	Brown silty SAND with gravel, loose, moist
			2			
			3		SM	Tan silty SAND with gravel, medium dense, moist (Glacial Till)
	16.6		4			-becomes gray, dense, well-cemented
			5			
	13.5		6			-becomes very dense
			7		SM	Tan silty SAND with gravel, very dense, moist (Possible Till)
			8			-contains volcanic rock fragments in silty sand matrix
			9			-iron oxide staining
			10			
			11			
			12			
			13			Test pit terminated at 13' below existing grade. No groundwater encountered during excavation.

Earth Consulting Incorporated

Test Pit Log
Issaquah Short Plat
Issaquah, Washington

Proj. No. 12741	Dwn. DNM	Date 6/21/07	Checked ELW	Date 6/21/07	Plate A10

BV TEST PIT LOG 12741.GPJ ECI.GDT 6/22/07

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

Test Pit Log

Project Name:				Sheet	of
Issaquah Short Plat				1	1
Job No.	Logged by:	Date:	Test Pit No.:		
12741	ELW	4/16/07	TP-10		
Excavation Contractor:			Approx. Ground Surface Elevation:		
NW Excavating			458'		
Notes:					

Surface Conditions: Depth of topsoil and sod 18"; ferns

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	
			1		TPSL	Black TOPSOIL
			2		SM	Brown silty medium SAND with gravel, loose, moist
	8.5		3			-becomes medium dense
	18.0		4		SM	Tan silty SAND with gravel, dense, moist (Glacial Till)
	39.8		5		ML	Tan SILT, dense, moist
			6			
			7		BDRK	Green to purple VOLCANIC ROCK, dense, moist (Tukwila Formation)
			8			-highly weathered
			9			
			10			
			11			
			12			
			13			Test pit terminated at 13' below existing grade. No groundwater encountered during excavation.

Earth Consulting Incorporated

Test Pit Log
Issaquah Short Plat
Issaquah, Washington

Proj. No. 12741	Dwn. DNM	Date 6/21/07	Checked ELW	Date 6/21/07	Plate A11

Subsurface conditions depicted represent our observations at the time and location of this exploratory hole, modified by engineering tests, analysis and judgment. They are not necessarily representative of other times and locations. We cannot accept responsibility for the use or interpretation by others of information presented on this log.

BV TEST PIT LOG 12741.GPJ ECI.GDT 8/22/07

Test Pit Log

Project Name:				Sheet	of
Issaquah Short Plat				1	1
Job No. 12741	Logged by: ELW	Date: 4/16/07	Test Pit No.: TP-11		
Excavation Contractor: NW Excavating			Approx. Ground Surface Elevation: 508'		
Notes:					

General Notes	W (%)	Graphic Symbol	Depth Ft.	Sample	USCS Symbol	Surface Conditions: Depth of topsoil and sod 18"; mixed brush
			1		TPSL	Black TOPSOIL
			2		SM	Dark brown silty SAND with gravel, loose, moist
			3		SM	Brown silty SAND with gravel, medium dense, moist (Glacial Till)
	7.7		4			
			5			-becomes dense
	5.8		6			-contains cobbles to occasional boulder
			7		SM	Tan silty SAND with gravel, dense, moist to wet (Possible Till)
			8			-angular volcanic rock in silty sand matrix
			9			
			10		SILTSTONE	Reddish brown SILTSTONE, dense, moist (Tukwila Formation)
			11			-fractured, magnesium oxide and iron oxide staining along fractures
			12			
			13			Test pit terminated at 13' below existing grade. No groundwater encountered during excavation.

