DRAFT

REPORT OF GEOTECHNICAL ENGINEERING SERVICES

Totem Lake Mall
Kirkland, Washington

For
CenterCal Properties, LLC
January 12, 2015

GeoDesign Project: CenterCal-23-01

January 12, 2015

CenterCal Properties, LLC
1600 East Franklin Avenue
El Segundo, CA 90245

Attention: Mr. Alec Paddock

Report of Geotechnical Engineering Services
Totem Lake Mall
Kirkland, Washington
GeoDesign Projects: CenterCal-23-01

GeoDesign, Inc. is pleased to submit our geotechnical engineering report for the proposed Totem Lake Mall development located in Kirkland, Washington. Our services for this project were conducted in accordance with the Professional Services Agreement between CenterCal Properties, LLC and GeoDesign, Inc. dated December 8, 2014.

We appreciate the opportunity to be of continued service to CenterCal Properties, LLC and to provide geotechnical engineering services for this project. Please contact us if you have questions regarding this report.

Sincerely,

GeoDesign, Inc.

DRAFT

Brett A. Shipton, P.E.
Principal Engineer

VCL:BAS:kt
Attachments
One copy submitted (via email only)
Document ID: CenterCal-23-01-011215-geor-DRAFT.docx
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EXECUTIVE SUMMARY

GeoDesign, Inc. completed our geotechnical engineering services and report in general accordance with the Professional Services Agreement between CenterCal Properties, LLC and GeoDesign, Inc. dated December 8, 2014 for the proposed Totem Lake Mall development located in Kirkland, Washington.

Based on the results of our subsurface explorations and analyses, it is our opinion that the site can be developed as proposed provided the site is prepared as recommended in this report. The recommendations in this report should be incorporated into design and construction, as well as incorporated into project specifications. The following summarizes general considerations for the planned construction project:

- Demolition and removal of some of the existing structures is planned prior to site development. Demolition will include removal of pavements and buried elements such as foundations and existing or abandoned utilities. Public utilities or large utility lines (existing or proposed) should not be located beneath the proposed structures.
- Due to the presence of peat layers that do not have a particular pattern throughout the upper and lower malls, we recommend the proposed structures located in the area where peat soil is present be supported on deep foundations bearing on the underlying competent soil. Figure 2 shows the approximate extent of the peat based on current and prior borings drilled at the site. Peat soil is highly compressible and can cause excessive foundation settlement.
- Approximately 2 to 25 feet of fill was encountered in the current and previous explorations. Where this soil is loose within the influence zones of foundations, it should be improved by compaction or removed and replaced by structural fill. The fill should be evaluated during construction to determine if it is capable of supporting foundation loads.
- Sensitive construction methods and specialized erosion control measures will be required to prevent wind-blown erosion and water-transported erosion during water runoff or heavy rains along the margins of the site.
- The on-site soil, with the exception of the peat and wood, is generally suitable for use as structural fill provided it is properly moisture conditioned and large particles are removed in accordance with the recommendations in this report.
- Fill imported to modify site grades should be approved by the project geotechnical engineer and should be in conformance with structural fill as described in this report. Imported fill should be compacted as recommended to 95 percent of maximum dry density, as determined by ASTM D 1557 (modified proctor).
- Sufficient density testing or inspection should be conducted and documented by qualified personnel to confirm that fill placement and compaction meets project requirements.
- Groundwater was measured at depths ranging from approximately 3 to 19 feet BGS across the upper and lower malls. Therefore, it is possible that dewatering will be required for deeper excavations. The contractor should be responsible for selecting the appropriate dewatering system based on their approach to construction.
- For walls not restrained from rotation, an equivalent fluid pressure of 35 pcf should be used for design. An equivalent fluid pressure of 55 pcf should be used for design of walls restrained from rotation. For the embedded building walls, a superimposed seismic lateral force should be calculated based on a dynamic force of $6H^2$ pounds per lineal foot of wall

(where H is the height of the wall in feet). The force should be applied as a distributed pressure with the resultant located at a distance of 0.6H from the base of the wall. Our retaining wall design recommendations are based on the following assumptions: (1) the walls are conventional, cantilevered retaining walls or embedded building walls, (2) the walls are less than 10 feet in height, and (3) the backfill is level, drained, and consists of imported granular material. Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project vary from these assumptions.

- Based on subsurface explorations and laboratory analyses, the native soil is not susceptible to liquefaction under design levels of ground shaking.

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ACRONYMS

1.0 INTRODUCTION

This report presents the results of GeoDesign's geotechnical engineering evaluation for the proposed Totem Lake Mall development located in Kirkland, Washington. The site location relative to surrounding physical features is shown on Figure 1. Acronyms used herein are defined at the end of this document.

The site currently consists of retail shop buildings divided into an upper mall and lower mall. The upper mall is currently developed with a main row of attached retail buildings at the east portion of the upper mall area and four separate small buildings. All the buildings are surrounded by an AC-paved parking lot. The lower mall is currently occupied by a main row of attached retail buildings on the east half of the site, near 120th Avenue NE, and three separate small buildings along Totem Lake Boulevard, all surrounded by an AC-paved parking lot. The current site layout is shown on Figure 2.

Based on information provided by you, including a conceptual preliminary site plan, which is included in Appendix B (after the field exploration information presented in Appendix A), we understand that the development includes demolition of most of the existing buildings and pavement. The proposed upper mall development includes demolishing all the existing retail buildings and AC parking and constructing new single-story retail shops and restaurant buildings varying in footprint from approximately 3,000 to 20,000 square feet; a two-story theater with a footprint of 35,000 square feet; a four-level parking structure at the east portion of the site; and a proposed four-story, wood-framed residential building at the southeast portion of the upper mall. Development plans of the lower mall include maintaining (and possibly renovating) retail buildings at the north portion of the lower mall. The majority of the existing lower mall buildings will be demolished and new retail shops and restaurants ranging from approximately 3,000 to 36,000 square feet, a 42,000-square-foot grocery store, and detached buildings with footprints ranging from approximately 5,000 to 6,000 square feet are proposed.

Foundation loads were not available at the time of this report. However, based on similar projects, we anticipate that maximum column loads could approach 100 to 200 kips for one- to two-story retail buildings and up to 500 kips for the proposed parking structure and residential building. GeoDesign could be contacted to verify that our recommendations are applicable if design columns vary from this. The scope of future grading work for the project is unknown at this time, although we have assumed cuts and fills will be no more than a few feet each. We understand that basement structures are not planned for the project.

