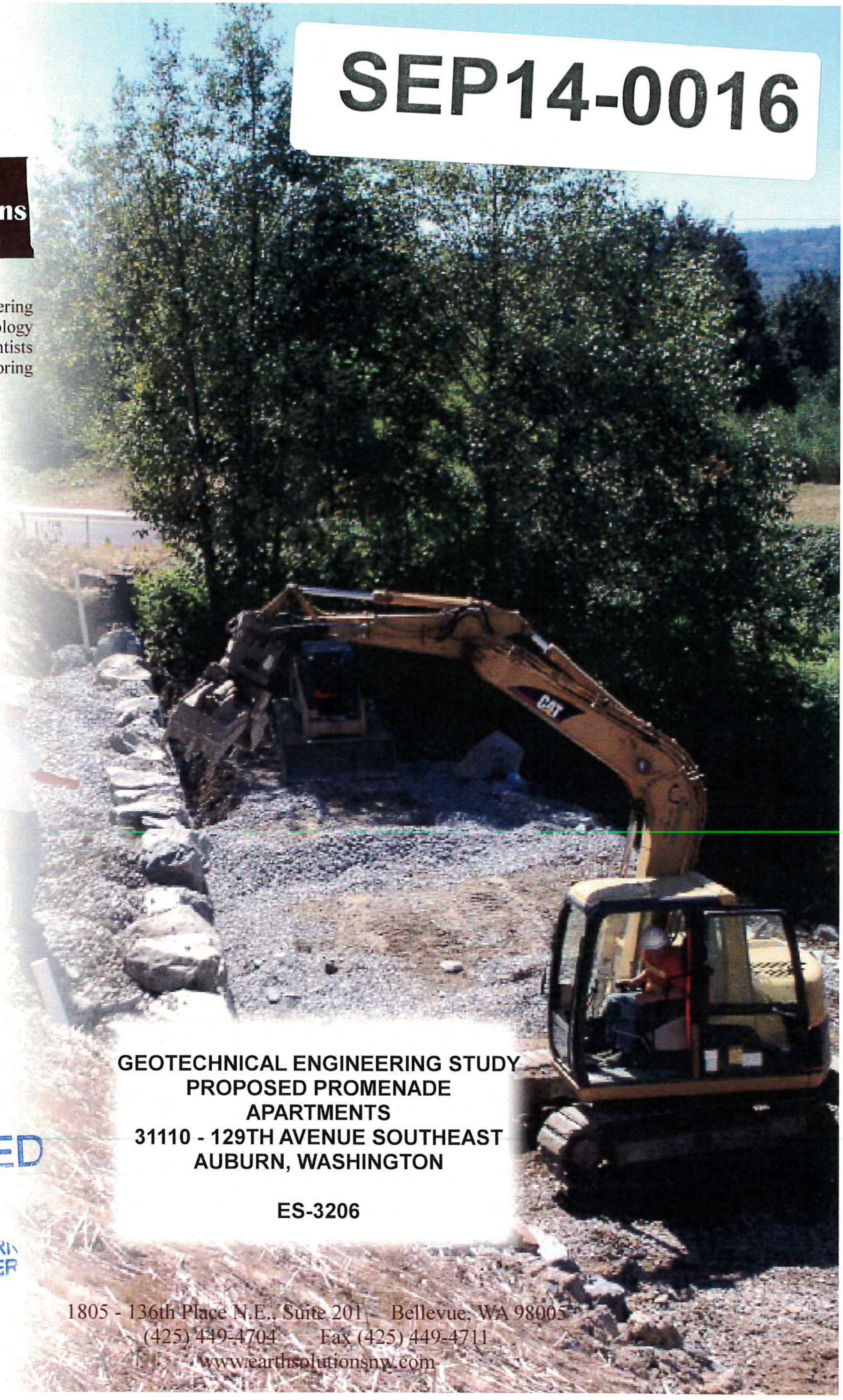
SEP14-0016

Earth Solutions NW LLC

Geotechnical Engineering
Geology
Environmental Scientists
Construction Monitoring



GEOTECHNICAL ENGINEERING STUDY
PROPOSED PROMENADE APARTMENTS
31110 - 129TH AVENUE SOUTHEAST
AUBURN, WASHINGTON

ES-3206

1805 - 136th Place N.E., Suite 201 - Bellevue, WA 98005
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PREPARED FOR

DEVCO, INC.

March 4, 2014

Keven D. Hoffmann, E.I.T.
Staff Engineer

RAYMOND A. COGLAS
STATE OF WASHINGTON
PROFESSIONAL ENGINEER

3/4/14

Raymond A. Coglas, P.E.
Principal

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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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Earth Solutions NW LLC

- Geotechnical Engineering
- Construction Monitoring
- Environmental Sciences

March 4, 2014
ES-3206

DevCo, Inc.
11100 Main Street, Suite 301
Bellevue, Washington 98004

Attention: Mr. David Ratliff

Dear Mr. Ratliff:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, Proposed Promenade Apartments, 31110 – 129th Avenue Southeast, Auburn, Washington". In our opinion, the proposed multi-family development is feasible from a geotechnical standpoint. Our subsurface exploration indicates the site is primarily underlain by glacial till and localized areas of fill. During our subsurface explorations completed on January 30 and February 19, 2014, groundwater seepage was encountered between depths of approximately 1.5 to 11 feet below existing grades.

In our opinion, the proposed multi-family structures can be constructed on competent native soil, recompacted native soil, or new structural fill. In general, dense glacial till was encountered beneath topsoil, loose to medium dense soil, and fill at depths of approximately five to eight feet below existing grades. Loose to medium dense soil encountered atop dense native deposits can likely be compacted to the specifications of structural fill, provided the soil is primarily free of organic and deleterious material. Successful use of upper deposits as structural fill will largely be dictated by moisture content at the time of placement and compaction. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

Recommendations for foundation design, site preparation, drainage, preliminary infiltration design, preliminary detention vault design, 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, E.I.T.
Staff Engineer

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GEOTECHNICAL ENGINEERING STUDY
PROPOSED PROMENADE APARTMENTS
31110 – 129TH AVENUE SOUTHEAST
AUBURN, WASHINGTON

ES-3206

INTRODUCTION

General

This geotechnical engineering study was prepared for the proposed Promenade apartment complex development to be completed at and around 31110 – 129th Avenue Southeast near the Lea Hill neighborhood of Auburn, Washington. The purpose of this study was to provide geotechnical recommendations for currently proposed development plans. Our scope of services for completing this geotechnical engineering study included the following:

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

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

- Site Plan prepared by Ross Deckman and Associates, Inc., revised January 3, 2014;
- Surface Water Management Manual (SWMM), prepared by the City of Auburn, Washington, Department of Public Works, November 2009;
- Online Web Soil Survey (WSS) resource provided by the United States Department of Agriculture (USDA), Natural Resources Conservation Service;
- Liquefaction Susceptibility Map 11-5 prepared by the King County Flood Control District, May 2010, and;
- Geologic Map of King County compiled by Derek B. Booth, Kathy A. Troost, and Aaron P. Wisher, March 2007.

Project Description

According to the referenced site plan, the site will be developed with 19 multi-story, multi-family apartment complex structures, a recreation facility, commercial space, parking areas, and drive areas. Stormwater will likely be managed by a below-grade detention vault and possibly infiltration galleries. A wetland area is indicated within the western site margin on the referenced site plan; we understand adequate buffer spacing has been incorporated into the preliminary site layout.

