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PRELIMINARY GEOTECHNICAL REPORT

169th Avenue Residential

6980 & 7016 – 169th Avenue SE
Bellevue, Washington

Project No. A-1276

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06/27/2018
CITY OF MONROE

Prepared For:

Vinh Vuong
VP Construction & Development, LLC
5936 NE 3rd Ct.
Renton, WA. 98059

July 7, 2016
Revised September 6, 2016

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VP Construction & Development, LLC
5936 NE 3rd Ct.
Renton, WA. 98059

Subject: Preliminary Geotechnical Report
169th Avenue Residential
6980 & 7016 – 169th Avenue NE
Bellevue, Washington
Parcel Numbers: 2524059051 &2524059052

Dear Mr. Vuong,

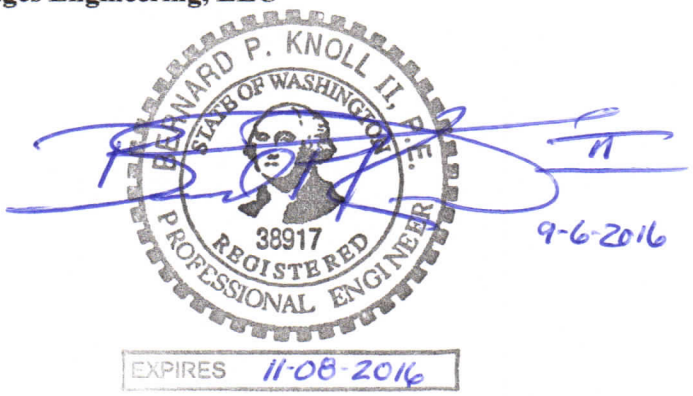
As requested, we have conducted a preliminary geotechnical study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

Our field exploration indicates the site is generally underlain by native silty sand with varying amounts of gravel, and clayey sand with trace amounts of gravel. The native soils became dense at depths ranging from 4.0 to 6.0 feet surface grades. We encountered light groundwater seepage at depths ranging from 5.0 to 7.5 feet below surface grades in the two test holes advances along the eastern (uphill) end of the site.

In our opinion, the soil and groundwater conditions at the site are suitable for the planned development. The new structures can be supported on conventional spread footing foundations bearing on the existing organic-free native soils observed at a minimum depth of 1.5 feet below surface grades, or on structural fill placed above these native soils. Floor slabs and pavements can be similarly supported. We recommend the Steep Slope Critical Area located along the western (downhill) end of the site be eliminated by grading it to less steep inclinations.

Detailed recommendations addressing these issues and other geotechnical design considerations are presented in the attached report. We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Respectfully Submitted,
Ages Engineering, LLC



9-6-2016

Bernard P. Knoll, II
Principal

BPK:bpk

Project Number:	A-1276
Project Name:	169th Avenue Residential
Date:	July 7, 2016 Revised September 6, 2016

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Preliminary Geotechnical Report
169th Avenue Residential
6980 & 7016 – 169th Avenue SE
Bellevue, Washington

1.0 PROJECT DESCRIPTION

The project will consist of a residential development. We discussed the project with the site owner, and were provided with nine sheets of project plans. Based on our conversation and review of the plans provided to us, we understand the subject site consists of two residential lots that will be developed with two new single-family residences. The site is currently unoccupied.

Detailed building plans are currently not available. However, based on our discussions and review of the plans provided to us, and our experience with similar projects in the vicinity of the site, we expect the new residences will be three-story wood-framed structures with the lowest floor constructed with slab-on-grade floors. The attached garage will also have slab-on-grade floors. The two lowest floors will daylight to the west and the upper floor will be provided with unobstructed access to the backyard along the eastern (uphill) end of the site. Foundation loads should be relatively light on the order of 1 to 3 kips per lineal foot for continuous footings, and up to 25 kips for column loads.

We expect excavations of up to 18 feet in depth will be necessary along the eastern (uphill) side of the new residences during development. Access to the two lots is currently obstructed by a short steep slope located between the lots and 169th Avenue along the western side of the site. Site development will entail grading the sites' steep western slope to a less steep inclination to facilitate development. Additionally, a Type O stream crosses the site from north to south.

The conclusions and recommendations presented in this report are based on our understanding of the above stated site and the planned project design features. If actual site conditions differ, the planned project design features are different than we expect, or if changes are made, we should review them in order to modify or supplement our conclusions and recommendations as necessary.

2.0 SCOPE

On July 5, 2016, we advanced four hand-augured Test Holes to a maximum depth of 8.0 feet below surface grades. Using the information obtained from our subsurface exploration, we developed geotechnical design and construction recommendations for the project. Specifically this Preliminary Geotechnical Report addresses the following:

- Reviewing the available geologic, hydrogeologic and geotechnical data for the site area, and conducting a geologic reconnaissance of the site area.
- Addressing the appropriate geotechnical regulatory requirements for the planned site development, including a Geologic Hazard evaluation.

- Advancing four test holes in the planned new development area to a maximum depth of approximately 8.0 feet below surface grades.
- Providing geotechnical recommendations for site grading including site preparation, subgrade preparation, fill placement criteria, suitability of on-site soils for use as structural fill, temporary and permanent cut and fill slopes, and drainage and erosion control measures.
- Providing geotechnical recommendations for design and construction of new foundations and floor slabs, including allowable bearing capacity and estimates of settlement.
- Providing geotechnical recommendations for lower level building or retaining walls, including backfill and drainage requirements, lateral design loads, and lateral resistance values.
- Providing an evaluation of the steep slopes on the site.
- Providing recommendations for site drainage.

It should be noted that our work does not include services related to environmental remediation or design and performance issues related to moisture intrusion through walls. An appropriate design professional or qualified contractor should be contacted to address these issues.

3.0 SITE CONDITIONS

3.1 Surface

The subject site consists of two residential parcels located at 6980 & 7016 – 169th Avenue SE in the Belvedere Neighborhood on Cougar Mountain in Bellevue, Washington. The site is currently unoccupied. The site is bordered with existing single-family residences to the north, south, and east, and 169th Avenue SE to the west.