2.0 BACKGROUND

CenterCal provided us with previous reports completed at the site, including two geotechnical reports (PSI, 2004; Landau, 2008). The prior work on site included 16 borings drilled in various locations around the existing buildings of the upper and lower malls in 2004 to depths ranging from approximately 11.5 to 36.5 feet BGS and 19 borings drilled within the upper mall area in 2008 to depths ranging from approximately 2.5 to 66.5 feet BGS. Figures 2 and 3 show the boring locations. Subsurface conditions are discussed in the “Subsurface Conditions” section of this report.

We reviewed a partial set of paper plans from the 1970s for the existing development. The plans were not complete and not all pages were legible. Specifications included in the plans indicate treated timber piles were used as foundation support of existing mall buildings. Information on the diameter and lengths of the piles are not available, although the plans indicate the piles were designed for a minimum capacity of 40 tons. The plans referenced recommendations from a 1971 Dames & Moore geotechnical report we were not able to obtain.

Based on our review of historical aerial photographs and topographic maps, the site appeared to be undeveloped between approximately 1895 through 1952 and was used for agricultural purposes. The eastern portion of the lower mall and much of the upper mall was a gravel mining operation between approximately 1965 and 1968. The Interstate 405 corridor to the west of the site was constructed between approximately 1968 and 1973. The south portions of the upper and lower malls may have been either a lake or bogs surrounding the lake and was filled to build the existing mall buildings. A small lake still exists southeast of 120th Avenue NE and Totem Lake Way. Several of the existing mall buildings were built between 1972 and 1974. In the upper mall, the cinema was built between 1980 and 1985 and the Chase Bank building was built in 1991.

3.0 PURPOSE AND SCOPE

The purpose of our geotechnical engineering evaluation was to provide geotechnical engineering recommendations for design and construction. Our specific scope of services is summarized as follows:

- Coordinated and managed the field investigation, utility locates, and scheduling of subcontractors and GeoDesign field staff.
- Completed four borings to depths ranging between 25.9 to 45.3 feet BGS to supplement previous borings by others.
- Obtained disturbed and undisturbed soil samples for laboratory testing at select depths from the explorations.
- Classified the materials encountered in the explorations. Maintained a detailed log of each exploration.
- Completed the following laboratory tests on select samples obtained from the explorations:
  - Fifteen natural moisture content tests in general accordance with ASTM D 2216
  - One organic content test in general accordance with ASTM D 2974
  - Two Atterberg limits tests in general accordance with ASTM D 4318
  - Five percent fines tests in general accordance with ASTM C 117 or ASTM D 1140
- Provided recommendations for site preparation, grading and drainage, stripping depths, fill type for imported material, compaction criteria, trench excavation and backfill, use of on-site soil, and wet/dry weather earthwork.
- Provided recommendations for design and construction of foundations, including shallow and deep foundation recommendations, as applicable.
- Provided recommendations for preparation of floor slab subgrade.
- Recommended design criteria for retaining walls, including lateral earth pressures, backfill, compaction, and drainage.

- Provided recommendations for the management of identified groundwater conditions that may affect the performance of structures or pavements.
- Provided recommendations for construction of asphalt pavements for on-site access roads and parking areas, including subbase, base course, and asphalt paving thickness.
- Provided recommendations for subsurface drainage of foundations and roadways, as necessary.
- Provided seismic coefficients and evaluated the risk of liquefaction at the site as presented by the IBC.
- Provided this report summarizing the results of our geotechnical evaluation.

4.0 SITE CONDITIONS

4.1 GEOLOGY

The geologic mapping completed by Minard (1983) maps the near-surface soil of the site as Quaternary glacial deposits. The majority of the site consists of recessional outwash deposited by the receding Vashon glacier. Minard (1983) describes the recessional outwash as generally composed of stratified sand and gravel, with minor silt and clay layers. The deposits may also contain ablation deposits. The eastern portion of the site is described by Minard (1983) as advance outwash composed of clean pebbly sand with increasing gravel with elevation.

4.2 SURFACE CONDITIONS

The approximately 26.9-acre property is bound on the west by Totem Lake Boulevard and is located on the northeast corner of Totem Lake Boulevard and 120th Avenue NE and consists of an upper and lower mall, which are divided by 120th Avenue NE that extends in a north-south direction.

The upper mall consists of existing attached mall buildings along the eastern portion of the site. A separate Trader Joe' building is at the northwest portion of the site, and a theater is located in the southeast corner of the site. A bank building is located near the center of the site, and a second bank is located near the intersection of 120th Avenue NE and Totem Lake Way. The buildings are surrounded by AC-paved parking areas. The ground surface of the upper mall slopes gently towards the west. The east and northeast sides of the site consist of slopes with inclinations of approximately 2H:1V. These slopes are vegetated with low brush and trees. Existing 4- to 6-foot-high rockery walls are present along the southeast side of the upper mall behind the current Big 5 Sporting Goods store and the Cinema building and along the northeast side of the upper mall behind the Trader Joe's building. Shorter 2- to 3-foot-tall rockery walls are present along the west side of the upper mall, along 120th Avenue NE.

The lower Mall is situated downslope from the upper mall, with ground surface elevations approximately 3 to 14 feet less than those of the upper mall. The surface topography of the lower mall is relatively level with a slight slope downward to the south and southwest. The lower mall area consists of attached mall buildings along the east half of the site. There is a separate Auto Zone building at the northwest corner of the site, a Chevron service station at the southeast corner of the site (near the intersection of Totem Lake Boulevard and 120th Avenue NE), and a Key Bank building approximately midway between the Auto Zone and Chevron buildings. The buildings are surrounded by AC pavement.

The existing AC pavement in the upper and lower mall is generally in fair to good condition considering its age. While we were on site, we observed pavement distress in the upper and lower mall parking lots, including alligator cracking, raveling, rutting, and utility trench patches.

4.3 SUBSURFACE CONDITIONS

Our understanding of subsurface conditions is based on review of subsurface explorations conducted by others and drilling four additional borings. PSI conducted a study in 2004 and Landau Associates (Landau) conducted a study in 2008.

Copies of the exploration logs completed by PSI in 2004 (borings B-1 through B-16) are included in Appendix C. Of the PSI borings, copies of borings B-1, B-2, B-10, and B-13 are not available. Copies of the explorations logs (borings B-1 through B-19), a site plan, and geologic cross sections completed by Landau in 2008 are included in Appendix D. The locations of the current and previous explorations are shown on Figure 2.