At the time of report submission, specific grading and building load plans were not available for review; however, based on our experience with similar developments, proposed residential structures will likely be on the order of two to four stories in height and constructed utilizing relatively lightly loaded wood framing supported on conventional foundations. We anticipate residential structures will incorporate slab-on-grade floors at garage elevations. We anticipate perimeter footing loads on the order of 2 to 4 kips per lineal foot (klf). Slab-on-grade loading is expected to be on the order of 150 pounds per square foot (psf).

We anticipate grade modifications up to approximately 10 feet will be required to achieve design elevations, except possibly at areas where detention vault cuts will be more significant. We anticipate mass grading at this site will primarily use a balanced approach, with cut soils utilized elsewhere on-site as structural fill.

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

SITE CONDITIONS

Surface

The subject site is located north of the intersection between Southeast 312th Street and 129th Avenue Southeast near the Lea Hill neighborhood of Auburn, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map). The irregularly shaped property consists of six adjoined tax parcels (King County Parcel Nos. 092105-9153, -9152, -9151, -9150, -9063, and -9032) totaling approximately 14.43 acres. The site is bordered to the north by residential housing, to the west by commercial and residential development, to the south by Southeast 312th Street, and to the east by 132nd Way Southeast.

Several single-family residences and associated outbuildings currently occupy the individual residential parcels. We understand existing structural improvements will be removed as part of project redevelopment plans. Site topography descends from the western and central site margins to a drainage course near the west-central site margin. Total elevation change is estimated on the order of 70 feet or less.

Subsurface

Subsurface conditions on the subject site were explored on two occasions as follows:

- Three test pits were excavated on January 30, 2014 using a trackhoe and operator retained by our firm, and;
- Eleven test pits were excavated on February 19, 2014 using a mini-trackhoe and operator retained by our firm.

The test pits were observed, logged, and sampled by a representative of our firm. The test pits were completed for purposes of assessing soil conditions and classifying site soils. 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 the subsurface conditions.

Topsoil and Fill

Topsoil was primarily encountered in the upper four to eight inches of existing grades; however, topsoil was encountered up to 18 inches in depth in localized areas. The topsoil was characterized by dark brown color, the presence of fine organic material, and small root intrusions.

Fill was encountered at test pit locations TP-4, TP-13, and TP-14 during our subsurface exploration and generally consisted of loose silty sand with gravel (Unified Soil Classification System: SM). Organic bedding, wood debris, concrete rubble, and rubbish were noted within the silty sand fill. Where encountered, fill depths were on the order of seven to eight feet below existing grades, and the fill was primarily in a moist condition.

Native Soil

Underlying topsoil and fill, native soils primarily consisted of dense silty sand with gravel (USCS: SM) and medium dense to dense silty gravel with sand (USCS: GM), otherwise known as glacial till. Loose to medium dense silty sands, as well as localized areas of sandy silts (USCS: ML), were encountered above dense glacial till deposits. At test pit location TP-2, loose to medium dense poorly graded sand (USCS: SP) was encountered at approximately three feet below existing grades. Native soils were primarily encountered in a moist condition, and extended to the maximum exploration depth of 14 feet below existing grades.

Geologic Setting

The referenced geologic map resource identifies Vashon glacial till (Qvt) deposits across the site and surrounding areas. As described on the geologic map resource, Vashon subglacial till deposits typically consist of compact diamicts of silt, sand, and subrounded to well-rounded gravel which were glacially transported and deposited under ice. In addition, the referenced WSS resource identifies Alderwood gravelly sandy loam (AgC) across the site and surrounding areas. Alderwood series soils formed in moraines and glacial till plains.

Based on our field observations, native soils underlying the subject site are primarily consistent with Vashon glacial till deposits.

Groundwater

During our subsurface explorations completed on January 30 and February 19, 2014, groundwater seepage was encountered at the test pit locations between depths of approximately 1.5 to 11 feet below existing grades. With the exception of TP-14, iron oxide staining was noted at depths on the order of two to eight feet below existing grades.

In our opinion, perched groundwater will likely be encountered during excavations on the subject site. Groundwater seepage at depth could be moderate to heavy at some locations. Groundwater 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.

DISCUSSION AND RECOMMENDATIONS

General

In our opinion, construction of the proposed apartment complex on the subject site 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 on-site soils as structural fill, preliminary infiltration design, and preliminary detention vault design.

In our opinion, the proposed multi-family structures can be constructed on competent native soil, recompacted native soil, or new structural fill. In general, dense glacial till was encountered beneath topsoil, loose to medium dense soil, and fill at depths of approximately five to eight feet below existing grades. Loose to medium dense soil encountered atop dense native deposits can likely be compacted to the specifications of structural fill, provided the soil is primarily free of organic and deleterious material. Successful use of upper deposits as structural fill will largely be dictated by moisture content at the time of placement and compaction. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

This study has been prepared for the exclusive use of DevCo, Inc. 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

Site preparation activities will include installing temporary erosion control measures, removing existing structural improvements, establishing grading limits, and performing clearing and site stripping, as necessary.

Temporary Erosion Control

Prior to finished pavement installation, temporary construction entrances and drive lanes, consisting of 6 to 12 inches of quarry spalls, should be considered in order to minimize off-site soil tracking and to provide a stable access entrance surface. 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 along down-gradient margins of the site perimeter. Soil stockpiles should be covered or otherwise protected to reduce soil erosion. Temporary approaches for controlling surface water runoff should be established prior to beginning earthwork activities.

Stripping

Topsoil was primarily encountered in the upper four to eight inches of existing grades; however, topsoil was encountered up to 18 inches in depth in localized areas. ESNW should be retained to observe site stripping activities at the time of construction to better assess the degree of required stripping. 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 is it suitable for use as structural fill. Topsoil and organic-rich soil can be used in non-structural areas if desired.

In-situ Soils

Successful use of native soils as structural fill will largely be dictated by the moisture content at the time of placement and compaction. From a geotechnical standpoint, native soils encountered at the test pit locations will generally be suitable for use as structural fill; however, native silty sands contain appreciable amounts of fines and maintain moisture sensitivity that is generally characterized as high. During wet weather conditions, perched seepage and groundwater flows may dictate the necessity for native soils to undergo remedial measures and aeration prior to use 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 periods of extended rainfall activity, a contingency should be provided in the project budget for export of soil that cannot be successfully compacted as structural fill. Soils with fines contents greater than 5 percent typically degrade rapidly when exposed to periods of rainfall.

Imported Soils

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 defined as the percent passing the Number 200 sieve, based on the minus three-quarter inch fraction.

Subgrade Preparation

Following site stripping and removal of existing structures, cuts and fills will be completed to establish proposed subgrade elevations throughout the site. ESNW should observe the subgrade during initial site preparation activities to confirm soil conditions and to provide supplement recommendations for subgrade preparation. The process of removing existing structures may produce voids where old foundations are removed. Complete restoration of voids from old foundation areas must be executed as part of overall subgrade and building pad preparation activities. The following guidelines for preparing building subgrade areas should be incorporated into the final design:

- Where voids and related demolition disturbances extend below planned subgrade elevations, restoration of these areas should be completed using structural fill to restore voids or unstable areas resulting from the removal of existing structural elements;
- Recompact or overexcavate and replace areas of existing fill, if present, exposed at building subgrade elevations, with overexcavations extending into competent native soils and structural fill utilized to restore subgrade elevations, and;
- ESNW should confirm subgrade conditions and the required level of recompaction or overexcavation and replacement during site preparation activities, as well as the overall suitability of prepared subgrade areas following site preparation activities.