Surface grades on the site slope down to the west. According to the topographic plan provided to us, the site slopes down to the west at surface inclinations ranging from 30 to 40 percent. Some areas along the central portions of the site slope down to the west at surface inclinations ranging from 5 to 45 percent. The western end of the site slopes down to the west and 169th Avenue SE at surface inclinations ranging from 30 to 50 percent. The sites' western slope was cut to its current inclination during mass grading for the Belvedere development and the construction of 169th Avenue SE. The sites' western slope ranges in height from 5 to 15 feet.

Site vegetation consists of field grass with sparse brush and small trees. The location of the site is shown on the Site Vicinity Map provided in Figure 1.

3.2 Soils

The soils we observed in the test holes generally consist of native silty sand with varying amounts of gravel and clay.

The soils observed in Test Hole TH-1, located along the eastern (uphill) end of the northernmost lot, consisted of light brown and orange, medium dense, moist, silty sand with fine gravel to a

depth of 2.0 feet below surface grades. Below 2.0 feet, the native soils became light brown and slightly cemented. The native soils became dense 4.5 feet. The soils observed in Test Hole TH-2, located along the center of the northernmost lot, consisted of light brown and orange, medium dense, moist, silty sand with fine gravel to a depth of 2.5 feet below surface grades. Below 2.5 feet, the native soils became light brown and slightly cemented. The native soils became dense 4.5 feet. The soils observed in Test Hole TH-3, located along the eastern (uphill) end of the southernmost lot, consisted of light brown and orange, medium dense, moist, silty sand with fine gravel to a depth of 2.5 feet below surface grades. Below 2.5 feet, the native soils became light brown and slightly cemented to a depth of 6.0 feet below surface grades. Below 6.0 feet in Test Hole TH-3, we encountered light brown and purple, moist, dense, clayey sand with trace amounts of silt and gravel. The soils observed in Test Hole TH-4, located along the western (downhill) end of the southernmost lot, consisted of dark brown, loose, moist, silty sand with gravel to a depth of 1.5 feet below surface grades. Below 1.5 feet, the native soils became light brown and orange, moist, medium dense, silty sand with fine gravel. Below 4.0 feet in Test Hole TH-3, we encountered light brown, orange, and yellow, moist, dense, clayey sand with trace amounts of silt and gravel.

All of our Test Holes were terminated at their respective depths due to obstructions. We interpret these obstructions to be the upper portions of the underlying bedrock. The interbedded silty sand we observed in the upper portions of the Test Holes was slightly cemented and relatively well-graded consistent with glacial till. The till appeared to be weathered. The clayey silt is likely the upper portion of the weathered bedrock.

Figures A-1 through A-3 present more detailed descriptions of the subsurface conditions encountered in the test holes. The approximate test hole locations are shown on the Exploration Location Plan provided in Figure 2.

3.3 Mapped Soils

According to the *Geologic Map of King County*, the soils in the vicinity of the site are mapped as Renton Formation (Tpr). We encountered a thin layering of glacially derived soils overlying the native weathered bedrock on the site. We interpret these interbedded soils to be consistent with Glacial Till (Qvt). The bedrock on the site was exposed following the Vashon stade of the Fraser Glaciation, approximately 12,000 to 15,000 years ago. The near surface portions of the bedrock have been disturbed by natural weathering processes that have weathered them to a residual soil overlying the bedrock. The weathered bedrock on the site has been overlain with small deposits of sand and gravel. No springs or groundwater seepage were observed on the surface of the site at the time of our site visit. A copy of the Geologic Map for the subject site is provided in Figure 3.

3.4 Groundwater

We encountered light groundwater seepage at depths ranging from 5.0 to 7.5 feet below surface grades in the two test holes excavated along the eastern (uphill) end of the site. We expect the groundwater observed is due to the Type O stream that crosses the site in the general area of the

two test holes encountering the groundwater seepage. Regardless, we expect a perched water table may develop on the site above the native bedrock at times during the wet winter months. The groundwater levels and flow rates will fluctuate seasonally and typically reach their highest levels during and shortly following the wet winter months (October through May).

4.0 CRITICAL AREAS

4.1 General

According to Section 20.25H.120 in the City of Bellevue Municipal Code (BMC), geologic hazard areas are considered Critical Areas. These include steep slopes, landslide hazards, and coal mine hazards.

4.2 Steep Slopes

According to Section 20.25H.120 in the City of Bellevue Municipal Code (BMC), Steep Slopes are defined as, "Slopes of 40 percent or more that have a rise of at least 10 feet and exceed 1,000 square feet in area".

Based on our site observations, surface grades along portions of the sites' western slope equal or exceed 40 percent with a rise of at least 10 feet and exceed 1,000 square feet in area and therefore meet the criteria for Steep Slopes. The slopes along the central and eastern portions of the site that exceed 40 percent do not appear to have a rise of 10 feet or more and are therefore are not classified as Steep Slope Critical Areas. According to section 20.25H.120 in the City of Bellevue Municipal Code, Steep Slope Critical Areas require a minimum 50-foot top-of-slope buffer and a 75-foot top-of-slope structural setback. However, according to Section 20.25H.125 and 20.25H.145 in the BMC, alterations to Critical Areas are acceptable if certain criteria are met.

4.3 Landslide

According to Section 20.25H.120 in the City of Bellevue Municipal Code (BMC), Landslide Hazards are defined as, "Areas of slopes of 15 percent or more with more than 10 feet of rise, which also display any of the following characteristics:

a. Areas of historic failures, including those areas designated as quaternary slumps, earthflows, mudflows, or landslides.

b. Areas that have shown movement during the Holocene Epoch (past 13,500 years) or that are underlain by landslide deposits.

c. Slopes that are parallel or subparallel to planes of weakness in subsurface materials.

d. Slopes exhibiting geomorphological features indicative of past failures, such as hummocky ground and back-rotated benches on slopes.

e. Areas with seeps indicating a shallow ground water table on or adjacent to the slope face.

f. Areas of potential instability because of rapid stream incision, stream bank erosion, and undercutting by wave action."