Our subsurface exploration program consisted of drilling four borings (B-1 through B-4) to depths ranging between 25.9 and 45.3 feet BGS. Copies of the exploration logs and results of the laboratory testing are provided in Appendix A

In general, soil conditions consist of variable amounts of fill overlying alluvial soil, which in turn overlies dense to very dense sand and gravel that have been interpreted as advance outwash sand, ablation and glacial till, and transitional beds. The conditions across the upper and lower malls are highly variable. The Landau (2008) report included three geologic cross sections for the upper mall area that illustrate the variable conditions. Most of the current and prior explorations were terminated in the dense to very dense soil.

The asphalt pavement sections observed in all four of the current borings (B-1 through B-4) consist of 5 inches of AC overlying various fill material. In borings B-1 and B-2 the AC is underlain directly by gravel with silt and stiff to hard silt with varying amounts of sand and gravel, respectively. In borings B-3 and B-4 (upper mall), the AC is underlain by medium dense gravel with sand and medium dense, silty sand, respectively. The AC thicknesses reported in the Landau borings (Landau, 2008) in the upper mall area ranged from approximately 2 to 4.5 inches thick. The AC is underlain by gravel with varying amounts of silt and sand and sand with varying amounts of silt and gravel. Borings B-9 through B-11 encountered aggregate base approximately 2.5 to 8 thick underneath the AC layer. The AC thicknesses observed in the PSI borings (PSI, 2004) in the lower mall area (borings B-12 and B-14 through B-16) were reported by PSI to be approximately 4 inches thick underlain directly by fill composed of gravel with varying amounts of silt and sand. In the upper mall area (borings B-3 through B-9 and B-11) PSI reported AC thicknesses of approximately 4 inches thick underlain by sand with varying amounts of silt and gravel and gravel with varying amounts of silt and sand. Boring B-4 was reported to have 1 inch of aggregate base underlying the AC. The soil encountered in our explorations is described in the following sections.

4.3.1 Fill

Fill was encountered in boring B-3 below AC to a depth of approximately 5.0 feet BGS. The fill is composed of medium dense gravel with sand. Laboratory testing indicates that the moisture content of the fill in B-3 was 7 percent at the time of our exploration.

Up to 25 feet of fill was reported in the borings completed by Landau (2008) and 10 feet of fill was reported by PSI (2004). The fill is generally thickest at the western portion of the upper mall site along 120th Avenue NE and on the south side of the upper mall along Totem Lake Way (Landau, 2008). Previous work by Landau (2008) reported highly variable fill composed of sand, silt, gravel, and organic soil (peat and wood).

4.3.2 Alluvial Deposits

Native alluvium was encountered in all borings either directly beneath the AC or underlying the sand and gravel fill at depths between approximately 1.5 and 5 feet BGS. Thicknesses ranged between 10 and 23.5 feet. The alluvium is generally composed of silt and is very soft to hard, light brown to red-brown with various amounts of sand, gravel, and organics composed of peat and wood. Laboratory testing indicates that the moisture contents of the silt ranged between 11 and 29 percent at the time of our explorations.

Native lacustrine deposits were encountered in 17 of the previous Landau (2008) borings at depths ranging from 5.5 to 52.0 feet BGS. A wide range of soil types were reported by Landau (2008) in the lacustrine deposits, which included silt, sand with various amounts of silt, silty gravel, and clay with sand. The most common reported soil type within the alluvial unit by Landau (2008) was silty sand. PSI (2004) reported similar soil types, which we interpret as alluvium composed predominantly of silty sand or silt in at least five borings. Depths of alluvium range from approximately 0.5 to 8.0 feet and vary in thicknesses between 5.5 and 24.5 feet thick.

4.3.3 Peat and Wood

In boring B-1, organics were encountered from approximately 5 to 7.5 feet BGS. Laboratory testing of one sample from B-1 indicates the moisture content was 51 percent and organic content was 12 percent at the time of our explorations.

Previous work by Landau (2008) and PSI (2004) encountered compressible soil within native alluvium and fill material. Landau (2008) encountered compressible soil composed of peat and wood in approximately 12 borings at depths between 4 and 41 feet BGS, with thicknesses ranging between 1.75 and 15 feet. PSI (2004) reported compressible soil in three borings at depths between 6.0 and 22.0 feet BGS with thicknesses between 1.5 to 13 feet.

Figure 2 shows the depth below ground surface and estimated thickness of the compressible material at the site. We used the information collected from our current explorations and information provided in the Landau (2008) and PSI (2004) reports.

4.3.4 Advance Outwash Sand

Dense to very dense sand with various amounts of silt and gravel and gravel with various amounts of sand and silt was encountered at depths between 11.0 and 25.0 feet BGS.

Thicknesses were observed to be 25 feet thick in B-3 and at least 10.8 feet thick in B-1. Laboratory testing indicates that the moisture contents of the sand ranged between 20 and 23 percent at the time of our explorations.

Previous work by Landau (2008) encountered advance outwash composed of dense to very dense sand with various amounts of silt and gravel below the alluvium in seven borings at depths between 5.5 to 49.0 feet BGS. Work by PSI (2004) possibly encountered outwash composed of silty sand with various amounts of gravel in at least five borings between approximately 1 to 21 feet BGS.

4.3.5 Ablation and Glacial Till

In our explorations, dense to very dense gray gravel with silt and sand was encountered in borings B-2, B-3, and B-4 at depths ranging between 15.0 and 40.0 feet BGS. All three borings where gravel was encountered were terminated due to drilling refusal between 25.9 to 45.3 feet BGS.

Landau (2008) reported encountering till deposits composed of very dense, silty sand and gravel in three borings at depths ranging between 14.0 and 66.5 feet BGS, with thicknesses between 10 and at least 37.4 feet thick. Their report also encountered ablation till in two borings at depths between 35.5 and 40.0 feet BGS, with thicknesses between 2.5 and 3.0 feet. According to Landau (2008), the ablation till is similar in composition as glacial till but is lower in density due to not being glacially overridden.

PSI (2004) encountered very dense, gray gravel with various amounts of sand and silt in at least five borings between 15.0 and 35.0 feet BGS. Thicknesses ranged from 1 to at least 5.5 feet, which represented the total depth explored.

4.3.6 Transitional Bed Deposits

Landau (2008) reported encountering native transitional bed deposits composed of dense to very dense, silty sand; sand with various amounts of gravel; silty gravel; and generally hard silt and clay with organics. Transitional beds were reported in 11 borings between depths of approximately 5.5 and 49 feet BGS and are generally saturated. These deposits extend down to depths of at least 30.9 to 61.5 feet BGS. Fine organics and decomposed wood was also encountered in two borings between 17.0 and 30.0 feet BGS and was reported to be less than 0.5 feet thick.