Structural Fill

Structural fill is defined as compacted soil placed 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 loose lifts of 12 inches or less and compacted to a relative compaction of 90 percent, based on the laboratory maximum dry density as determined by the Modified Proctor Method (ASTM D1557). Soil placed in the upper 12 inches of slab-on-grade, utility trench, and pavement areas should be compacted to a relative compaction of at least 95 percent. Additionally, 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 multi-family structures can be constructed on competent native soil, recompacted native soil, or new structural fill. In general, dense glacial till was encountered beneath topsoil, loose to medium dense soil, and fill at depths of approximately five to eight feet below existing grades. Loose to medium dense soil encountered atop dense native deposits can likely be compacted to the specifications of structural fill, provided the soil is primarily free of organic and deleterious material. Successful use of upper deposits as structural fill will largely be dictated by moisture content at the time of placement and compaction. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with a suitable structural fill material, will be necessary.

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

- Allowable soil bearing capacity 3,000 psf
- Passive earth pressure 350 pcf (equivalent fluid)
- Coefficient of friction 0.40

A one-third increase in the allowable soil bearing capacity can 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 approximately one-half inch is anticipated. The majority of the settlements should occur during construction, as dead loads are applied.

Seismic Design

The 2012 International Building Code (IBC) recognizes the American Society of Civil Engineers (ASCE) for seismic site class definitions. Based on the soil conditions observed at the test pit locations, in accordance with Table 20.3-1 of the ASCE Minimum Design Loads for Buildings and Other Structures manual, Site Class C should be used for design.

The referenced liquefaction susceptibility map indicates the site and surrounding areas maintain very low 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 increased pore water pressures resulting from an earthquake or other intense ground shaking.

During our subsurface explorations completed on January 30 and February 19, 2014, groundwater seepage was encountered at every test pit location between depths of approximately 1.5 to 11 feet below existing grades. Iron oxide staining was noted at every test pit location, with the exception of TP-14, at depths on the order of two to eight feet below existing grades. In our opinion, site susceptibility to liquefaction can be characterized as low to moderate. Establishment of uniform subgrades during construction will aid to mitigate typical hazards associated with liquefaction in the event of seismic activity.

Slab-On-Grade Floors

Slab-on-grade floors for proposed residential structures constructed at this site should be supported on a firm and unyielding subgrade. We anticipate that native soils likely to be exposed at slab-on-grade subgrade levels can 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 material should have a fines content of 5 percent or less (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 manufacturer's specifications.

Retaining Walls

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

- Active earth pressure (yielding condition) — 35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 50 pcf
- Traffic surcharge* (passenger vehicles) — 70 psf (rectangular distribution)
- Passive earth pressure — 350 pcf (equivalent fluid)
- Coefficient of friction — 0.40
- Seismic surcharge — 6H*

* Where H equals retained height

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.

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 drain pipe 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

Perched groundwater should be anticipated in site excavations depending on the time of year grading operations take place, particularly in excavations at depth for utilities and the stormwater detention vault, if applicable. 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.

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

Preliminary Infiltration Evaluation

The feasibility of utilizing infiltration facilities to accommodate stormwater runoff from new impervious surfaces was investigated as part of project development plans. The City of Auburn adopts the referenced SWMM for design of infiltration facilities. The following preliminary recommendations can be utilized regarding proposed infiltration facilities for the subject site.

Soil samples from selected test pit locations were analyzed in accordance with the USDA textural classification system. Native glacial till was generally classified as loam with varying amounts of sand and gravel. Localized amounts of very gravelly coarse sand (USCS: SP-SM) were encountered at test pit location TP-7. Infiltration capacity typically exhibited by loam can be characterized as very low. As previously mentioned in the *Groundwater* section of this report, groundwater seepage was encountered at the test pit locations between depths of approximately 1.5 to 11 feet below existing grades during our fieldwork.

From a geotechnical standpoint, infiltration at the subject site is generally not considered feasible due to the presence of glacial till (loam) soil deposits and relatively shallow perched groundwater seepage conditions. Localized areas of sand were encountered, but did not appear extensive enough to support infiltration. Additional (targeted) investigation would be needed to determine infiltration feasibility where sand deposits are present. In general, infiltration facilities must be at least three feet above the seasonal high groundwater level, have at least three feet of permeable soil beneath the facility bottom, and extend at least one foot into native soils. Dense native glacial till, as well as the likely presence of groundwater seepage within site excavations, will interfere with the successful design and functionality of infiltration facilities.

Preliminary Detention Vault Design

We understand below-grade stormwater detention may be utilized on the subject site. The following preliminary recommendations should be incorporated into the design of detention facilities:

- Detention vault foundations should be supported on competent native soil or crushed rock placed atop competent native soil;
- Final detention vault designs must incorporate adequate buffer space from property boundaries such that temporary excavation to construct the vault structure can be successfully completed, and;
- Perimeter drains should be installed around the vault and conveyed to an approved discharge point.

During our subsurface explorations completed on January 30 and February 19, 2014, groundwater seepage was encountered at the test pit locations between depths of approximately 1.5 to 11 feet below existing grades. In our opinion, the presence of groundwater seepage should be expected in excavations for below-grade detention facilities. The following preliminary parameters can be used for the detention vault design:

- Allowable soil bearing capacity 5,000 psf
- Active earth pressure (unrestrained) 35 pcf
- At-rest earth pressure (restrained) 50 pcf
- Coefficient of friction 0.40
- Passive earth pressure 350 pcf

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

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

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 a high compressive strength are allowed steeper temporary slope inclinations than are soils that exhibit a lower compressive strength.

Based on the soil conditions encountered at the test pit locations, loose and medium dense native soils, fill, or areas where groundwater seepage is exposed, are 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 1.5H:1V (Horizontal:Vertical). Dense native glacial till encountered without the presence of groundwater would be classified as Type A by OSHA and WISHA. Temporary slopes over four feet in height in Type A soils must be sloped no steeper than 0.75H:1V. Type A soils that are fissured, subjected to vibrations from heavy traffic, or have been otherwise previously disturbed must be classified as Type B by OSHA and WISHA. Temporary slopes over four feet in height in Type B soils must be sloped no steeper than 1H:1V.

The presence of perched groundwater may cause caving of the temporary slopes due to hydrostatic pressure. 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 maintain a gradient of 2H:1V or flatter, and should be planted with vegetation to enhance stability and to minimize erosion. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions, and to provide additional excavation and slope recommendations as necessary.

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. 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 will require remedial measures such as overexcavation and thicker crushed rock or structural fill sections prior to pavement.

We anticipate new pavement sections will be primarily subjected to passenger vehicle traffic. For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections can be considered:

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

- Two inches of HMA placed over three inches of asphalt treated base (ATB).

For relatively high volume, heavily loaded pavements subjected to occasional truck traffic, the following preliminary pavement sections can be considered:

- Three inches of HMA placed over six inches of CRB, or;

- Three inches of HMA placed over four inches of 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 can be provided once final traffic loading has been determined. City of Auburn road standards may supersede the recommendations provided in this report.

Utility Support and Trench Backfill

In our opinion, glacial till deposits primarily encountered on the subject site will likely be suitable for support of utilities. Organic-rich soil is not considered suitable for direct support of utilities and may require removal at utility grades if encountered. Remedial measures may be necessary in some areas in order to provide support for utilities, such as overexcavation and replacement with structural fill, or placement of geotextile fabric.

Based on the results of our subsurface explorations completed on January 30 and February 19, 2014, groundwater seepage will likely be encountered during excavations for utilities. Caving was observed at several test pit locations during our fieldwork, and may occur within trench walls where groundwater seepage is encountered. Dewatering, as well as temporary trench shoring, may be necessary during utility excavation and installation.