The existing slopes along many portions of the site exceed 15 percent with more than 10 feet of vertical rise. However, we did not observe any areas of historic failures, including those areas designated as quaternary slumps, earthflows, mudflows, or landslides. We observed no areas showing movement during the Holocene Epoch (past 13,500 years) or that are underlain by landslide deposits. We did not observe any slopes that are parallel or subparallel to planes of weakness in subsurface materials, and we did not observe any slopes exhibiting geomorphological features indicative of past failures, such as hummocky ground and back-rotated benches on slopes. We did observe light shallow groundwater seepage in the two test holes advanced along the eastern (uphill) end of the site. However, the groundwater observed appears to be from a Type O stream that crosses the site. Site development will eliminate this stream and it's associated groundwater. Additionally, surface and subsurface drainage features installed on the site during site development will also provide a relatively dry subsurface. Based on these observations, it is our opinion, the slopes on the subject site are not classified as Landslide Hazard Areas.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 General

Based on our study, in our opinion, soil and groundwater conditions at the site are suitable for the proposed development. The new structures can be supported on conventional spread footings bearing on the existing native organic-free native soils observed below a minimum depth of 1.5 feet on the site, or on structural fill placed above these native soils. Floor slabs and pavements can be similarly supported.

The Steep Slope Critical Area located along the western end of the site limits access to and development of the site. Eliminating the sites' Critical Area western slope and grading the surface of the site along the western end to provide less steep inclinations and unobstructed access to the front of the lots will result in a much more stable configuration than attempting to develop over, around, or through the sites' western slope area.

Due to the existence of bedrock at a relatively shallow depth, we expect excavations extending past a depth of 8.0 feet below surface grades on the site will encounter difficult digging conditions.

The native soils encountered at the site contain a high enough percentage of fines (silt and clay-size particles) that will make them difficult to compact as structural fill when too wet. Accordingly, the ability to use the soils from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions at the time of construction. If grading activities will take place during the winter season, the owner should be prepared to import free-draining granular material for use as structural fill and backfill.

The following sections provide detailed recommendations regarding these issues and other geotechnical design considerations. These recommendations should be incorporated into the final design drawings and construction specifications.

5.2 Critical Areas

The western end of the site, between 169th Avenue SE and the main portion of the subject site, consists of a Steep Slope Critical Area. The Steep Slope located along the western end of the site limits access to and development of the site. Eliminating the sites' Critical Area western slope and grading the surface of the site to provide unobstructed access to the front of the lots will result in a much more stable configuration than attempting to develop over, around, and through the sites' western slope area. According to the current City of Bellevue Municipal Code, development in Critical Areas is permitted if certain performance standards are met.

Section 20.25H.125 Performance Standards – Steep Slopes

Based on the current Bellevue Municipal Code, development within a Steep Slope Critical Area is allowed if certain performance standards are met. According to Section 20.25H.125 in the BMC, "...development within a landslide hazard or steep slope critical area or the critical area buffers of such hazards shall incorporate the following additional performance standards in design of the development, as applicable. The requirement for long-term slope stability shall exclude designs that require regular and periodic maintenance to maintain their level of function.

A. Structures and improvements shall minimize alterations to the natural contour of the slope, and foundations shall be tiered where possible to conform to existing topography;

B. Structures and improvements shall be located to preserve the most critical portion of the site and its natural landforms and vegetation;

C. The proposed development shall not result in greater risk or a need for increased buffers on neighboring properties;

D. The use of retaining walls that allow the maintenance of existing natural slope area is preferred over graded artificial slopes where graded slopes would result in increased disturbance as compared to use of retaining wall;

E. Development shall be designed to minimize impervious surfaces within the critical area and critical area buffer;

F. Where change in grade outside the building footprint is necessary, the site retention system should be stepped and regrading should be designed to minimize topographic modification. On slopes in excess of 40 percent, grading for yard area may be disallowed where inconsistent with this criteria;

G. Building foundation walls shall be utilized as retaining walls rather than rockeries or retaining structures built separately and away from the building wherever feasible. Freestanding retaining devices are only permitted when they cannot be designed as structural elements of the building foundation;

H. On slopes in excess of 40 percent, use of pole-type construction which conforms to the existing topography is required where feasible. If pole-type construction is not technically feasible, the structure must be tiered to conform to the existing topography and to minimize topographic modification;

I. On slopes in excess of 40 percent, piled deck support structures are required where technically feasible for parking or garages over fill-based construction types; and

J. Areas of new permanent disturbance and all areas of temporary disturbance shall be mitigated and/or restored pursuant to a mitigation and restoration plan meeting the requirements of LUC 20.25H.210. (Ord. 5680, 6-26-06, § 3)"

The entire structure will be provided with a full daylight basement and therefore the foundations will not be stepped to match the slope. However, after foundation construction, the surface of the site around the new residence will be returned to its original sloping configuration and completely stabilized with a professionally installed landscape.

Determination of the most critical portion of the site is relative. In our opinion, there are no areas of critical importance on the subject site. The Steep Slope Critical Area located along the western end of the site is very small and limits access to the site. Therefore, it is critical to remove the Steep Slope Critical Area along the western end of the site. We expect site development to be much more difficult with the Steep Slope Critical Area in place and will result in a less stable configuration after development. The natural landform on the site is a slope down to the west. This natural landform will not be removed. After site development, the site will still slope down to the west. Due to the relatively small size of the two lots, preserving the natural vegetation will not be possible. After construction of the two residences is complete, the site will be completely stabilized with a professionally installed landscape.

Eliminating the sites' Steep Slope Critical Area along the western end of the site will only affect the subject site as it is between the site and the roadway access to the site. Additionally, eliminating the Steep Slope Critical Area will result in a configuration that more closely resembles the residential properties on each side of the subject site. Therefore, the proposed development will not result in greater risk or a need for increased buffers on neighboring properties.