PSI (2004) did not separate out transitional bed deposits in their report. However, it is possible that they encountered transitional beds composed of wet, very stiff silt with peat in at least two borings at depths between approximately 10.5 and 25 feet BGS, with a thickness of at least 2 feet.

4.3.7 Groundwater

Groundwater was encountered at a depth of 15 feet BGS in borings B-3 (upper mall). Groundwater was not encountered in borings B-1, B-2 (lower mall), or B-4 (upper mall) during drilling. In the previous explorations by PSI (2004), groundwater was encountered in most of the borings at depths ranging from approximately 3 to 19 feet BGS. In the previous explorations by

Landau (2008), groundwater was encountered in most of the soil borings, with the exception of one boring (B-9), at depths ranging from approximately 7 to 19 feet BGS. These corresponded to ground surface elevations ranging from approximately 117.2 to 130.5 feet above MSL. One of the borings (B-12) had a water level at 41 feet BGS (elevation 95.9 feet above MSL). The depth to groundwater may fluctuate in response to seasonal changes, prolonged rainfall, changes in surface topography, and other factors not observed in this study.

Based on our review of the Landau (2008) report, measurements were taken from two existing piezometers located on the west side of the upper mall (in front of the New Attitude store) and the east side of the lower mall (near the former Gotchalks store). The groundwater levels were approximately 127 and 125.7 feet above MSL at the upper mall and lower mall locations, respectively.

In addition, the Landau (2008) report indicated that discussions with the Totem Lake Mall manager at the time revealed that the mall experienced surface water issues during the winter and spring months. They reported that water would seep out of the asphalt pavement along the access road that runs along the east side of the upper mall building and out of the rockery wall along the northeast side of the upper mall.

4.4 CORROSIVITY TESTING BY OTHERS

Corrosivity testing results were reported in the Landau report (Landau, 2008) for the upper mall. The corrosivity testing included tests for pH, soluble sulfate content, chloride content, and soil resistivity. The results of corrosivity testing by Landau are summarized in Table 1.

Table 1. Corrosivity Test Results
(summarized from previous Landau, 2008 report)

Boring	Depth (feet BGS)	pH	Sulfate (ppm)	Chloride (ppm)	Resistivity (ohm-cm)
B-5 (Landau, 2008)	2.5 - 4.0	6.08	767	118	7,000
B-8 (Landau, 2008)	5.0 - 6.5	7.05	516	< 57.3	7,100
B-10 (Landau, 2008)	2.5 - 4.0	7.08	599	84.7	5,900
B-10 (Landau, 2008)	5.0 - 6.25	6.47	355	< 63.7	4,000
B-11 (Landau, 2008)	2.5 - 4.0	6.91	966	183	7,900

We reviewed Wilmott and Jack (2000) and FHWA (2000) regarding soil corrosivity. Both publications indicate that soil with a measured resistivity ranging between 2,000 and 5,000 ohm-cm are considered to be moderately corrosive. Values ranging between 5,000 and 10,000 ohm-cm are mildly corrosive. Values above 10,000 ohm-cm indicate very mild

corrosivity. pH values below 5 are considered corrosive. Sulfate contents above 200 ppm are considered corrosive. Based on the results, the soil tested by Landau (2008) is moderately corrosive.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our subsurface explorations and analyses, it is our opinion that the site can be developed as proposed provided the site is prepared as recommended in this report. The recommendations in this report should be incorporated into design and construction, as well as incorporated into project specifications. The following summarizes general considerations for the planned construction project:

- Demolition and removal of some of the existing structures is planned prior to site development. Demolition will include removal of pavements and buried elements such as foundations and existing or abandoned utilities. Public utilities or large utility lines (existing or proposed) should not be located beneath the proposed structures.
- Peat was encountered over a large area of the upper mall. Figure 3 shows our interpretation of the extent of the peat based on the borings drilled at the site. We recommend structures in this area be supported on deep foundations that extend through the loose fill, peat, and wood layers and bearing in the underlying very dense sand and gravel. Peat soil is highly compressible and can cause excessive foundation settlement.
- Approximately 2 to 25 feet of fill was encountered in the current and previous explorations. Fill in the influence zones of foundations should be improved where it is soft and loose. Where soft fill is present at depth and is not practical to remove and replace, structures can be supported on deep foundations. Much of the deeper fill is present in areas where peat soil is also present. Specific recommendations for subgrade improvement are provided in the "Site Preparation" section of this report.
- Slabs on grade may be feasible in the areas where peat is present, provided they are not heavily loaded and a small risk of repair associated with settlement is acceptable over the life of the structure.
- The on-site soil, with the exception of the peat and wood, is generally suitable for use as structural fill provided it is properly moisture conditioned and large particles are removed in accordance with the recommendations in this report.

The following sections present specific geotechnical recommendations for design and construction of the proposed development.

6.0 SITE DEVELOPMENT RECOMMENDATIONS

6.1 SITE PREPARATION

6.1.1 Demolition

Existing improvements are present in areas of proposed new development. Demolition of these improvements will require complete removal of the structure within areas to receive new pavements, buildings, or engineered fills. Removal will include buried foundations associated with buildings and pavements in the surrounding areas. Existing timber piles should be removed to a depth of 2 feet below finished subgrade.

Existing asphalt, structural elements, hardscapes, and the topsoil zone should be stripped and removed from all proposed structural fill, pavement, and improvement areas and for a 5-foot margin around such areas. Underground utility lines or hidden, buried tanks encountered in areas of new improvements should also be completely removed. Depending on the trench backfill, it may be possible to grout full if left in place. Material generated during demolition should be transported off site for disposal or stockpiled in areas designated by the owner. In general, this material will not be suitable for re-use as engineered fill.

Voids resulting from removal of improvements or loose soil in utility lines should be backfilled with compacted structural fill, as discussed in the "Structural Fill" section of this report. The bottom of such excavations should be excavated to expose a firm subgrade before filling and their sides sloped at a minimum of 1H:1V to allow for more uniform compaction at the edges of the excavations.

6.1.2 Fill

Between 2 and 25 feet of variable fill was encountered at site in the current and prior explorations. Following demolition, we recommend the subgrade within pavement and building floor slab areas be evaluated by a geotechnical engineer. Loose, soft fill present in the influence zones of foundations should be removed and replaced with structural fill. Structures in areas where the fill is deep and it is impractical to excavate can be supported on deep foundations.

Soft fill can also affect the performance of pavements and slabs-on-grade. It is acceptable to improve the upper 18 inches of soft and loose fill in these areas provided the small risk of future maintenance is acceptable.