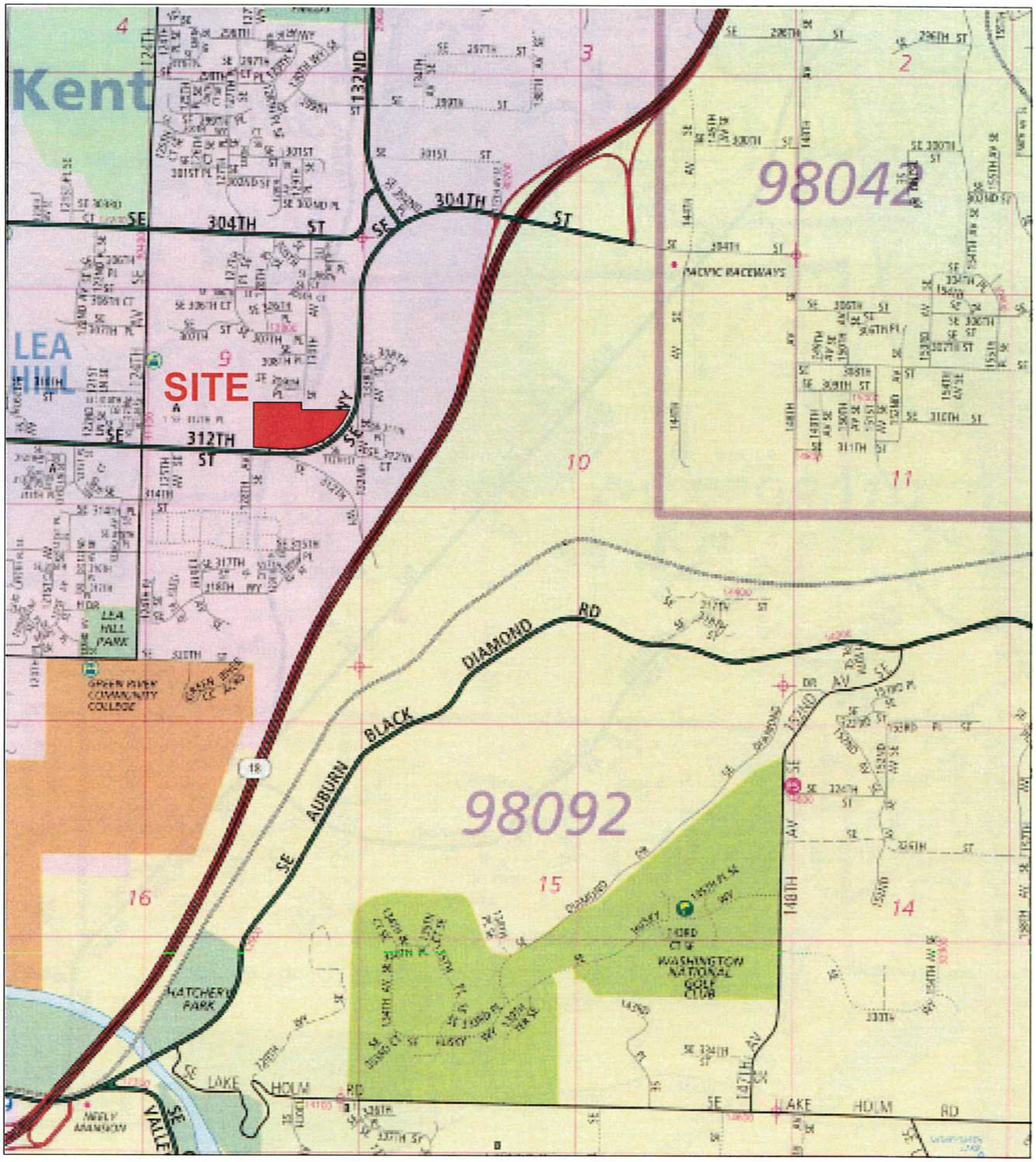
In general, native deposits should be suitable for use as structural backfill in utility trench excavations, provided the soil is at or near the optimum moisture content at the time of placement and compaction. Moisture conditioning of the soils may be necessary at some locations prior to use as structural fill, especially where groundwater seepage is encountered. Each section of utility lines must be adequately supported in the 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 Auburn or other responsible jurisdiction or agency.

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



Reference:
King County, Washington
Map 746
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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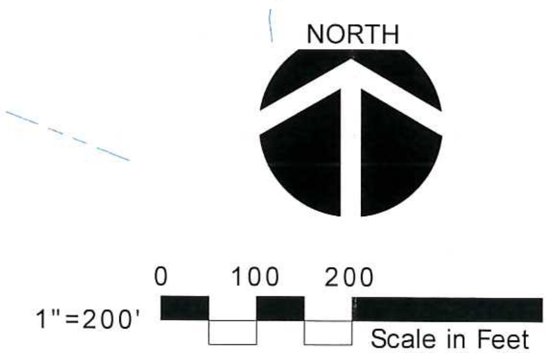
Vicinity Map
Promenade Apartments
Auburn, Washington

Drwn. GLS	Date 02/21/2014	Proj. No. 3206
Checked KDH	Date Feb. 2014	Plate 1



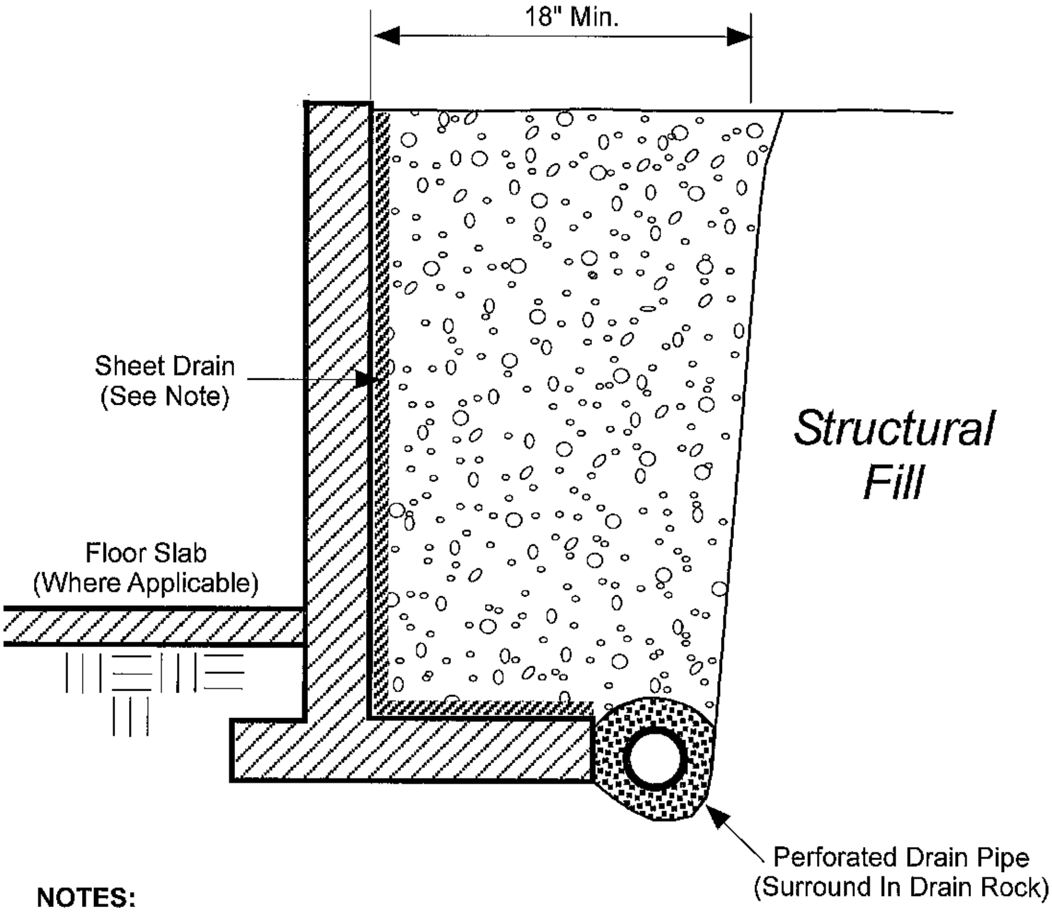
NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided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