Since the entire site slopes down to the west, the use of retaining walls to provide access through the sites Steep Slope Critical Area would require the lower floor elevation to be raised considerably and would result in a less stable site configuration. Placing foundations high along the surface of a steeply sloping area is much less stable than embedding them deeply into the slope face. The weight of the structure can be offset by the removal of the soil in the development area. This effect causes a reduction of stress on the slope and slope surface which can increase the overall stability of the site.

The Steep Slope Critical Area located along the western end of the site will be eliminated and therefore there will be no critical area buffer. Regardless of this fact, the planned development is currently configured to limit to the greatest extent possible the introduction of impervious surfaces to the site. The new structures, driveways, and surface of the site will be provided with

drainage measures that will control the surface water collected on the new impervious surfaces, essentially increasing the stability of the site by reducing the amount of surface water that will reach the soils along the sloping portions of the site.

The only proposed change to the outside the building footprint will be along the western end of the site between the new structures and 169th Avenue SE, and along the sides of the new structures where surface grades will be restored after development to match previous surface grades as close as possible. The area along the western end of the site will be graded to less steep inclinations. The grades along the sides of the new residences will likely be graded to steeper inclinations than previously existed in order for the surface grades to match up with the existing grade along the eastern end of the site. However, these areas are small and relatively narrow. The surface of the site in these areas will be stabilized after development with a professionally installed landscape which may include landscape walls (i.e. walls that are less than four feet in total height and no closer than 8 feet from each other), subsurface drainage pipe, and surface drains.

The new building foundation walls will act as retaining walls along all sides of the new structures.

Due to the new development being new single-family residence, use of pole-type construction is not feasible on this site. Additionally, it is our opinion that stepping the new foundations to conform to the existing topography will result in a much less stable configuration. Embedding the new structure into the hillside will result in a much more stable site configuration than tiering the foundations to conform to the existing topography.

No decks are proposed on slopes in excess of 40 percent.

We understand the final development plans will result in all areas of new permanent disturbance and all areas of temporary disturbance being mitigated and/or restored pursuant to a mitigation and restoration plan meeting the requirements of LUC.

Based on our review and analysis of the performance standards provided by the City of Bellevue, it is our opinion the Steep Slope Critical Area located along the western end of the site can be eliminated as discussed in this report. We expect the new site and slope configuration will result in an increase in the overall stability of the site.

Section 20.25H.145 Critical Areas Report – Approval of Modification

Additionally, according to Section 20.25H145 in the BMC, "Modifications to geologic hazard critical areas and critical area buffers shall only be approved if the Director determines that the modification:

A. Will not increase the threat of the geological hazard to adjacent properties over conditions that would exist if the provisions of this part were not modified;

B. Will not adversely impact other critical areas;

C. Is designed so that the hazard to the project is eliminated or mitigated to a level equal to or less than would exist if the provisions of this part were not modified;

D. Is certified as safe as designed and under anticipated conditions by a qualified engineer or geologist, licensed in the state of Washington;

E. The applicant provides a geotechnical report prepared by a qualified professional demonstrating that modification of the critical area or critical area buffer will have no adverse impacts on stability of any adjacent slopes, and will not impact stability of any existing structures. Geotechnical reporting standards shall comply with requirements developed by the Director in City of Bellevue Submittal Requirements Sheet 25, Geotechnical Report and Stability Analysis Requirements, now or as hereafter amended;

F. Any modification complies with recommendations of the geotechnical support with respect to best management practices, construction techniques or other recommendations; and

G. The proposed modification to the critical area or critical area buffer with any associated mitigation does not significantly impact habitat associated with species of local importance, or such habitat that could reasonably be expected to exist during the anticipated life of the development proposal if the area were regulated under this part. (Ord. 5680, 6-26-06, § 3)"

In accordance with the City of Bellevue Municipal Code, we recommend the western end of the subject site be graded to eliminate the Steep Slope Critical Area. The sites' western Steep Slope Critical Area currently limits access to the subject site. The front yards, adjacent to 169th Avenue SE, of the existing single-family residences to the north and south of the subject site have already been graded to the approximate elevation of the street, as is proposed for the subject site. The development along the north and south sides of the subject site has currently resulted in isolating the subject sites' Steep Slope Critical Area. By eliminating the Steep Slope Critical Area, the subject site will conform to the past and current grading activities that have occurred along all sides. Additionally, eliminating the sites' western Steep Slope Critical Area will result in a much more stable site after development is complete. By eliminating the sites' western Steep Slope Critical Area and grading the surface of the site along the north and south sides of the new residence to meet existing grades along the eastern end of the site, the finish surface grades on the site will be reduced along the west side, and increased but stabilized along the north and south sides, and the overall stability of the site will be increased. Attempting to develop on, over, or around the sites' western Steep Slope Critical Area would be considerably more difficult and less stable than eliminating the Steep Slope. Additionally, developing on, over, or around the sites' Steep Slope area would require regular and periodic maintenance after development to maintain its level of performance. We expect very little or no alteration to the sites' eastern slope area will be necessary.

The western end of the site should be graded to provide a gradual slope of no more than 10 percent from the curb to the front of the new residence. Surface grades along the north and south sides of the new residence should be altered as little as possible to allow development and match existing grades along the eastern end of the site. Since the new residences are planned to have their lowest two floors daylight to the west, the surface grades along the eastern (uphill) end of the site will have only minor modifications immediately adjacent the new foundations. The slope along the eastern end of the site will not be altered. The building walls along the north, south and east sides of the new residence will act as retaining walls.

Based on our review and analysis of the Approval of Modification standards provided by the City of Bellevue, it is our opinion the Steep Slope Critical Area located along the western end of the site can be eliminated as discussed in this report. We expect the new site and slope configuration will result in an increase in the overall stability of the site.

5.3 Site Preparation and Grading

To prepare the site for construction, all vegetation, organic surface soils, and other deleterious materials including any existing structures, foundations or abandoned utility lines should be stripped and removed from the new development areas.

Once clearing and stripping operations are complete, cut and fill operations can be initiated to establish desired grades. In order to achieve proper compaction of structural fill, and to provide adequate foundation and floor slab support, the native subgrade must be in a stable condition. Prior to placing structural fill, and to prepare the foundation subgrade, all exposed surfaces should be compacted with heavy vibratory compaction equipment to determine if any isolated soft and yielding areas are present.