6.1.3 Wet Weather/Wet Soil Grading

The fine-grained, silty soil encountered near the surface at the site is moderately disturbed during wet weather and when it is above the optimum moisture content. If construction occurs in areas of wet, silty soil, site preparation activities may need to be accomplished using track-mounted excavating equipment that loads removed material into trucks supported on granular haul roads. The thickness of the granular material for haul roads and staging areas will depend on the amount and type of construction traffic. Generally, a 12-inch-thick mat of granular material is sufficient for light staging areas and the basic building pad but is generally not expected to be adequate to support heavy equipment or truck traffic. The granular mat for haul roads and areas with repeated heavy construction traffic typically needs to be increased to 18 inches. These thicknesses can be reduced in areas of clean sand.

The above values are only guidelines; the actual thickness of haul roads and staging areas should be selected by the contractor based on their approach to site development, the actual subgrade soil, and the amount and type of construction traffic. The granular material should be placed in one lift over the prepared, undisturbed subgrade and compacted using a smooth-drum, non-vibratory roller. The imported granular material should meet the specifications for stabilization material in the "Structural Fill" section of this report. A geotextile fabric can be placed as a barrier between the subgrade and imported granular material in areas of repeated construction traffic for additional support. The geotextile should meet the guidelines for separation geotextiles as described in the "Structural Fill" section of this report.

Alternatively, construction can be staged such that the existing pavements can be used as haul roads or it may be possible to stabilize the subgrade using a cement amendment provided oversized and deleterious material can be removed. If this approach is used, the cement-amended soil should meet the guidelines provided in the "Structural Fill" section of this report.

6.2 SUBGRADE EVALUATION

Undocumented fill may be present on site that was not encountered during our exploration. Proper subgrade evaluation by qualified geotechnical personnel is critical to determine if unsuitable soil exists after demolition and stripping.

After preparation activities are complete for the existing subgrade, the subgrade should be proof rolled with a fully loaded dump truck or similar heavy, rubber-tired construction equipment to identify any remaining soft, loose, or unsuitable areas. The proof roll should be conducted prior to placing additional fill. The proof rolling should be observed by a qualified geotechnical engineer who should evaluate the suitability of the subgrade and identify any areas of yielding that are indicative of soft or loose soil. If soft or loose zones are identified during proof rolling, these areas should be excavated to the extent indicated by the engineer and replaced with structural fill. Subgrade preparation and evaluation by proof rolling should not be conducted during freezing weather.

Wet soil that has been disturbed during site preparation activities, or soft or loose zones identified during subgrade evaluation, should be removed and replaced with compacted structural fill or improved in place as recommended.

6.3 EXCAVATION

Conventional, heavy earthmoving equipment in proper working condition should be capable of making necessary general excavations of the on-site soil and excavations for utilities and footings. The sandy or gravelly soil will be prone to caving, which may result in widening of excavations. We recommend loose material at the base of footing and trench excavations be smoothed and compacted prior to footing or fill placement. Heavy excavation equipment and hard excavation methods may be required to excavate the dense material.

Excavation sidewalls should stand vertical to a depth of approximately 4 feet provided excessively dry or wet conditions do not affect the sidewalls. However, moderate caving is possible in the native granular soil when dry and even shallow excavations may need to be laid back to control caving. Excavations deeper than 4 feet BGS should be shored or laid back at an inclination of 1H:1V or flatter if workers are required to enter. The contractor should be responsible for selecting the appropriate shoring system.

Shoring for trenches less than 6 feet deep should be possible with a conventional box system. Moderate sloughing should be expected outside the box, particularly in conditions that are exceptionally dry. All shoring should be approved by a registered engineer before use.

Excavations should be made in accordance with applicable OSHA and state regulations. While this report describes certain approaches to excavation and shoring, the contract documents should specify that the contractor is responsible for providing adequate excavation equipment,

selecting and designing the specific methods, observing excavations for safety, and providing shoring as required to protect personnel and adjacent structural elements.

Groundwater on site was generally encountered at depths ranging from approximately 3 to 19 feet BGS. Therefore, it is possible that dewatering will be required for deeper excavations. The contractor should be responsible for selecting the appropriate dewatering system based on their approach to construction.

6.4 STRUCTURAL FILL

6.4.1 General

Fills should only be placed over subgrade that has been prepared in conformance with the "Site Preparation" section of this report. A variety of material may be used as structural fill at the site. However, all material used as structural fill should be free of organic matter or other unsuitable material and should meet the specifications provided in WSS 9-03 – Aggregates, depending on the application. A brief characterization of some of the acceptable materials and our recommendations for their use as structural fill is provided below.

6.4.2 On-Site Soil

The on-site silt, sand, and gravel material may be used as general fill, provided it is properly moisture conditioned, has less than 3 percent organics by weight, and meets the specifications provided in WSS 9-03.14(3) – Common Borrow. The compressible peat and wood will not be suitable for use as fill.

Moderate moisture conditioning (i.e., drying) of the on-site soil will be required in order to achieve proper compaction; therefore, the use of on-site soil for structural fill may need to be restricted to periods of prolonged dry weather.

6.4.3 Imported Granular Material

Imported granular material used as structural fill for subgrade stabilization during periods of wet weather or for haul roads, staging areas, etc. should be pit- or quarry-run rock, crushed rock, or crushed gravel and sand. The imported granular material should meet the specifications provided in WSS 9-03.9(1) – Ballast, WSS 9-03.14(1) – Gravel Borrow, or WSS 9-03.14(2) – Select Borrow. The imported granular material should also be angular, well graded between coarse and fine material, have less than 5 percent by dry weight passing the U.S. Standard No. 200 Sieve, and have at least two fractured faces.

During the wet season or when wet subgrade conditions exist, the initial lift should be approximately 18 inches in uncompacted thickness and should be compacted by rolling with a smooth-drum roller without using vibratory action.

Where imported granular material is placed over soft soil subgrades, we recommend a geotextile be placed as a barrier between the subgrade and imported granular material. The geotextile should meet the specifications provided in WSS 9-33.2 – Geosynthetic Properties, Table 3 for soil separation or Table 4 for soil stabilization, depending on the required use and subgrade conditions. The geotextile should be installed in conformance with the specifications provided in WSS 2-12 – Construction Geosynthetic.

6.4.4 Floor Slab Base Rock

Imported granular material placed beneath building floor slabs should be clean, crushed rock or crushed gravel and sand that is fairly well graded between coarse and fine. The granular material should contain no deleterious material, have a maximum particle size of 1½ inches and less than 5 percent by dry weight passing the U.S. Standard No. 200 Sieve, and meet the guidelines as described for separation geotextile in the "Structural Fill" section of this report.