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

Test Pit Location Plan
Promenade Apartments
Auburn, Washington

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

Drwn. By	GLS
Checked By	KDH
Date	02/21/2014
Proj. No.	3206
Plate	2

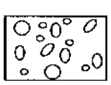


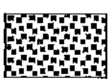
NOTES:

- 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

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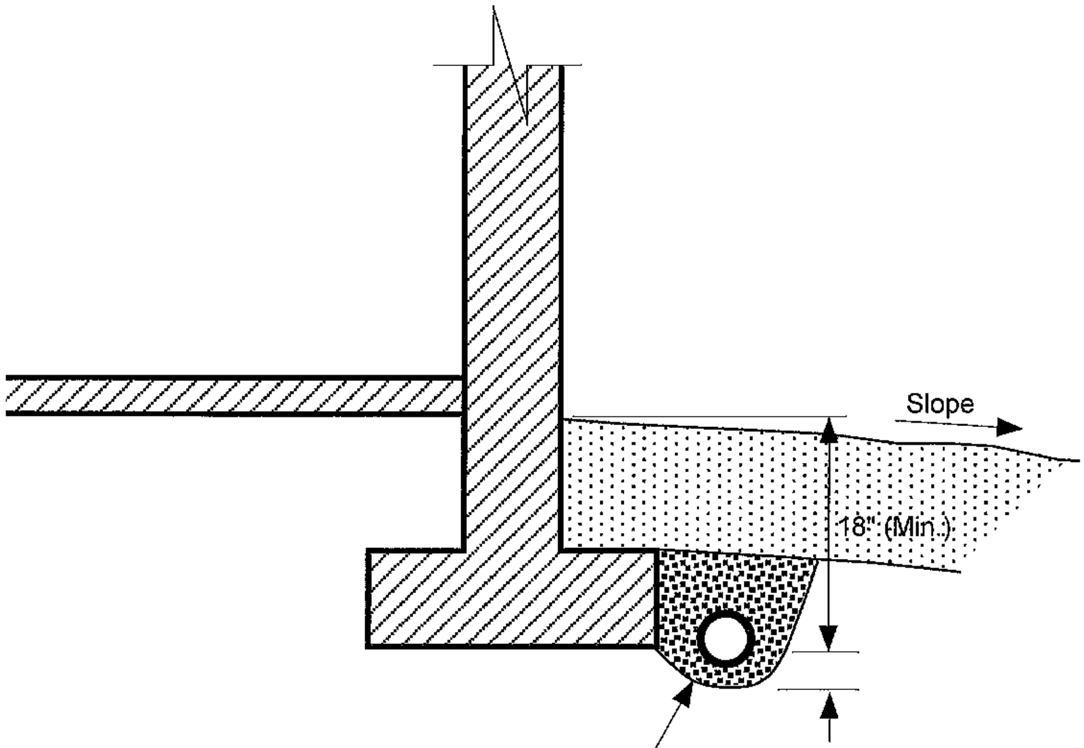
RETAINING WALL DRAINAGE DETAIL
Promenade Apartments
Auburn, Washington

Drwn. GLS	Date 02/24/2014	Proj. No. 3206
Checked KDH	Date Feb. 2014	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.

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NOT A CONSTRUCTION DRAWING

LEGEND:

Surface Seal; native soil or other low permeability material.

1" Drain Rock

Earth Solutions NW LLC
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FOOTING DRAIN DETAIL
Promenade Apartments
Auburn, Washington

Drwn. GLS	Date 02/24/2014	Proj. No. 3206
Checked KDH	Date Feb. 2014	Plate 4

Appendix A

Subsurface Exploration
Test Pit Logs

ES-3206

Subsurface conditions on the subject site were explored on two occasions as follows:

- Three test pits were excavated on January 30, 2014 using a trackhoe and operator retained by our firm, and;

- Eleven test pits were excavated on February 19, 2014 using a mini-trackhoe and operator retained by our firm.

The test pits were observed, logged, and sampled by a representative of our firm. The test pits were completed for purposes of assessing soil conditions and classifying site soils. The approximate locations of subsurface exploration test pits are illustrated on Plate 2 of this study. The subsurface test pit logs are provided in this Appendix. The test pits were advanced to a maximum depth of 14 feet below existing grades.

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.

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SOIL CLASSIFICATION CHART

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

DUAL SYMBOLS are used to indicate borderline soil classifications.

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

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

TEST PIT NUMBER TP-1

CLIENT DevCo, Inc.
PROJECT NAME Promenade Apartments
PROJECT NUMBER 3206
PROJECT LOCATION Auburn, Washington
DATE STARTED 1/30/14 **COMPLETED** 1/30/14
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY KDH **CHECKED BY** KDH
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 6": lawn grass
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, roots to 1'
		MC = 23.80% MC = 21.70% MC = 10.80%	SM	7.5	Brown silty SAND with gravel, loose, moist -becomes tan, medium dense -iron oxide staining -silt interbeds to 5' -sand interbeds to 5.5' -becomes brown, minor groundwater seepage at 6' -moderate caving to BOH
5		MC = 10.40%	GM	9.5	Brown silty GRAVEL with sand, medium dense, wet -intermittent cobbles -moderate groundwater seepage at 9.5'
10		MC = 11.30% Fines = 27.40% MC = 9.40%	SM	12.0	Brown silty SAND with gravel, medium dense, wet -iron oxide staining [USDA Classification: very gravelly sandy LOAM]

Test pit terminated at 12.0 feet below existing grade. Groundwater seepage encountered at 6.0 and 9.5 feet during excavation.

Bottom of test pit at 12.0 feet.

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TEST PIT NUMBER TP-2

CLIENT DevCo, Inc.
PROJECT NAME Promenade Apartments
PROJECT NUMBER 3206
PROJECT LOCATION Auburn, Washington
DATE STARTED 1/30/14 **COMPLETED** 1/30/14
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY KDH **CHECKED BY** KDH
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 8"- 12": brambles
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.0	Dark brown TOPSOIL, roots to 1'
		MC = 26.60%	SM	3.0	Brown silty SAND, loose, moist to wet -heavy groundwater seepage at 1.5' -becomes wet -iron oxide staining
5			SP	6.0	Brown poorly graded SAND, loose to medium dense, wet -heavy groundwater seepage at 4' to 6'
		MC = 28.40%	SM	9.0	Brown silty SAND, loose to medium dense, moist to wet
10		MC = 26.40%	GM	11.0	Brown silty GRAVEL with sand, medium dense, moist -heavy iron oxide staining pocket -moderate groundwater seepage at 10' to 11'
		MC = 10.90% Fines = 34.60% MC = 6.90%	SM	14.0	Gray silty SAND with gravel, dense to very dense, moist [USDA Classification: gravelly LOAM] -iron oxide staining to BOH

Test pit terminated at 14.0 feet below existing grade. Groundwater seepage encountered at 1.5, 4.0 and 10.0 feet during excavation.

Bottom of test pit at 14.0 feet.