If excessively soft or yielding areas are present, and cannot be stabilized in place by compaction, they should be cut to firm bearing soil and filled to grade with structural fill. If the depth to remove the unsuitable soil is excessive, using a geotextile fabric can be considered, such as Mirafi HP270 or an approved equivalent, in conjunction with structural fill. In general, a minimum of 18-inches of clean, granular structural fill over the geotextile fabric should establish a stable bearing surface.

A representative of Ages Engineering, LLC should observe the foundation subgrade compaction operations to verify that stable subgrades are achieved for support of structural elements.

Our study indicates the native surface soils encountered at the site contain a sufficient enough percentage of fines (silt and clay-size particles) that will make them difficult to compact as structural fill when too wet. Accordingly, the ability to use the soils from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions at the time of construction. If grading activities are planned during the wet winter months, or the on-site soils become too wet to achieve adequate compaction, the owner should be prepared to import a wet-weather structural fill. For wet weather structural fill, we recommend importing a granular soil that meets the following gradation requirements:

U. S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

* Based on the ¾ inch fraction

Prior to use, Ages Engineering, LLC should examine and test all materials to be imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soils' laboratory maximum dry density as determined by American Society for Testing and Materials (ASTM) Test Designation D-1557 (Modified Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this same ASTM standard. In non-structural areas, the degree of compaction can be reduced to 90 percent.

5.4 Excavations

Due to the existence of bedrock at a relatively shallow depth, we expect excavations extending past a depth of 8.0 feet below surface grades on the site will encounter difficult digging conditions. We understand excavations along the eastern end of the new residences will approach 18.0 feet in depth. All of our test hole excavations at the site were terminated after encountering obstructions. We expect these obstructions are the upper portions of the underlying bedrock. The bedrock is likely highly weathered and friable in the upper portions.

All excavations at the site associated with confined spaces, such as utility trenches and lower level building and retaining walls, must be completed in accordance with local, state, and/or federal requirements. Based on current Washington State Safety and Health Administration (WSHA) regulations, the existing near-surface loose to medium dense weathered soils are classified as Type C soils. The deeper unweathered dense soils and weathered bedrock would be classified as Type B soils.

According to WSHA, for temporary excavations of less than 20 feet in depth, the side slopes in Type C soils should be laid back at a slope inclination of 1.5:1 (Horizontal:Vertical) or flatter from the toe to the crest of the slope and the side slopes in Type B soils should be laid back at a slope inclination of 1:1 (Horizontal:Vertical) or flatter from the toe to the crest of the slope. All exposed slope faces should be covered with a durable reinforced plastic membrane during construction to prevent slope raveling and rutting during periods of precipitation. These guidelines assume that all surface loads are kept at a minimum distance of at least one half the depth of the cut away from the top of the excavation slope and that significant seepage is not present on the slope face. Flatter cut slopes will be necessary where significant raveling or seepage occurs, or if construction materials will be stockpiled along the slope crest. If these safe temporary slope inclinations cannot be achieved due to property line constraints, shoring may be necessary.

This information is provided solely for the benefit of the owner and other design consultants, and should not be construed to imply that Ages Engineering, LLC assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

5.5 Foundations

The new foundations may be supported on conventional spread footing foundations bearing on the competent native organic-free native soils or on structural fills placed above these native soils.

Foundation subgrades should be prepared as recommended in the "Site Preparation and Grading" section of this report.

Perimeter foundations exposed to the weather should bear at a minimum depth of 1.5 feet below final exterior grades for frost protection. Interior foundations can be constructed at any convenient depth below the floor slab. We recommend designing new foundations for a net allowable bearing capacity of 2,500 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used. With the anticipated loads and this bearing stress applied, building settlements should be less than one-half inch total and one-quarter inch differential.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressures acting on the sides of the footings can also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 325 pounds per cubic foot (pcf). We recommend not including the upper 12 inches of soil in this computation because it can be affected by weather or disturbed by future grading activity. This value assumes the foundations will be constructed neat against competent soil and backfilled with structural fill, as described in the "Site Preparation and Grading" section of this report. The values recommended include a safety factor of 1.5.

Foundation Parameter Summary	
Description	***Design Value**
Net Allowable Bearing Capacity	2,500 psf
Friction Coefficient	0.35
Lateral Resistance	325 pcf

*Details regarding the use of these parameters are provided in the section above.

The state of Washington has adopted the International Building Code (IBC). Based on the soil conditions encountered and the local geology, per chapter 16 of the (IBC) site class "C" can be used in structural design. This correlates to Soil Profile Type S_C in the older Uniform Building Code (UBC). This is based on the inferred range of SPT (Standard Penetration Test) blow counts for the upper 100 feet of the site relative to hand excavation progress and probing with a ½-inch diameter steel probe rod. The presence of glacially consolidated soil conditions were assumed to be representative for the site conditions beyond the depths explored.

5.6 Slab-On-Grade

Slab-on-grade floors should be supported on subgrades prepared as recommended in the "Site Preparation and Grading" section of this report.

Immediately below the floor slab, we recommend placing a four-inch thick capillary break layer of clean, free-draining, coarse sand or fine gravel that has less than three percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water

through the underlying soil and subsequent wetting of the floor slabs. The drainage material should be placed in one lift and compacted to a firm and unyielding condition.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and aid in uniform curing of the concrete slab. It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will not assist in uniform curing of the slab, and may serve as a water supply for moisture transmission through the slab and affecting floor coverings. Additionally, if the sand is too dry, it can effectively drain the fresh concrete, thereby lowering its strength. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided.

5.7 Lower Level Building and Concrete Retaining Walls

The magnitude of earth pressure development on below-grade walls, such as basement or retaining walls, will greatly depend on the quality of the wall backfill and the wall drainage. We recommend placing and compacting wall backfill as structural fill. Wall backfill below structurally loaded areas, such as pavements or floor slabs, should be compacted to a minimum of 95 percent of its maximum dry density, as determined by ASTM Test Designation D-1557 (Modified Proctor). In unimproved areas, the relative compaction can be reduced to 90 percent.