6.4.5 Pavement Aggregate Base

Imported granular material used as aggregate base (base rock) beneath pavements should be clean crushed rock or crushed gravel and sand that is fairly well graded between coarse and fine. The aggregate base should meet the specifications provided in WSS 9-03.9 – Aggregates for Ballast and Crushed Surfacing, depending on application, with the exception that the aggregate should have less than 5 percent by dry weight passing the U.S. Standard No. 200 Sieve and have at least two mechanically fractured faces. The aggregate base should be compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D 1557.

6.4.6 Trench Backfill

Utility trench backfill should be placed in accordance with the specifications provided in WSS 7-08 – General Pipe Installation Requirements and should meet the material specifications provided in WSS 9-03.12 – Gravel Backfill.

General pipe bedding should meet the specifications provided in WSS 9-03.12(3) – Gravel Backfill for Pipe Zone Bedding and be compacted to at least 90 percent of the maximum dry density, as determined by ASTM D 1557.

General pipe zone backfill should consist of well-graded, granular material with a maximum particle size of 1¼ inches and be compacted to at least 90 percent of the maximum dry density, as determined by ASTM D 1557.

General trench backfill above the pipe zone should be placed in lifts no greater than 6 inches thick and compacted to at least 95 percent of the maximum dry density, as determined by ASTM D 1557. Outside of structural improvement areas (e.g., roadway or wall alignments), general trench backfill above the pipe zone shall be placed in lifts no greater than 6 inches thick and compacted to at least 85 percent of the maximum dry density, as determined by ASTM D 1557.

6.4.7 Stabilization Material

Stabilization aggregate should consist of pit- or quarry-run rock, crushed rock, or crushed gravel and sand and should meet the specifications provided in WSS 9-03.9(1) – Ballast, WSS 9-03.14(1) – Gravel Borrow, or WSS 9-03.14(2) – Select Borrow. Stabilization aggregate should have a maximum particle size of 6 inches, less than 5 percent by dry weight passing the U.S. Standard No. 4 Sieve, and at least two mechanically fractured faces. The material should be free of organic matter and other deleterious material. Stabilization aggregate should be placed over a geotextile fabric in one lift and compacted to a firm condition.

6.4.8 Drain Rock

Drain rock should consist of angular, granular material with a maximum particle size of 2 inches and should meet WSS 9-03.12(4) – Gravel Backfill for Drains. The material should be free of roots, organic matter, and other unsuitable material; have less than 2 percent by dry weight passing the U.S. Standard No. 200 Sieve (washed analysis); and have at least two mechanically fractured faces.

6.4.9 Recycled On-Site Material

Recycled material in accordance with WSS 9-03.21- Recycled Material may be used as, or blended uniformly with, natural material for aggregates. Table 9-03.21(1)E should be reviewed to determine the percentage of recycled material that can be used for specific applications. Recycled material may require processing to meet the requirements of its intended use. Processing includes crushing and screening, grinding in place, or other methods to meet the requirements for structural fill. The processed material should be fairly well graded and contain no metal, organic, or other deleterious material. The minimum specified compaction level is 95 percent of its maximum dry density, as determined by ASTM D 1557.

6.4.10 Geotextile Fabric

6.4.10.1 Separation Geotextile Fabric

The geotextile should meet the specifications provided in WSS 9-33.2(1) – Geosynthetic Properties (Table 3) for soil separation. The geotextile should be installed in conformance the specifications provided in WSS 2-12 – Construction Geosynthetic.

6.4.10.2 Drainage Geotextile Fabric

Drain rock, and other granular material used for subsurface drains, should be wrapped in a geotextile fabric that meets the specifications provided in WSS 9-33.2(1) – Geotextile Properties (Table 3) for drainage geotextiles. The geotextile should be installed in conformance the specifications provided in WSS 2-12 – Construction Geosynthetic.

6.4.11 Cement Amendment

As an alternative to the use of imported granular material for wet weather subgrade improvement or structural fill, an experienced contractor should be able to amend the on-site soil with portland cement to obtain suitable support properties. If successfully executed, cement-amended subgrade can also be utilized as a subbase layer in the pavement section, thereby reducing the overlying base rock and pavement section. Oversized material such as cobbles, if encountered, generally needs to be removed prior to treatment to prevent damage to the specialty tilling equipment used in cement amendment.

Successful use of soil amendment depends on the use of correct mixing techniques, soil moisture content, and amendment quantities. We recommend a target strength for cement-amended soil of 80 psi. The amount of cement used to achieve this target generally varies with moisture content and soil type. It is difficult to predict field performance of soil to cement amendment due to variability in soil response, and we recommend laboratory testing to confirm expectations. However, for preliminary design purposes, 5 percent cement by weight of dry soil can generally be used when the soil moisture content does not exceed approximately 20 percent. If the soil moisture content is in the range of 25 to 35 percent, 6 to 7 percent by

weight of dry soil is recommended. We recommend initially assuming a cement ratio of 6 percent. The cement ratio may need to be adjusted based on field observations and performance.

Typically, a minimum curing of four days is required between treatment and construction traffic access. The amended surface should be protected from abrasion by placing a minimum of 4 inches crushed rock. As discussed in the "Pavement Design Recommendations" and "Wet Weather Construction/Wet Soil Grading" sections of this report, thicker layers of crushed rock may be required for the pavement section or for staging and haul roads. The crushed rock can become contaminated with soil during construction. Contaminated base rock should be removed and replaced with clean rock in pavement areas, such that the minimum thickness of free-draining base at the surface is 4 inches.

Portland cement-amended soil is hard and has low permeability. Therefore, this soil does not drain well, nor is it suitable for planting. Future planted areas should not be cement amended, if practical, or accommodations should be planned for drainage and planting.

6.5 FILL PLACEMENT AND COMPACTION

Fill soil should be compacted at a moisture content that is near optimum. The maximum allowable moisture content varies with the soil gradation and should be evaluated during construction.

Fill and backfill material should be placed in uniform, horizontal lifts and compacted with appropriate equipment. The maximum lift thickness will vary depending on the material and compaction equipment used but should generally not exceed the loose thicknesses provided in Table 2. Fill material should be compacted in accordance with the compaction criteria provided in Table 3.