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Fax: 425-449-4711

TEST PIT NUMBER TP-3

CLIENT DevCo, Inc. **PROJECT NAME** Promenade Apartments

PROJECT NUMBER 3206 **PROJECT LOCATION** Auburn, Washington

DATE STARTED 1/30/14 **COMPLETED** 1/30/14 **GROUND ELEVATION** **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

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

LOGGED BY KDH **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, root to 1.6'
			SM			Brown silty SAND with gravel, loose, moist
						-minor groundwater seepage at 2'
		MC = 11.90%				-scattered iron oxide staining pockets to 6', large rock
5						-minor groundwater seepage at 4' to 5'
		MC = 10.20% Fines = 27.80%				-large rock [USDA Classification: very gravelly sandy LOAM]
					7.0	
			GM			Brown silty GRAVEL with sand, medium dense, moist
		MC = 10.90%				-becomes dense -minor groundwater seepage at 9' -moderate caving to BOH
10						-becomes dense to very dense
		MC = 10.50%			12.0	Test pit terminated at 12.0 feet below existing grade. Groundwater seepage encountered at 2.0, 4.5 and 9.0 feet during excavation. Bottom of test pit at 12.0 feet.

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TEST PIT NUMBER TP-4

CLIENT DevCo, Inc. **PROJECT NAME** Promenade Apartments

PROJECT NUMBER 3206 **PROJECT LOCATION** Auburn, Washington

DATE STARTED 2/19/14 **COMPLETED** 2/19/14 **GROUND ELEVATION** ______ **TEST PIT SIZE** ______

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD ______ **AT TIME OF EXCAVATION** ---

LOGGED BY KDH **CHECKED BY** KDH **AT END OF EXCAVATION** ---

NOTES Graded Gravel Driveway **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Dark brown silty SAND with gravel, loose, moist (Fill)
					-6" black organics layer -becomes gray
		MC = 17.00%	SM		
					-becomes brown
5					-moderate groundwater seepage
		MC = 36.30%			-minor groundwater seepage
				7.0	-iron oxide staining
		MC = 14.00%	SM		Brown silty SAND with gravel, medium dense to dense, moist
		MC = 18.70%		8.0	Test pit terminated at 8.0 feet below existing grade. Groundwater seepage encountered at 4.5 and 6.0 feet during excavation. Bottom of test pit at 8.0 feet.

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TEST PIT NUMBER TP-5

CLIENT DevCo, Inc.
PROJECT NAME Promenade Apartments
PROJECT NUMBER 3206
PROJECT LOCATION Auburn, Washington
DATE STARTED 2/19/14 COMPLETED 2/19/14
GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY KDH CHECKED BY KDH
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 18": grass
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	1.5	Dark brown TOPSOIL, roots to 3'
		MC = 45.10%	SM	3.0	Brown silty SAND with gravel, loose, moist
5		MC = 25.80% Fines = 57.60%	ML	5.5	Tan sandy SILT, medium dense, moist [USDA Classification: LOAM] -moderate groundwater seepage to 5', iron oxide staining -becomes moist to wet
		MC = 8.90% MC = 13.30%	SM	8.0	Brown silty SAND with gravel, dense, moist to wet -becomes dense to very dense
					Test pit terminated at 8.0 feet below existing grade. Groundwater seepage encountered at 3.5 feet during excavation. Bottom of test pit at 8.0 feet.

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TEST PIT NUMBER TP-6

CLIENT DevCo, Inc.
PROJECT NAME Promenade Apartments
PROJECT NUMBER 3206
PROJECT LOCATION Auburn, Washington
DATE STARTED 2/19/14 **COMPLETED** 2/19/14
GROUND ELEVATION ______ **TEST PIT SIZE** ______
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD ______
AT TIME OF EXCAVATION ---
LOGGED BY KDH **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, roots to 1'
			SM			Tan silty SAND with gravel, loose, moist
						-becomes wet, tan
		MC = 24.90%				
						-caving to 5', iron oxide staining
						-minor groundwater seepage to 4'
						-becomes moist
5		MC = 20.30%				
		MC = 22.20%				-becomes wet
					7.5	-becomes moist
		MC = 10.80%				Test pit terminated at 7.5 feet below existing grade. Groundwater seepage encountered at 4.0 feet during excavation.
						Bottom of test pit at 7.5 feet.

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TEST PIT NUMBER TP-7

CLIENT DevCo, Inc.

PROJECT NAME Promenade Apartments

PROJECT NUMBER 3206

PROJECT LOCATION Auburn, Washington

DATE STARTED 2/19/14 COMPLETED 2/19/14

GROUND ELEVATION

TEST PIT SIZE

EXCAVATION CONTRACTOR NW Excavating

GROUND WATER LEVELS:

EXCAVATION METHOD

AT TIME OF EXCAVATION ---

LOGGED BY KDH CHECKED BY KDH

AT END OF EXCAVATION ---

NOTES Depth of Topsoil & Sod 3": moss, short grass.

AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		MC = 13.20%	SM		Brown silty SAND with gravel, loose, moist -becomes medium dense
		MC = 10.40% Fines = 6.10%		3.0	
5		MC = 9.10%	SP-SM		Brown poorly graded SAND with silt and gravel, dense, moist [USDA Classification: very gravelly coarse SAND] -iron oxide staining -minor groundwater seepage to 5.5' -becomes moist to wet
				7.0	Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 4.5 feet during excavation. Bottom of test pit at 7.0 feet.

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Fax: 425-449-4711

TEST PIT NUMBER TP-8

CLIENT DevCo, Inc. **PROJECT NAME** Promenade Apartments

PROJECT NUMBER 3206 **PROJECT LOCATION** Auburn, Washington

DATE STARTED 2/19/14 **COMPLETED** 2/19/14 **GROUND ELEVATION** ______ **TEST PIT SIZE** ______

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

EXCAVATION METHOD ______ **AT TIME OF EXCAVATION** ---

LOGGED BY KDH **CHECKED BY** KDH **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 5" - 7": grass **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG		MATERIAL DESCRIPTION
0			TPSL		0.5	Dark brown TOPSOIL, roots to 6"
			SM			Brown silty SAND with gravel, loose, moist
		MC = 20.30%				
						-iron oxide staining
						-moderate groundwater seepage
						-becomes medium dense
		MC = 13.40%				
5						
		MC = 63.80% Fines = 13.00%				-becomes moist to wet -large rocks [USDA Classification: very gravelly loamy SAND]
						-becomes dense
						-becomes moist
		MC = 14.40%				
10					10.0	Test pit terminated at 10.0 feet below existing grade. Groundwater seepage encountered at 2.5 feet during excavation. 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-9

CLIENT DevCo, Inc. **PROJECT NAME** Promenade Apartments
PROJECT NUMBER 3206 **PROJECT LOCATION** Auburn, Washington
DATE STARTED 2/19/14 **COMPLETED** 2/19/14 **GROUND ELEVATION** ______ **TEST PIT SIZE** ______
EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**
EXCAVATION METHOD ______ **AT TIME OF EXCAVATION** ---
LOGGED BY KDH **CHECKED BY** KDH **AT END OF EXCAVATION** ---
NOTES Depth of Topsoil & Sod 7": grass, moss **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL	0.5	Dark brown TOPSOIL, roots to 1'
			SM		Brown silty SAND with gravel, loose, moist
		MC = 16.80%			-iron oxide staining
					-minor groundwater seepage and slight caving
					-becomes tan, medium dense to dense
5		MC = 16.60%			
					-large rocks
					-becomes dense
		MC = 15.90%		8.5	Test pit terminated at 8.5 feet below existing grade. Groundwater seepage encountered at 3.5 feet during excavation. Bottom of test pit at 8.5 feet.