To guard against hydrostatic pressure development, drainage must be installed behind the wall. We recommend that wall drainage consist of a minimum 12 inches of clean sand and/or gravel with less than three percent fines placed against the back of the wall. In addition, a drainage collector system consisting of 4-inch perforated PVC pipe should be placed behind the wall to provide an outlet for any accumulated water. The drains should be provided with cleanouts at easily accessible locations. These cleanouts should be serviced at least once every year. The wall drainage material should be capped at the ground surface with 1-foot of relatively impermeable soil to prevent surface intrusion into the drainage zone. Alternatively, the 12-inch wide drainage layer placed against the back of the wall can be replaced with a Mirafi G100N Drainage Board, or an approved equivalent. If drainage board is used, the 4-inch perforated PVC pipe should be covered with at least 12 inches of clean washed gravel and the drainage board should be hydraulically connected to drainpipe and surrounding gravel.

With wall backfill placed and compacted as recommended and the wall drainage properly installed, unrestrained walls can be designed for an active earth pressure equivalent to a fluid weighing 35 pcf. For restrained walls, an additional uniform lateral pressure of 100 psf should be included. These values assume a horizontal backfill condition and that no other surcharge loading, such as traffic, sloping embankments, or adjacent buildings, will act on the wall. If such conditions exist, then the imposed loading must be included in the wall design. Friction at the base of the wall foundation and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in the "Foundations" section of this report.

Lower Level Building and Retaining Wall Parameter Summary		
Description	**Condition**	***Design Value**
Earth Pressure	Unrestrained	35 pcf
Earth Pressure	Restrained	Additional 100 psf
Earth Pressure	Surcharge	Dependent upon magnitude

*Details regarding the use of these parameters are provided in the section above.

5.8 Permanent Slopes

Permanent slopes on the site should be graded to finish inclinations of no steeper than 2:1 (Horizontal:Vertical). After construction, the permanent slopes must be completely stabilized with permanent landscaping that include a complete surface covering of plants or landscape bark. If steeper permanent slopes are desired, the surface must be covered with a surface stabilization measure such as jute netting or the Geoweb Cellular Confinement System. Alternatively, one or more landscape walls can be incorporated into the development to provide stable grade breaks. If desired, we can provide additional recommendations for permanent slopes exceeding an inclination of 2:1.

5.9 Site Drainage

Surface,

Final exterior grades should promote free and positive drainage away from the building area. All ground surfaces, pavements, and sidewalks should be sloped away from the structure. We recommend providing a gradient of at least three percent for a minimum distance of ten feet from the building perimeter, except in paved locations. In paved locations, a minimum gradient of one percent should be provided, unless provisions are included for collection and disposal of surface water adjacent to the structure.

Subsurface,

We recommend installing a continuous drain along the lower outside edge of the perimeter building foundation. The foundation drain should be tightlined to an approved point of controlled discharge. The roof drain should not be connected to the footing drains unless a backflow device will be installed, or an adequate gradient will prevent backflow into the footing drains.

Subsurface drains must be laid with a gradient sufficient to promote positive flow to the point of discharge. All drains should be provided with cleanouts at easily accessible locations. These cleanouts should be serviced at least once every year.

6.0 ADDITIONAL SERVICES

Ages Engineering, LLC should review the final project designs and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and incorporated into project design. If changes are made in the loads, grades, locations, configura-

tions or types of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as necessary.

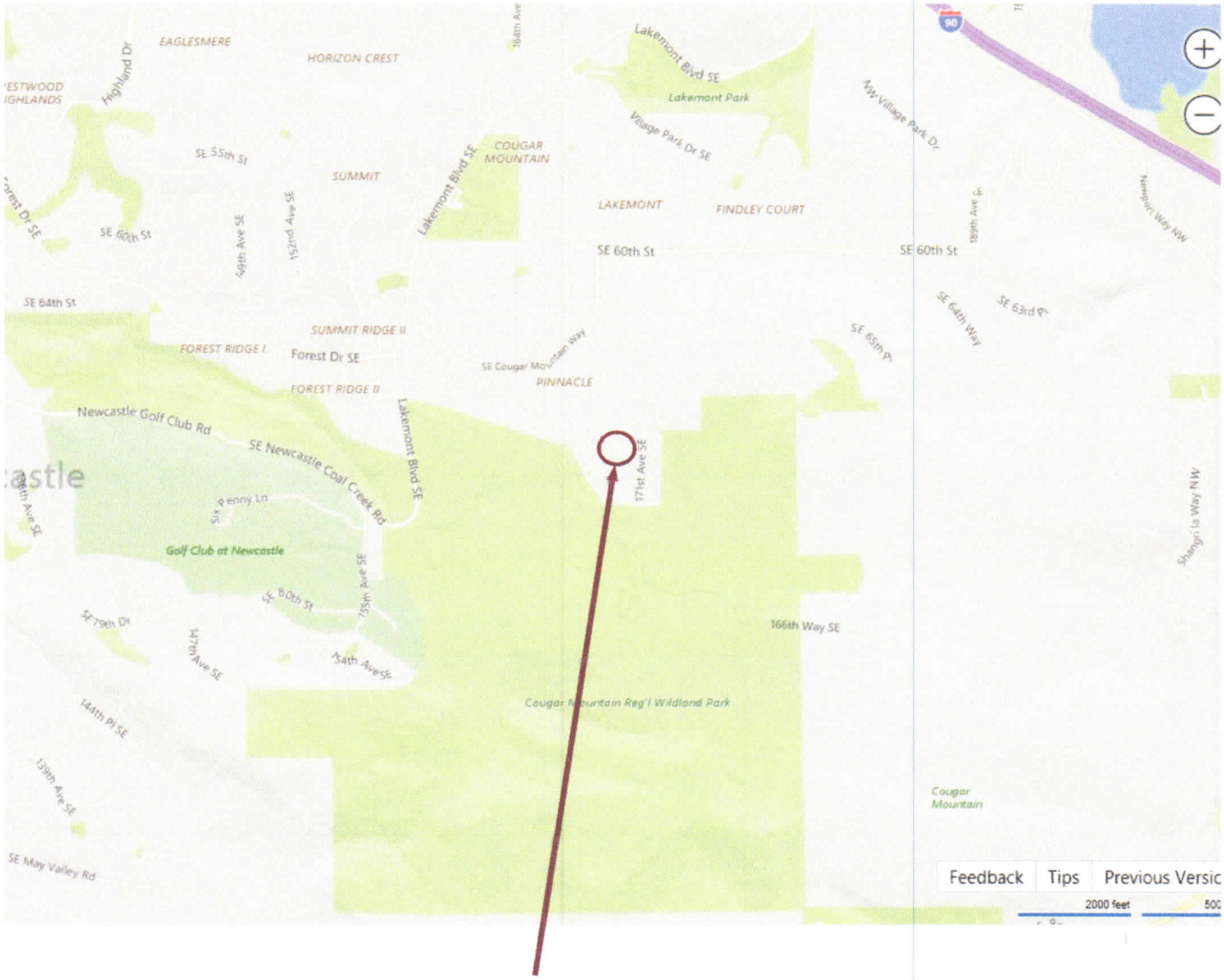
We should also provide geotechnical services during construction to observe compliance with our design concepts, specifications, and recommendations. This will allow for expedient design changes if subsurface conditions differ from those anticipated prior to the start of construction.