Earth Consulting Incorporated

Test Pit Log
Issaquah Short Plat
Issaquah, Washington

Proj. No. 12741	Dwn. DNM	Date 6/21/07	Checked ELW	Date 6/21/07	Plate A12

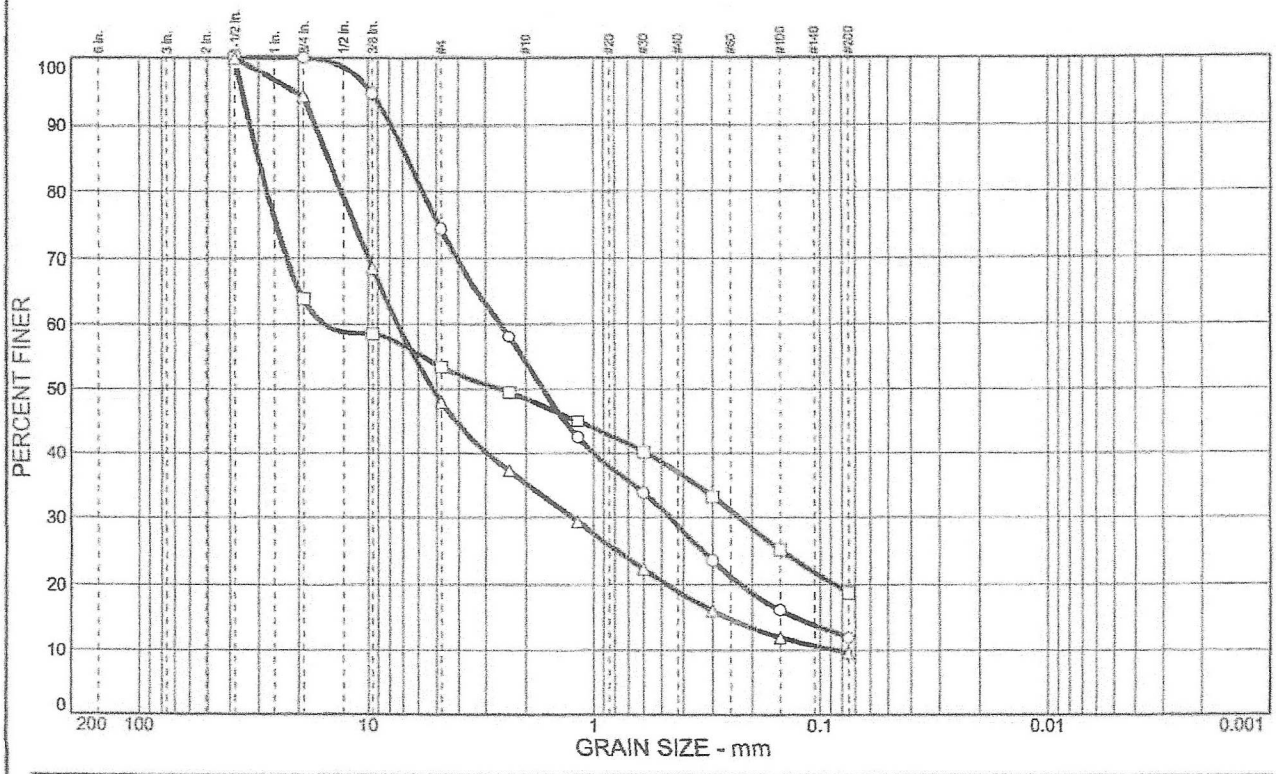
BV TEST PIT LOG 12741.GPJ ECI.GDT 6/22/07

Appendix B

Laboratory Test Results

ES-4064

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		25.8	62.2	12.0		SP-SM			
□		46.6	34.6	18.8		GM			
△		52.0	38.4	9.6		GW-GM			

SIEVE Inches size	PERCENT FINER ○	□	△
1.5	100.0	100.0	100.0
3/4	100.0	64.0	94.4
3/8	94.7	58.5	68.6
	GRAIN SIZE		
D_{60}	2.57	15.4	7.37
D_{30}	0.459	0.229	1.25
D_{10}			0.0856
	COEFFICIENTS		
C_c			2.46
C_u			86.04

SIEVE number size	PERCENT FINER ○	□	△
#4	74.2	53.4	48.0
#8	58.1	49.5	37.2
#16	42.5	45.0	29.4
#30	33.8	40.2	22.3
#50	23.6	33.2	16.1
#100	16.2	25.2	12.0
#200	12.0	18.8	9.6

SOIL DESCRIPTION

○ TP-1; 2.5' - SP-SM
Brown poorly graded SAND with silt and gravel; 10% moisture

□ TP-3; 5' - GM
Tan silty GRAVEL with sand; 19.9% moisture

△ TP-6; 7' - GW-GM
Brown well-graded GRAVEL with silt and sand; 7.8% moisture

REMARKS:

○ Sampled by ELW on 04/16/07. Tested by MS.

□ Sampled by ELW on 04/16/07. Tested by MS.

△ Sampled by ELW on 04/16/07. Tested by MS.

○ Source:	Sample No.: TP-1	Elev./Depth: 2.5'
□ Source:	Sample No.: TP-3	Elev./Depth: 5'
△ Source:	Sample No.: TP-6	Elev./Depth: 7'

EARTH CONSULTANTS, INC.

