SECTION 12

SPECIAL REPORTS AND STUDIES

APPENDIX 12-A

GEOTECHNICAL REPORT

Associated Earth Sciences, Inc.

Serving the Pacific Northwest Since 1981

August 8, 2012
Project No. KE120280A

Select Homes, Inc.
16531 13th Avenue West, Suite A-107
Lynnwood, Washington 98037

Attention: Mr. Craig Pierce

Subject: Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report
Eaglemont
Monroe, Washington

Dear Mr. Pierce:

We are pleased to present the enclosed copies of the above-referenced report. This report summarizes the results of our subsurface exploration, geologic hazard, and geotechnical engineering studies and offers recommendations for the preliminary design and development of the proposed project. Our recommendations are preliminary in that construction details have not been finalized at the time of this report.

We have enjoyed working with you on this study and are confident that the recommendations presented in this report will aid in the successful completion of your project. If you should have any questions or if we can be of additional help to you, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Jon N. Sondergaard, L.G., L.E.G.
Senior Principal Geologist

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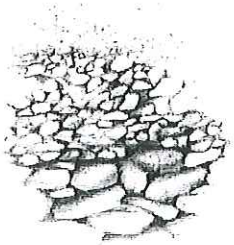
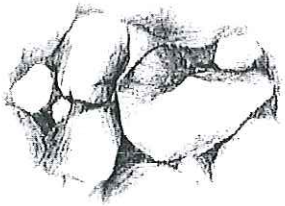


Geotechnical Engineering

Water Resources

Environmental Assessments and Remediation

Sustainable Development Services



Geologic Assessments

Associated Earth Sciences, Inc.

Serving the Pacific Northwest Since 1981

Subsurface Exploration, Geologic Hazard, and Geotechnical Engineering Report

EAGLEMONT

Monroe, Washington

Prepared for

Select Homes, Inc.

Project No. KE120280A
August 8, 2012

SUBSURFACE EXPLORATION, GEOLOGIC HAZARD, AND GEOTECHNICAL ENGINEERING REPORT

EAGLEMONT

Monroe, Washington

Prepared for:
Select Homes, Inc.
16531 13th Avenue West, Suite A-107
Lynnwood, Washington 98037

Prepared by:
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August 8, 2012
Project No. KE120280A

I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of Associated Earth Sciences, Inc.'s (AESI's) subsurface exploration, geologic hazard, and geotechnical engineering study for Eaglemont, located on 197th Avenue SE off of Chain Lake Road in Monroe, Washington (Figure 1). The site boundaries, topographic contours, the proposed lot and road layout, and the approximate locations of the explorations accomplished for this study are presented on the "Site and Exploration Plan," Figure 2.

The recommendations in this report are considered to be preliminary because construction details were not finalized at the time of this study. Once development plans are substantially complete, the conclusions and recommendations in this report should be reviewed and modified, or verified, as appropriate.

1.1 Purpose and Scope

The purpose of this study was to provide subsurface data to be used in the preliminary design and development of the subject project. Our study included a review of available geologic literature, excavating seven exploration pits, and performing geologic studies to assess the type, thickness, distribution, and physical properties of the subsurface sediments and shallow ground water conditions. Geotechnical engineering studies were also conducted to assess the type of suitable foundation, allowable foundation soil bearing pressures, temporary cut slope recommendations, anticipated settlements, basement/retaining wall lateral pressures, floor support recommendations, and drainage recommendations. This report summarizes our current fieldwork and offers development recommendations based on our present understanding of the project.

1.2 Authorization

Written authorization to proceed with this study was granted by Mr. Randy Clark of Select Homes, Inc. Our study was accomplished in general accordance with our proposal dated July 6, 2012. This report has been prepared for the exclusive use of Select Homes, Inc., and their agents, for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering and engineering geology practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made.