7.0 LIMITATIONS

We prepared this report in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. This report is the copyrighted property of Ages Engineering, LLC and is intended for the exclusive use of TP Homes and their authorized representatives for use in the design, permitting, and construction portions of this project.

The analysis and recommendations presented in this report are based on data obtained from others and our site explorations, and should not be construed as a warranty of the subsurface conditions. Variations in subsurface conditions are possible. The nature and extent of which may not become evident until the time of construction. If variations appear evident, Ages Engineering, LLC should be requested to reevaluate the recommendations in this report prior to proceeding with construction. A contingency for unanticipated subsurface conditions should be included in the budget and schedule. Sufficient monitoring, testing and consultation should be provided by our firm during construction to confirm that the conditions encountered are consistent with those indicated during our exploration, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork and foundation installation activities comply with contract plans and specifications.

The scope of our services does not include services related to environmental remediation and construction safety precautions. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.



Approximate Site Location

Ages Engineering, LLC
P. O. Box 935
Puyallup, WA. 98371

Main (253) 845-7000
www.agesengineering.com

Site Vicinity Map
169th Avenue Residential
6980 & 7016 – 169th Avenue SE
Bellevue, Washington

Project No.: A-1276	September 2016	**Figure 1**

KEY:

APPROXIMATE LOCATION OF TEST HOLE TH-1

Ages Engineering, LLC
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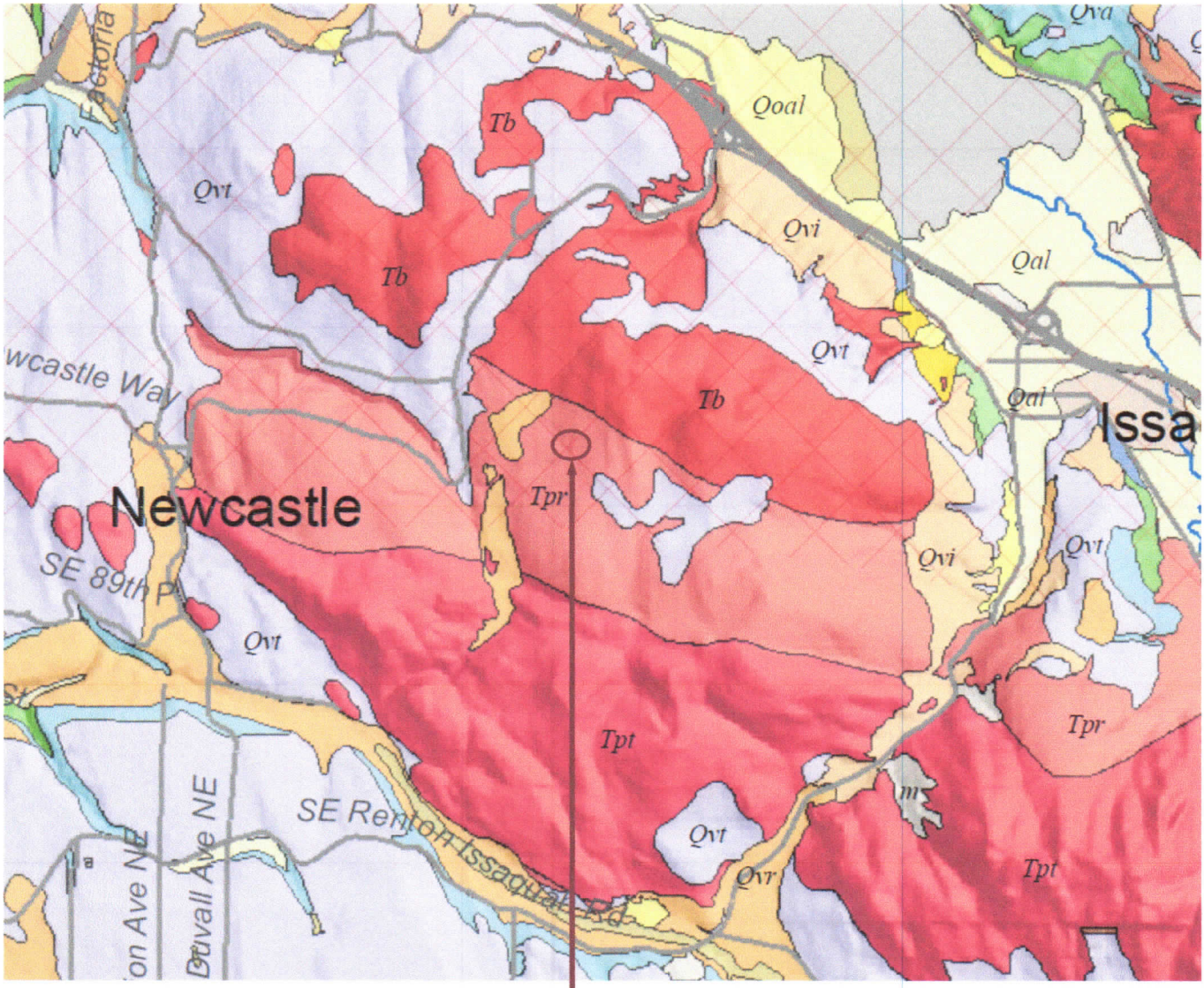
Exploration Location Plan
169th Avenue Residential
6980 & 7016 169th Avenue SE
Bellevue, Washington