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

TEST PIT NUMBER TP-10

CLIENT DevCo, Inc. PROJECT NAME Promenade Apartments
PROJECT NUMBER 3206 PROJECT LOCATION Auburn, Washington
DATE STARTED 2/19/14 COMPLETED 2/19/14 GROUND ELEVATION ____ TEST PIT SIZE ____
EXCAVATION CONTRACTOR NW Excavating GROUND WATER LEVELS:
EXCAVATION METHOD ____ AT TIME OF EXCAVATION ---
LOGGED BY KDH CHECKED BY KDH AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 10": grass AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		Dark brown TOPSOIL, roots to 2.5'
1.0		MC = 27.80%	SM		Brown silty SAND with gravel, loose, moist
		MC = 13.70%			-iron oxide staining -becomes medium dense, tan -heavy groundwater seepage to 4.5'
5					
7.0		MC = 12.50%			Test pit terminated at 7.0 feet below existing grade. Groundwater seepage encountered at 3.5 feet during excavation. Bottom of test pit at 7.0 feet.

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-11

CLIENT DevCo, Inc. **PROJECT NAME** Promenade Apartments

PROJECT NUMBER 3206 **PROJECT LOCATION** Auburn, Washington

DATE STARTED 2/19/14 **COMPLETED** 2/19/14 **GROUND ELEVATION** **TEST PIT SIZE**

EXCAVATION CONTRACTOR NW Excavating **GROUND WATER LEVELS:**

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

LOGGED BY KDH **CHECKED BY** KDH **AT END OF EXCAVATION** ---

NOTES Depth of Topsoil & Sod 8": brambles, duff **AFTER EXCAVATION** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			TPSL		0.5 Dark brown TOPSOIL, roots to 2'
			SM		Brown silty SAND with gravel, loose, moist
					-becomes wet
		MC = 17.40%			-iron oxide staining
					-moderate groundwater seepage
		MC = 15.20%			-becomes tan with increased sand content, medium dense, moist
5					-moderate groundwater seepage to 6', becomes wet
		MC = 13.20%			8.0
					Test pit terminated at 8.0 feet below existing grade. Groundwater seepage encountered at 3.5, 5.0 and 6.0 feet during excavation. Bottom of test pit at 8.0 feet.

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Bellevue, Washington 98005
Telephone: 425-449-4704
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TEST PIT NUMBER TP-12

CLIENT DevCo, Inc.
PROJECT NAME Promenade Apartments
PROJECT NUMBER 3206
PROJECT LOCATION Auburn, Washington
DATE STARTED 2/19/14 COMPLETED 2/19/14
GROUND ELEVATION
TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY KDH CHECKED BY KDH
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 4": field grass
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND with gravel, loose to medium dense, moist
		MC = 20.40%			-light groundwater seepage
					-iron oxide staining
		MC = 15.20%			-moderate groundwater seepage
5					-becomes tan, dense, increased moisture content
					-large rocks
		MC = 8.90% Fines = 42.10%		7.5	[USDA Classification: gravelly LOAM]
					Test pit terminated at 7.5 feet below existing grade. Groundwater seepage encountered at 2.5 and 4.0 feet during excavation. Bottom of test pit at 7.5 feet.

Earth Solutions NWLLC
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-13

CLIENT DevCo, Inc.
PROJECT NAME Promenade Apartments
PROJECT NUMBER 3206
PROJECT LOCATION Auburn, Washington
DATE STARTED 2/19/14 COMPLETED 2/19/14
GROUND ELEVATION TEST PIT SIZE
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY KDH CHECKED BY KDH
AT END OF EXCAVATION ---
NOTES Grass
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Brown silty SAND with gravel, loose ,to medium dense, moist (Fill)
					-becomes gray
					-becomes medium dense
5		MC = 17.60%			-scattered wood debris
					-becomes dark brown, loose to medium dense
					-large concrete piece
					-becomes brown, wet, groundwater seepage
				8.0	
		MC = 14.80%	ML		Tan sandy SILT, medium dense, water bearing
					-iron oxide staining
				9.0	Test pit terminated at 9.0 feet below existing grade. Groundwater seepage encountered at 7.0 feet during excavation.
					Bottom of test pit at 9.0 feet.

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TEST PIT NUMBER TP-14

CLIENT DevCo, Inc.
PROJECT NAME Promenade Apartments
PROJECT NUMBER 3206
PROJECT LOCATION Auburn, Washington
DATE STARTED 2/19/14 **COMPLETED** 2/19/14
GROUND ELEVATION **TEST PIT SIZE**
EXCAVATION CONTRACTOR NW Excavating
GROUND WATER LEVELS:
EXCAVATION METHOD
AT TIME OF EXCAVATION ---
LOGGED BY KDH **CHECKED BY** KDH
AT END OF EXCAVATION ---
NOTES Depth of Topsoil & Sod 2": grass
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0			SM		Dark brown silty SAND with gravel, loose, moist (Fill)
					-wood debris
					-string
		MC = 29.50%			
5					
					-large wood debris
					-becomes water bearing
				8.0	
			SM		Brown silty SAND with gravel, loose to medium dense, water bearing
		MC = 20.00%		9.0	Test pit terminated at 9.0 feet below existing grade. Groundwater seepage encountered at 7.5 feet during excavation. Bottom of test pit at 9.0 feet.