Washington - Implications for Earthquake Hazards, Geological Society of America Bulletin, July 1999, v. 111, n. 7, pp. 1042-1053) have provided evidence of surficial ground rupture along a northern splay of the Seattle Fault. According to the USGS studies, the latest movement of this fault was about 1,100 years ago when about 20 feet of surficial displacement took place. This displacement can presently be seen in the form of raised, wave-cut beach terraces along Alki Point in West Seattle and Restoration Point at the south end of Bainbridge Island. The recurrence interval of movement along this fault system is still unknown, although it is hypothesized to be in excess of several thousand years.

Due to the suspected long recurrence intervals for both fault zones, the potential for surficial ground rupture is considered to be low during the expected life of the proposed structures.

5.2 Seismically Induced Landslides

It is our opinion that the risk of damage to the proposed structures by landsliding under both static and seismic conditions is low due to the lack of steep slopes on the subject site and adjoining areas. No mitigation of landslide hazards is warranted. In our opinion, the site is not a landslide hazard area according to MMC 20.05.

5.3 Liquefaction

It is our opinion that the sediments underlying the site present a low risk of liquefaction due their dense state and the lack of adverse ground water conditions. No mitigation of liquefaction hazards is warranted.

5.4 Ground Motion

Structural design of the building should follow 2009 *International Building Code* (IBC) standards using Site Class "C" as defined in Table 1613.5.2. The 2009 IBC seismic design parameters for short period (S_S) and 1-second period (S_1) spectral acceleration values were determined from the latitude and longitude of the project site using the USGS National Seismic Hazard Mapping Project website (http://earthquake.usgs.gov/hazmaps/). These values are based on Site Class "B". Based on the more current 2002 data, the USGS website interpolated ground motions at the project site to be 1.092g and 0.367g for building periods of 0.2 and 1.0 seconds, respectively, with a 2 percent chance of exceedance in 50 years. These values correspond to site coefficients F_a = 1.00 and F_v = 1.433, and a peak horizontal acceleration of 0.29g. The F_a, F_v, and peak horizontal acceleration values have been corrected for Site Class "C" in accordance with the IBC.

6.0 EROSION HAZARDS AND MITIGATIONS

The natural glacial sediments underlying the site generally contain a high percentage of silt and fine sand and are sensitive to erosion; however, the potential for erosion at the site is moderated by the fairly flat topography. In order to control erosion and reduce the amount of sediment transport off the site during construction, the following recommendations should be followed.

1. Properly embedded silt fencing should be placed around the lower perimeter of the cleared area(s). The fencing should be periodically inspected and maintained, as necessary, to ensure proper function.

2. The construction entrance should be stabilized with gravel pads to minimize tracking sediment off-site.

3. If possible, construction should proceed during the drier periods of the year.

4. Areas stripped of vegetation during construction should be mulched and hydroseeded, replanted as soon as possible, or otherwise protected. During winter construction, hydroseeded areas should be covered with clear plastic to facilitate grass growth.

5. If excavated soils are to be stockpiled on the site for reuse, measures should be taken to reduce the potential for erosion from the stockpile. These could include, but are not limited to, limiting stockpiled soil to the flatter areas of the site, covering stockpiles with plastic sheeting, and the use of straw bales/silt fences around pile perimeters.

Review of the U.S. Department of Agriculture Natural Resources Conservation Service (formerly known as the Soil Conservation Service) soil survey for the subject area, indicates that mapped soil types for the site include Tokul gravelly loam, 0 to 8 percent slopes, and Tokul gravelly loam 8 to 15 percent slopes. The mapped soil types are consistent with the sediments encountered in our explorations. Given presence of this soil type, the site does not classify as an erosion hazard area under MMC 20.05

III. PRELIMINARY DESIGN RECOMMENDATIONS

7.0 INTRODUCTION

Our exploration indicates that, from a geotechnical standpoint, the parcel is suitable for the proposed development provided the recommendations contained herein are properly followed. The foundation bearing stratum is relatively shallow and conventional spread footing foundations may be utilized. Consequently, foundations bearing on either the medium dense to very dense, natural glacial sediments or on structural fill placed over these sediments are capable of providing suitable building support.