Project No.: A-1276	September 2016	**Figure 2**



Approximate Site Location

Ages Engineering, LLC
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Geologic Map
169th Avenue Residential
6980 & 7016 – 169th Avenue SE
Bellevue, Washington

Project No.: A-1276	September 2016	**Figure 3**

APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

169th Avenue Residential
Bellevue, Washington

On July 6, 2016 we explored subsurface conditions at the site by excavating four hand-augured test holes to a maximum depth of 7.5 feet below surface grades. The approximate test hole locations are shown on the Exploration Location Plan provided in Figure 2. The test hole logs are presented on Figures A-2 and A-3.

A geotechnical engineering representative from our office conducted the field exploration, maintained a log of each test hole and, classified the soils encountered, collected representative soil samples, and observed pertinent site features. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1.

Representative soil samples obtained from the test holes were placed in sealed containers and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the test hole logs.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS More than 50% Retained on No. 200 Sieve	GRAVEL More than 50% Of Coarse Fraction Retained on No. 4 Sieve	GRAVEL WITH < 5 % FINES	GW	Well-Graded GRAVEL
			GP	Poorly-Graded GRAVEL
		GRAVEL WITH BETWEEN 5 AND 15 % FINES	GW-GM	Well-Graded GRAVEL with silt
			GW-GC	Well-Graded GRAVEL with clay
			GP-GM	Poorly-Graded GRAVEL with silt
			GP-GC	Poorly-Graded GRAVEL with clay
		GRAVEL WITH > 15 % FINES	GM	Silty GRAVEL
			GC	Clayey GRAVEL
	SAND More than 50% Of Coarse Fraction Passes No. 4 Sieve	SAND WITH < 5 % FINES	SW	Well-Graded SAND
			SP	Poorly-Graded SAND
		SAND WITH BETWEEN 5 AND 15 % FINES	SW-SM	Well-Graded SAND with silt
			SW-SC	Well-Graded SAND with clay
			SP-SM	Poorly-Graded SAND with silt
			SP-SC	Poorly-Graded SAND with clay
		SAND WITH > 15 % FINES	SM	Silty SAND
			SC	Clayey SAND
FINE GRAINED SOILS More than 50% Passes No. 200 Sieve	SILT AND CLAY	Liquid Limit Less than 50	ML	Inorganic SILT with low plasticity
			CL	Lean inorganic CLAY with low plasticity
			OL	Organic SILT with low plasticity
		Liquid Limit 50 or more	MH	Elastic inorganic SILT with moderate to high plasticity
			CH	Fat inorganic CLAY with moderate to high plasticity
			OH	Organic SILT or CLAY with moderate to high plasticity
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

(1) Soil descriptions are based on visual field and laboratory observations using the classification methods described in ASTM D-2488. Where laboratory data are available, classifications are in accordance with ASTM D-2487.

(2) Solid lines between soil descriptions indicate a change in the interpreted geologic unit. Dashed lines indicate stratigraphic change within the unit.

(3) Fines are material passing the U.S. No. 200 Sieve.

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Unified Soil Classification System (USCS)
169th Avenue Residential
6980 & 7016 – 169th Avenue SE
Bellevue, Washington

Project No.: A-1276	September 2016	**Figure A-1**

Ages Engineering, LLC

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Puyallup, WA. 98371
Office (253) 845-7000

Test Hole TH-1

DATE: July 5, 2016 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	Light brown and orange silty **SAND** with fine gravel, medium dense, moist. (SM)		
	Light brown silty **SAND** with fine gravel, slight cementation, medium dense, moist. (SM)		
5	Becomes dense below 4.5 feet.		▼
	Test hole terminated at 6.0 feet due to obstruction.		
	Light groundwater seepage encountered at 5.0 feet.		

Test Hole TH-2

DATE: July 5, 2016 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	Light brown and orange silty **SAND** with fine gravel, medium dense, moist. (SM)		
	Light brown silty **SAND** with fine gravel, slight cementation, medium dense, moist. (SM)		
5	Light brown silty **SAND** with gravel and cobbles to 4 inches, dense, moist. (SM)		
	Test hole terminated at 6.5 feet due to obstruction.		
	No groundwater seepage encountered.		

FIGURE A-2

Ages Engineering, LLC

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Test Hole TH-3

DATE: July 5, 2016 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	Light brown and orange silty **SAND** with fine gravel, medium dense, moist. (SM)		
5	Light brown silty **SAND** with gravel, slight cementation, medium dense, moist. (SM)		
	Light brown and purple silty **SAND,** trace gravel, dense, moist. (SM)		▼
	Test hole terminated at 8.0 feet due to obstruction. Light groundwater seepage encountered at 7.5 feet.		

Test Hole TH-4

DATE: July 5, 2016 LOGGED BY: BPK ELEV:

Depth (feet)	Soil Description	Notes M%	Notes Other
0	Dark brown silty **SAND** with gravel, trace topsoil, loose, moist. (SM)		
	Light brown and orange silty SAND with fine gravel, medium dense, moist. (SM)		
5	Light brown, orange, and yellow clayey SAND with silt and gravel, slight cementation, dense, moist. (SM)		
	Test hole terminated at 6.5 feet due to obstruction. No groundwater seepage encountered.		

FIGURE A-3