Client:

Project: Sunrise Place

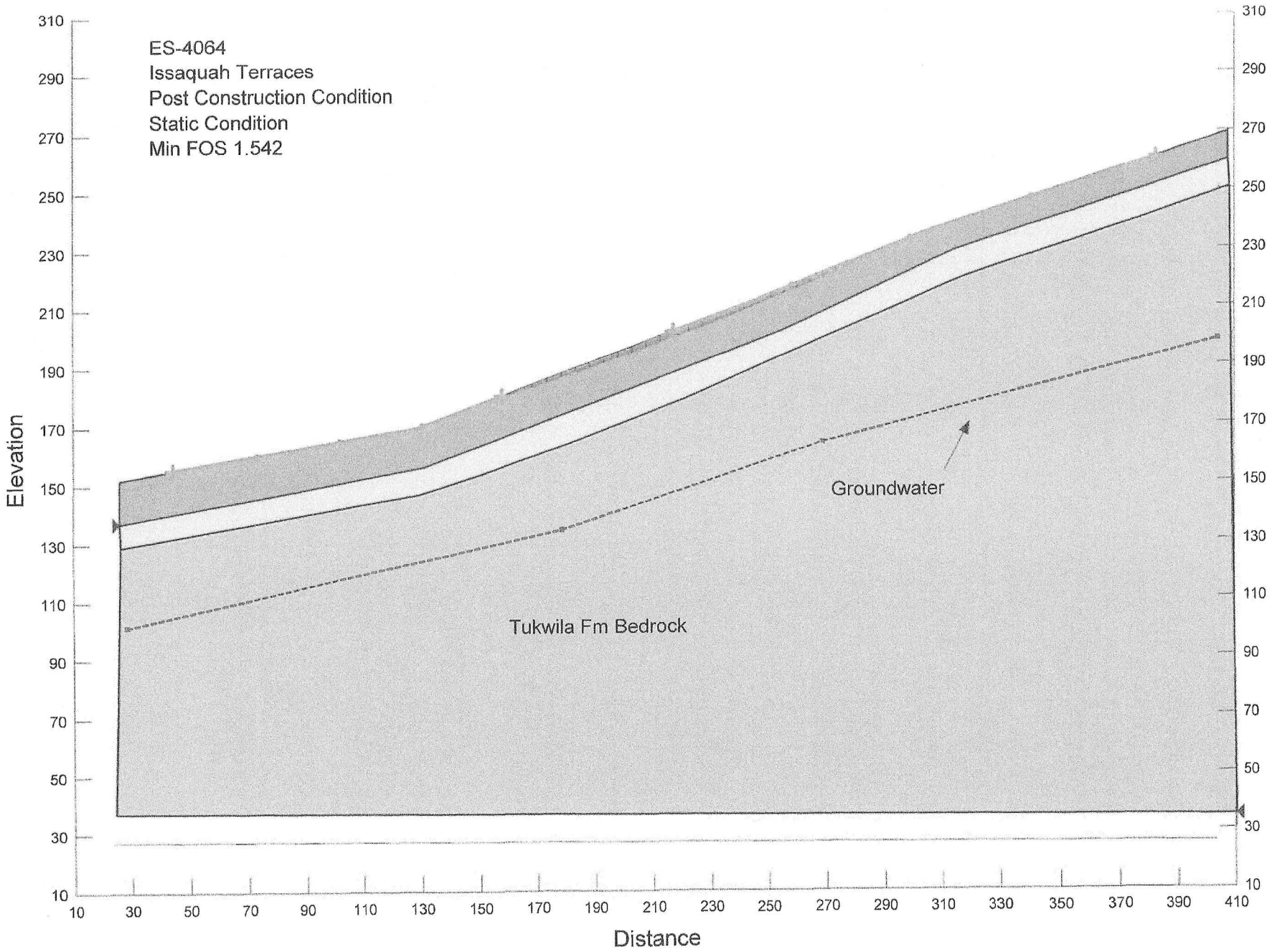
Project No.: E-12741 Plate B1

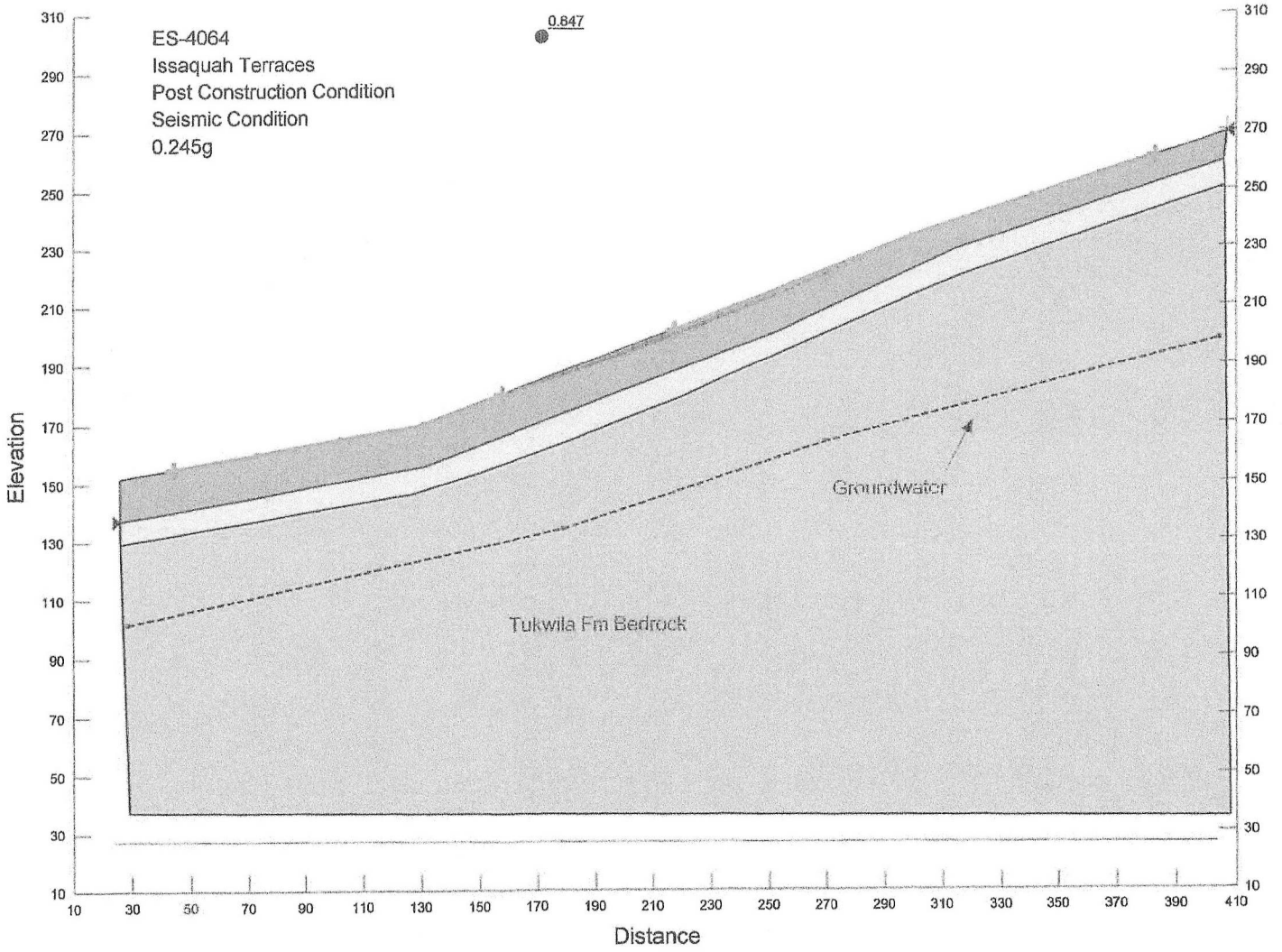
Appendix C

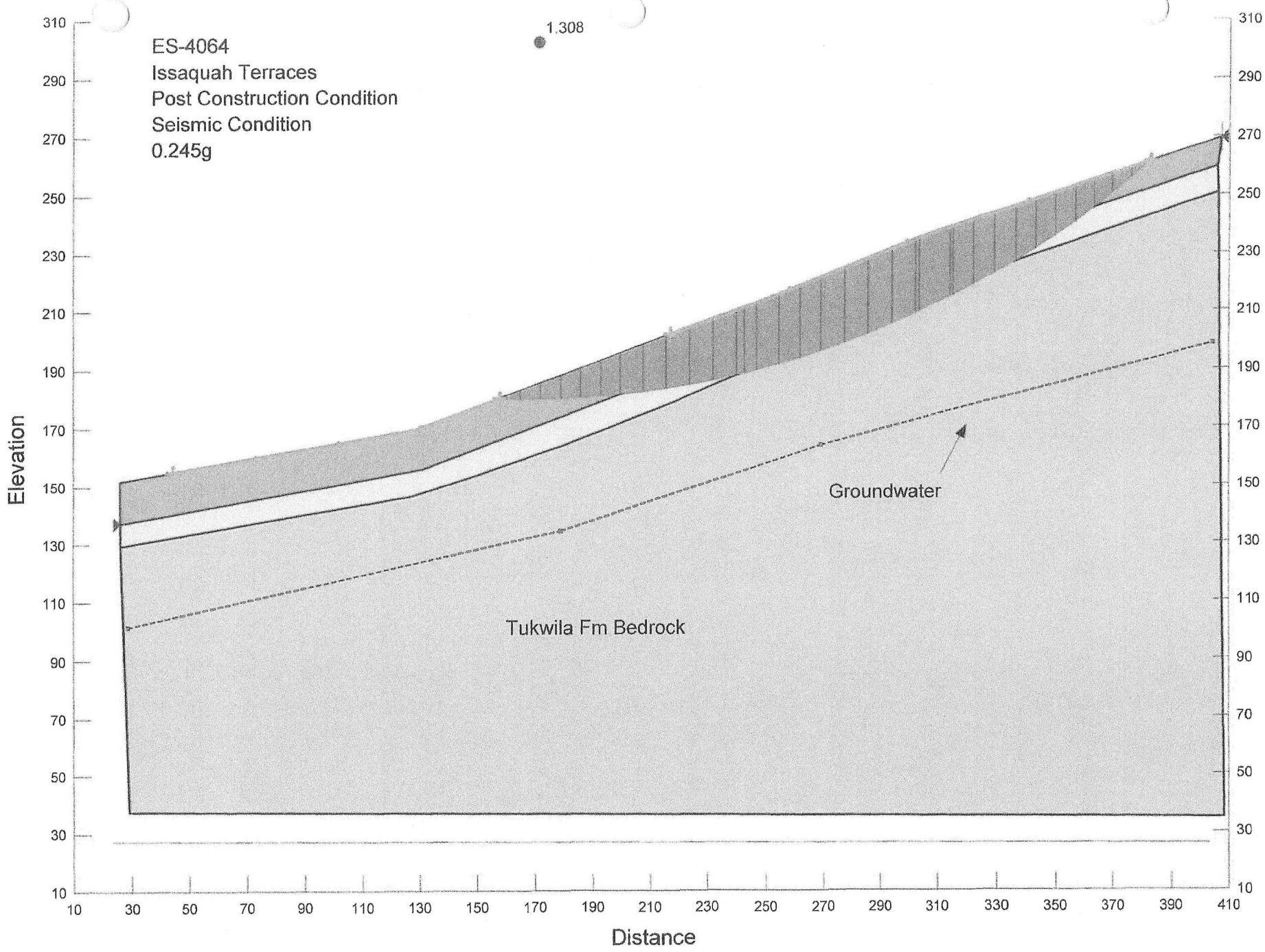
Slope W Outpost

ES-4064

1.542


ES-4064
Issaquah Terraces
Post Construction Condition
Static Condition
Min FOS 1.542
Groundwater
Tukwila Fm Bedrock
Elevation
Distance
310
290
270
250
230
210
190
170
150
130
110
90
70
50
30
10
10
30
50
70
90
110
130
150
170
190
210
230
250
270
290
310
330
350
370
390
410


ES-4064
Issaquah Terraces
Post Construction Condition
Seismic Condition
0.245g
0.847
Groundwater
Tukwila Fm Bedrock
Elevation
Distance
310
290
270
250
230
210
190
170
150
130
110
90
70
50
30
10
10
30
50
70
90
110
130
150
170
190
210
230
250
270
290
310
330
350
370
390
410


ES-4064
Issaquah Terraces
Post Construction Condition
Seismic Condition
0.245g
1.308
Groundwater
Tukwila Fm Bedrock
Elevation
Distance
310
290
270
250
230
210
190
170
150
130
110
90
70
50
30
10
10
30
50
70
90
110
130
150
170
190
210
230
250
270
290
310
330
350
370
390
410

Report Distribution

ES-4064

EMAIL ONLY

CAW Issaquah, LLC
8711 Ridge Road
Medina, Washington 98039

Attention: Mr. Chris Weymouth

EMAIL ONLY

Speros Design, LLC
6698A - 161st Avenue Southeast
Bellevue, Washington 98006

Attention: Mr. Speros Bavelas