8.0 SITE PREPARATION

8.1 Clearing and Stripping

Following demolition of the existing structures, any underground utilities located within the proposed building areas should be removed or relocated. The resulting depressions should be backfilled with structural fill as discussed under the "Structural Fill" section of this report. Any remaining foundation elements that will not be incorporated into the new buildings should also be removed. Site preparation of the planned building areas should also include removal of all trees, brush, debris, and any other deleterious materials. These unsuitable materials should be properly disposed of off-site. Additionally, all organic topsoil within the proposed building areas, road areas, or areas to receive structural fill should be removed and the remaining roots grubbed. Areas where loose surficial soils exist due to grubbing operations should be considered as fill to the depth of disturbance and treated as subsequently recommended for structural fill placement. Any existing fill soils below footing areas should be stripped down to the underlying, medium dense to very dense natural till sediments. These sediments were encountered in our explorations at depths of approximately 1.5 to 3 feet.

8.2 Proof-Rolling

After stripping of the organic topsoil layer and removal of roots, we recommend that the soil exposed in proposed roadway areas be recompacted to a firm and unyielding condition using a 20-ton (minimum) vibratory roller. The recompacted area should then be proof-rolled with a fully loaded tandem-axle dump truck. Any soft or yielding areas identified during proof-rolling should be overexcavated and backfilled with structural fill.

8.3 Temporary and Permanent Cut Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction based on the local conditions encountered at that

10.4 Footing Settlement

Anticipated settlement of footings founded as described above should be on the order of 1 inch or less. However, disturbed soil not removed from footing excavations prior to footing placement could result in increased settlements.

10.5 Footing Subgrade Bearing Verification

All footing areas should be observed by AESI prior to placing concrete to verify that the exposed soils can support the design foundation bearing capacity and that construction conforms with the recommendations in this report. Foundation bearing verification may also be required by the governing municipality.

10.6 Foundation Drainage

Perimeter footing drains should be provided as discussed under the "Drainage Considerations" section of this report.

11.0 LATERAL WALL PRESSURES

All backfill behind walls or around foundations should be placed following our recommendations for structural fill and as described in this section of the report. Horizontally backfilled walls, which are free to yield laterally at least 0.1 percent of their height, may be designed using an equivalent fluid equal to 35 pounds per cubic foot (pcf). Fully restrained, horizontally backfilled, rigid walls that cannot yield should be designed for an equivalent fluid of 55 pcf. Walls that retain sloping backfill at a maximum angle of 50 percent should be designed for 45 pcf for yielding conditions and 65 pcf for restrained conditions. If parking areas or driveways are adjacent to walls, a surcharge equivalent to 2 feet of soil should be added to the wall height in determining lateral design forces.

11.1 Wall Backfill

The lateral pressures presented above are based on the conditions of a uniform backfill consisting of either the on-site glacial sediments or imported sand and gravel compacted to 90 to 95 percent of ASTM:D 1557. A higher degree of compaction is not recommended, as this will increase the pressure acting on the walls. A lower compaction may result in unacceptable settlement behind the walls. Thus, the compaction level is critical and must be tested by our firm during placement. The recommended compaction of 90 to 95 percent of ASTM:D 1557 applies to any structural fill placed behind the wall within a distance equal to the wall height and up to the elevation of the top of the wall. Structural fill used to construct slopes above retaining walls should be compacted to at least 95 percent of ASTM:D 1557 if the fill is placed above the elevation of the top of the wall. Surcharges from adjacent footings,

heavy construction equipment, or sloping ground must be added to the above recommended lateral pressures. Footing drains should be provided for all retaining walls, as discussed under the "Drainage Considerations" section of this report.

11.2 Wall Drainage

It is imperative that proper drainage be provided so that hydrostatic pressures do not develop against the walls. This would involve installation of a minimum 1-foot-wide blanket drain for the full wall height using imported, washed gravel against the walls. If drainage mat is used it should be installed according to the manufacturer's specifications.

11.3 Passive Resistance and Friction Factor

Lateral loads can be resisted by friction between the foundation and the natural, medium dense to dense glacial sediments or supporting structural fill soils, or by passive earth pressure acting on the buried portions of the foundations. The foundations must be backfilled with compacted structural fill to achieve the passive resistance provided below. We recommend the following design parameters:

- Passive equivalent fluid = 250 pcf
- Coefficient of friction = 0.30

The above values are allowable.