Table 2. Recommended Uncompacted Lift Thickness

Compaction Equipment	Recommended Uncompacted Lift Thickness (inches)		
	On-Site Silty and Sandy Soil	Granular and Crushed Rock Maximum Particle Size ≤ 1½ Inches	Crushed Rock Maximum Particle Size > 1½ Inches
Hand Tools: Plate Compactor and Jumping Jack	4 to 8	4 to 8	Not Recommended
Rubber-Tired Equipment	6 to 8	10 to 12	6 to 8
Light Roller	8 to 10	10 to 12	8 to 10
Heavy Roller	10 to 12	12 to 18	12 to 16
Hoe Pack Equipment	12 to 16	18 to 24	12 to 16

The table above is based on our experience and is intended to serve only as a guideline. The information provided in this table should not be included in the project specifications.

Table 3. Compaction Criteria

Fill Location	Compaction Requirements in Structural Zones		
	Percent Maximum Dry Density Determined by ASTM D 1557		
	0 to 2 Feet Below Subgrade (percent)	> 2 Feet Below Subgrade (percent)	Pipe Zone (percent)
Beneath Footings and Columns	95[1]	95	-----
Beneath Interior Slabs	95	95	-----
Beneath Paving	95	95	-----
Utility Trenches	95[1]	92	90[2]
Sidewalks	95	92	-----
Retaining Wall Backfill	95[1,3]	92[3]	-----
Area Fills	95[1]	92	
Non-Structural (Landscape Areas)	85	80	-----

1. May be reduced to 92 percent if fine-grained soil is used.
2. Or as recommended by the pipe manufacturer.
3. Should be reduced to 90 percent within a horizontal distance of 3 feet from the retaining wall.

6.6 CUT AND FILL SLOPES

Permanent cut and fill slopes in the site soil should not be inclined steeper than 2H:1V. Buildings, access roads, and pavements should be set back a minimum of 5 feet from the crest of any such slopes.

6.7 SITE DRAINAGE

6.7.1 General

We recommend that roof drains, retaining wall back drains, and other subsurface drains be tightlined to the storm drain facilities. Access road, parking, and open space areas should be sloped such that surface water runoff is collected and routed to suitable discharge points. We recommend that ground surfaces within 10 feet of the building be sloped at least 2 percent away from the foundations.

6.7.2 Temporary Drainage

During grading at the site, the contractor should be made responsible for temporary drainage of surface water as necessary to prevent standing water and/or erosion at the working surface. During grading and excavation on site, the contractor should keep all footing excavations and floor slab subgrade free of water.

6.8 EROSION CONTROL

The on-site soil is moderately susceptible to erosion. We recommend that slopes be covered with an appropriate erosion control product if construction occurs during periods of wet weather. We recommend that all slope surfaces be planted as soon as practical to minimize erosion. Surface water runoff should be collected and directed away from slopes to prevent water from

running down the slope face. Erosion control measures (such as straw bales, sediment fences, and temporary detention and settling basins) should be used in accordance with state and local ordinances.

7.0 FOUNDATION SUPPORT

Peat and wood was encountered in the borings; the peat and fill appear to be concentrated in pockets on the southeast portion of the site. Figure 3 shows the approximate extent of the fill based on our knowledge of subsurface conditions. To minimize the risk of future foundation settlement, we recommend deep foundations be used to support buildings in these areas. Based on our experience, augercast piles or driven steel pipe piles are suitable options for foundation support. We anticipate that spread footings can be used in other areas. Although not widely encountered, pockets of peat may be in other portions of the site. Consequently, we recommend that foundation subgrade be explored using a dynamic cone penetrometer or other suitable method to determine if peat is present. If peat is present, it should be removed and replaced with structural fill.

We have provided additional recommendations for foundation support alternatives in the following sections.

7.1 DEEP FOUNDATIONS

7.1.1 Axial Capacity

The piles will achieve axial capacity primarily through end bearing in the underlying dense sand and gravel layers. These layers were encountered in the current and prior borings at variable depths ranging from approximately 30 to 52 feet BGS. The depths to the top of the competent soil layers encountered in each boring are shown on Figure 3. The variable contact elevations to the underlying sand and gravel layer will require close observation in the field during construction. The pile contractor should provide unit prices for adding and deducting footages actually installed.

A structural engineer should determine the final limiting structural capacity values for the selected pile and pile system. Tables 4 and 5 present the anticipated allowable capacities for augercast and driven pipe piles, respectively. The capacities are based on a factor of safety of 3.0. Pile capacity should be verified using WEAP analysis of piles.

Table 4. Axial Allowable Compressive Capacity - Augercast Piles

Pile Diameter (inches)	Allowable Compressive Capacity[1] (tons)
14	110
16	130
18	150

1. This will vary depending on the depth installed. Assumes 10-foot penetration into very dense sand and gravel.

Table 5. Axial Allowable Compressive Capacity - Steel Pipe Piles

Pile Diameter (inches)	Allowable Compressive Capacity[1] (tons)
12¾	150
14	165

1. Pipe piles are driven close-ended

7.1.2 Pile Spacing and Group Effects

The anticipated column loads that will be developed by the proposed buildings may require greater capacities than can be provided by a single pile. Pile groups should be designed to allow at least a center-to-center spacing of at least 3 pile diameters. Closer spacing could create installation difficulties and/or a reduction in group capacities. The axial capacity of pile groups with this minimum spacing can be calculated as the sum of the axial capacities of individual piles. If closer pile spacing is required, our office should be contacted to evaluate the group effects.

7.1.3 Lateral Capacity

Lateral pile response can be modeled using the LPILE software package using the parameters in Table 6.

Table 6. Soil Parameters for Lateral Pile Response Analysis

General Soil Type	p-y Curve Model	Effective Unit Weight, γ' (pcf)	Cohesion, C (psf)	Friction Angle, ϕ (degrees)	Strain Factor E_{50}	k (pci)
Fill	Sand (Reese)	115 (53)[1]	NA	28	NA	30 (20)[1]
Alluvial Soil	Sand (Reese)	120 (58)[1]	NA	30	NA	100 (50)[1]
Dense to Very Dense Sand and Gravel (outwash, ablation till, glacial till, transitional beds)	Sand (Reese)	130 (68)[1]	NA	36	NA	200 (100)[1]

1. Values in parentheses () are buoyant unit weights for soil below the groundwater table. Groundwater table should be assumed at a depth of 10 feet BGS.

For predesign estimates, an average fill thickness of 10 feet underlain by an average thickness of 18 feet of alluvial soil can be assumed in determining the lateral capacity.

In addition to the lateral resistance provided by the piles, resistance to lateral loads also can be developed by passive pressure on the face of pile caps, grade beams, tie beams, and other buried foundation elements. Sliding friction on the base of pile-supported foundation elements should be ignored. Assuming a maximum translation of 0.5 inch, the allowable passive resistance on the face of buried foundation elements may be computed using an equivalent fluid density of 250 pcf for foundation elements cast neat against the existing soil or backfilled with structural fill.