Appendix B

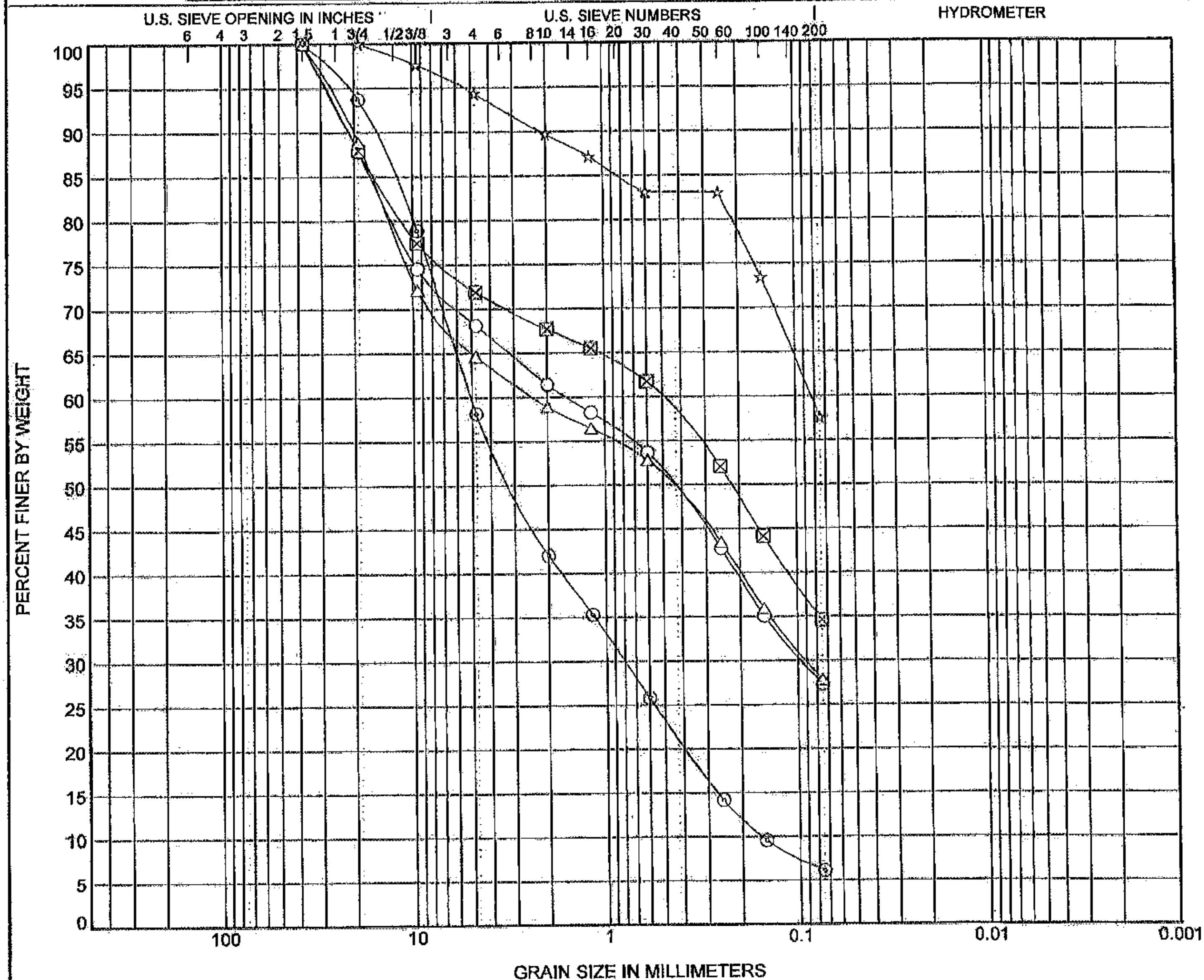
Laboratory Test Results

ES-3206

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-284-3300

GRAIN SIZE DISTRIBUTION

CLIENT DevCo Inc.
PROJECT NAME Promenade Apartments
PROJECT NUMBER ES-3206
PROJECT LOCATION Auburn



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	Cc	Cu
○	TP-1	10.0ft.	USDA: Brown Very Gravelly Sandy Loam. USCS: SM with Gravel.		
⊠	TP-2	12.0ft.	USDA: Gray Gravelly Loam. USCS: SM with Gravel.		
△	TP-3	6.0ft.	USDA: Brown Very Gravelly Sandy Loam. USCS: SM with Gravel.		
☆	TP-5	3.0ft.	USDA: Tan Loam. USCS: Sandy ML.		
⊙	TP-7	3.0ft.	USDA: Brown Very Gravelly Coarse Sand. USCS: SP-SM with Gravel.	0.82	32.16

Specimen Identification			D100	D60	D30	D10			%Silt	%Clay
○	TP-1	10.0ft.	37.5	1.569	0.095				27.4	
⊠	TP-2	12.0ft.	37.5	0.513					34.6	
△	TP-3	6.0ft.	37.5	2.354	0.09				27.8	
☆	TP-5	3.0ft.	19	0.083					57.6	
⊙	TP-7	3.0ft.	37.5	5.047	0.806	0.157			6.1	

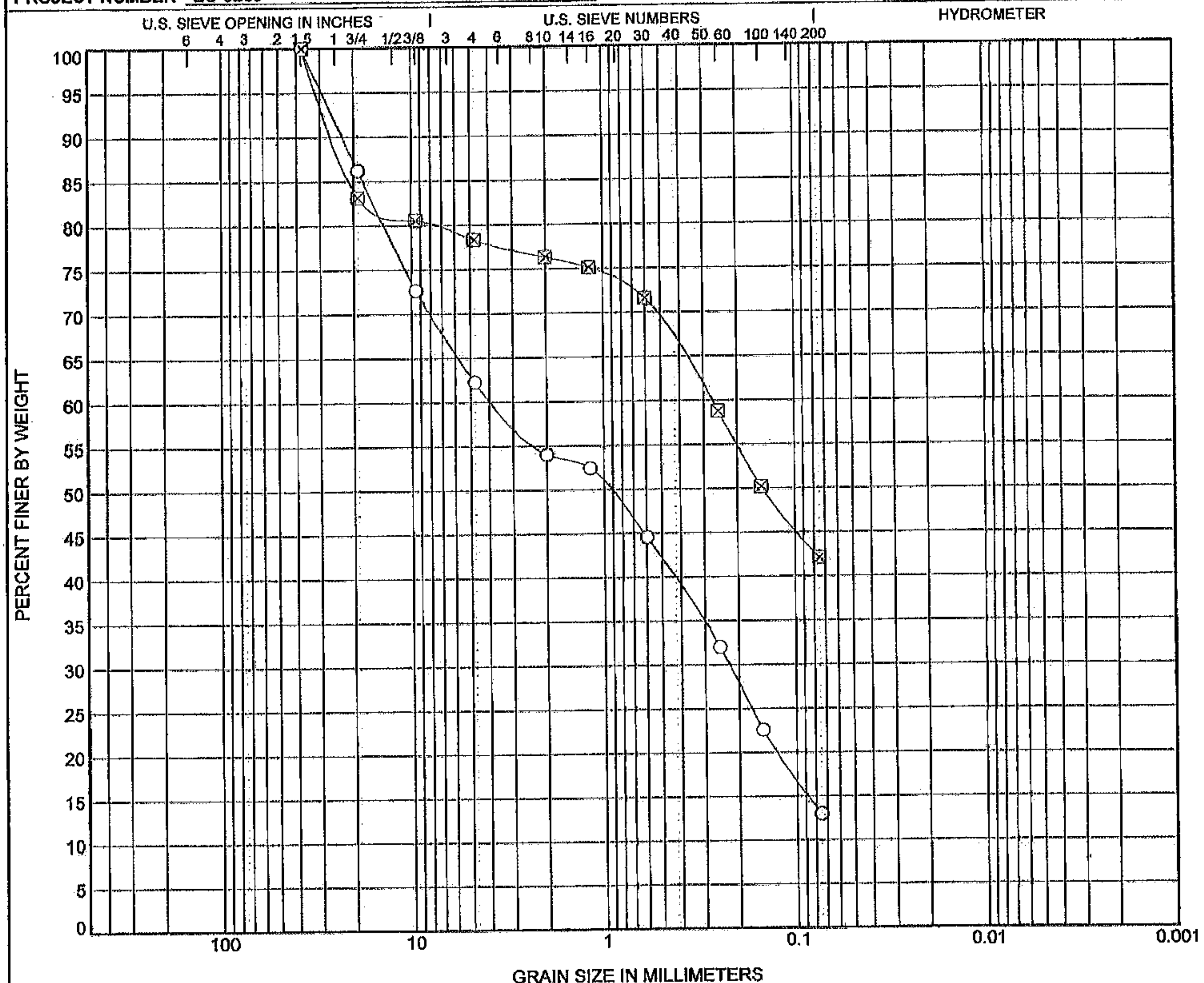
GRAIN SIZE ES-3206.GPJ GINT US LAB.GDT 2/20/14

GRAIN SIZE DISTRIBUTION

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-284-3300

CLIENT DevCo Inc. **PROJECT NAME** Promenade Apartments

PROJECT NUMBER ES-3206 **PROJECT LOCATION** Auburn



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	Cc	Cu
○	TP-8	6.0ft.	USDA: Brown Very Gravelly Loamy Sand. USCS: SM with Gravel.		
⊠	TP-12	7.5ft.	USDA: Tan Gravelly Loam. USCS: SM with Gravel.		

	Specimen Identification		D100	D60	D30	D10			%Silt	%Clay
○	TP-8	6.0ft.	37.5	3.73	0.224				13.0	
⊠	TP-12	7.5ft.	37.5	0.271					42.1	

GRAIN SIZE ES-3206.GPJ GINT US LAB.GDT 2/20/14

Report Distribution

ES-3206

<u>EMAIL ONLY</u>

DevCo, Inc.
11100 Main Street, Suite 301
Bellevue, Washington 98004

Attention: Mr. David Ratliff