11.4 Seismic Surcharge

As required by the 2009 IBC, retaining wall design should include a seismic surcharge pressure in addition to the equivalent fluid pressures presented above. Considering the site soils and the calculated peak horizontal acceleration of 0.29g, we recommend a seismic surcharge pressure of 9H to 12H where H is the wall height in feet for the "active" and "at-rest" loading conditions, respectively. The seismic surcharge should be modeled as a rectangular distribution with the resultant applied at the midpoint of the wall.

12.0 FLOOR SUPPORT

Slab-on-grade floors may be constructed either directly on the medium dense to very dense natural sediments, or on structural fill placed over these materials. Areas of the slab subgrade that are disturbed (loosened) during construction should be recompacted to an unyielding condition prior to placing the pea gravel, as described below.

If moisture intrusion through slab-on-grade floors is to be limited, the floors should be constructed atop a capillary break consisting of a minimum thickness of 4 inches of washed pea

gravel, washed crushed rock, or other suitable material approved by the geotechnical engineer. The capillary break should be overlain by a 10-mil (minimum thickness) plastic vapor retarder.

13.0 DRAINAGE CONSIDERATIONS

The natural glacial sediments encountered in our explorations generally contained significant amounts of silt and are considered to be highly moisture-sensitive. Traffic from vehicles, construction equipment, and even foot traffic across these sediments when they are very moist or wet will result in disturbance of the otherwise firm stratum. Therefore, prior to site work and construction, the contractor should be prepared to provide drainage and subgrade protection, as necessary.

13.1 Wall/Foundation Drains

All retaining and perimeter footing walls should be provided with a drain at the footing elevation. The drains should consist of rigid, perforated, polyvinyl chloride (PVC) pipe surrounded by washed pea gravel. The level of the perforations in the pipe should be set approximately 2 inches below the bottom of the footing, and the drains should be constructed with sufficient gradient to allow gravity discharge away from the buildings. All retaining walls should be lined with a minimum, 12-inch-thick, washed gravel blanket provided to within 1 foot of finish grade, and which ties into the footing drain. If drainage mat is used it should be installed according to the manufacturer's specifications. Roof and surface runoff should not discharge into the footing drain system, but should be handled by a separate, rigid, tightline drain.

Exterior grades adjacent to walls should be sloped downward away from the structures to achieve surface drainage. Final exterior grades should promote free and positive drainage away from the buildings at all times. Water must not be allowed to pond or to collect adjacent to the foundation or within the immediate building area. It is recommended that a gradient of at least 3 percent for a minimum distance of 10 feet from the building perimeter be provided, except in paved locations. In paved locations, a minimum gradient of 1 percent should be provided unless provisions are included for collection and disposal of surface water adjacent to the structures. Additionally, pavement subgrades should be crowned to provide drainage toward catch basins and pavement edges.

14.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

We are available to provide additional geotechnical consultation as the project design develops and possibly changes from that upon which this report is based. If significant changes in grading are made, we recommend that AESI perform a geotechnical review of the plans prior to final design completion. In this way, our earthwork and foundation recommendations may

be properly interpreted and implemented in the design. This plan review is not included in our current scope of work and budget.

We are also available to provide geotechnical engineering and monitoring services during construction. The integrity of the foundations depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent. Construction monitoring services are not part of this current scope of work. If these services are desired, please let us know, and we will prepare a proposal.

We have enjoyed working with you on this study and are confident that these recommendations will aid in the successful completion of your project. If you should have any questions, or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Timothy J. Peter, L.E.G., L.Hg.
Senior Project Geologist

Jon N. Sondergaard, L.G., L.E.G.
Senior Principal Geologist

Matthew A. Miller, P.E.
Principal Engineer

Attachments: Figure 1: Vicinity Map
Figure 2: Site and Exploration Plan
Appendix: Exploration Logs