7.1.4 Settlement

Settlement of the pile under static load conditions should be less than ½ inch for piles embedded at least 10 feet into the dense sand and gravel.

7.1.5 Augercast Pile Installation Considerations

Augercast piles are installed using large-diameter, continuous flight augers to create a specified sized hole. Once the auger reaches the specified tip elevation, the auger is slowly rotated as grout is pumped into the hole. Pumping of the grout continues as the auger is retrieved from the pile unit. Augercast piles have advantages of not creating pile driving vibrations and the ability to penetrate formations that would normally be difficult to penetrate by driving. Augercast piles can also be easily installed below the water table.

Installation of the augercast piles should be performed by a qualified augercast pile contractor with experience in the Portland area. For augercast piles, the installation recommendations as provided in the *Augered Cast-In-Place Piles Manual*, as developed by the Deep Foundations Institute, should be followed. Careful quality control data collection is required for augercast piles in order to determine the integrity and continuity of each pile unit.

Pile lengths may vary depending on the consistency of the bearing stratum at pile locations across the site. It is reasonable to assume that some piles may terminate at different depths. Pipe piles should be driven closed-ended with a steel plate and spaced at least 3 pile diameters center to center.

7.1.6 Driven Pile Installation Considerations

Steel pipe piles should be driven to refusal in the underlying dense to very dense gravel formation using a hammer having adequate energy to penetrate through the overlying soil and properly found the piles in the designated ground formation. Terminal blow counts will depend on the pile type and driving equipment chosen. It should be verified that the selected piles have sufficient structural capacity to withstand the stresses induced by pile driving. GeoDesign should be consulted to select the appropriate hammer energy to develop the required capacity while avoiding excessive driving stresses. GeoDesign will develop the terminal blow criteria based on WEAP analysis considering the pile type, required capacity, and the selected driving equipment.

The piles should be installed with suitable alignment tolerances. Vertical alignment should be within 3 percent of plumb or as determined by the structural engineer. Lateral alignment should be within tolerances determined by the structural engineer, considering the pile cap design. Settlement of piles driven to refusal in the very dense gravel will be negligible beyond the elastic compression of the pile.

If buried obstructions are encountered during driving, such as any existing timber piling, the pile should be extracted and the obstruction removed. If the buried obstruction cannot be removed, the structural engineer should be consulted to select a new pile location. Each pile should be carefully inspected for damage caused by impacting buried obstructions during driving.

We recommend full-time monitoring of pile installation to confirm that the piles are driven in accordance with the recommendations in this report and with the project specifications.

7.2 CONVENTIONAL SPREAD FOOTINGS

7.2.1 Dimensions and Capacities

Spread footings are acceptable where peat is not present. Figure 3 shows the area where peat is present based on our knowledge of subsurface conditions. Pockets of peat may be present in pockets outside of this area. Consequently, we recommend that foundation subgrade be explored using a dynamic cone penetrometer or other suitable method to determine if peat is present. If peat is present, it should be removed and replaced with structural fill. All undocumented fill and soft soil should be removed from the footing subgrade. We recommend the footing subgrade, after cutting, be observed by a qualified geotechnical engineer to evaluate whether it is suitable as is or if it needs to be compacted in place or scarified and re-compacted in place.

We recommend that footings be sized based on an allowable bearing pressure of 3,000 psf. This is a net bearing pressure; the weight of the footing and overlying backfill can be ignored in calculating footing sizes. The recommended allowable bearing pressure applies to the total of dead plus long-term live loads and may be increased by 50 percent for short-term loads, such as those resulting from wind or seismic forces. Isolated spread footings should be at least 18 inches wide and continuous spread footings should be at least 12 inches wide. The bottom of exterior footings should be at least 18 inches below the lowest adjacent final grade. The bottom of interior footings should be placed at least 12 inches below the base of the floor slab.

7.2.2 Lateral Resistance

Lateral loads can be resisted by passive earth pressure on the sides of footings and by friction on the bearing surface. We recommend that passive earth pressures be calculated using an allowable equivalent fluid pressure of 250 pcf if footings are confined by undisturbed on-site soil or structural fill. For footings in contact with the on-site soil, a coefficient of friction equal to 0.30 may be used when calculating resistance to sliding. This value should be increased to 0.40 for footings in contact with a layer of crushed rock material placed over the existing soil subgrade.

The passive earth pressure value is based on the assumptions that the adjacent grade is level and that static groundwater remains below the base of the footing throughout the year. Adjacent floor slabs, pavements, or the upper 12-inch depth of adjacent unpaved areas should not be considered when calculating passive resistance.

7.2.3 Settlement

Foundations as defined above should experience post-construction settlement of less than 1 inch. Differential settlement of approximately one-half of the total predicted settlement magnitude can be expected between adjacent footings with similar loads.

7.3 FLOOR SLABS

Satisfactory subgrade support for building floor slabs supporting loads of up to up to 150 psf can be obtained provided the subgrade is prepared in accordance with the recommendations in this report. A minimum 6-inch-thick layer of imported granular material should be placed and compacted over the prepared subgrade to assist as a capillary break. The floor slab base rock should be crushed rock or crushed gravel and sand, meeting the requirements outlined in the "Structural Fill" section of this report. The imported granular material should be placed in one lift and compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D 1557. Floor slab base rock contaminated with excessive fines (greater than 5 percent by dry weight passing the U.S. Standard No. 200 Sieve) should be replaced. Settlement of floor slabs supporting the anticipated design loads and constructed as recommended is not expected to exceed approximately ½ inch.

Flooring manufacturers often require vapor barriers to protect flooring and flooring adhesives. Many flooring manufacturers will warrant their product only if a vapor barrier is installed according to their recommendations. Selection and design of an appropriate vapor barrier, if needed, should be based on discussions among members of the design team. We can provide additional information to assist you with your decision.

8.0 SEISMIC CONSIDERATIONS

8.1 SEISMIC HAZARDS

8.1.1 Liquefaction

Liquefaction is caused by a rapid increase in pore water pressure that reduces the effective stress between soil particles to near zero. Granular soil, which relies on interparticle friction for strength, is susceptible to liquefaction until the excess pore pressures can dissipate. In general, loose, saturated sand soil with low silt and clay content is the most susceptible to liquefaction. Silty soil with low plasticity is moderately susceptible to liquefaction under relatively higher levels of ground shaking.

Based on subsurface conditions, laboratory testing, and analysis, it is our opinion that there may be thin pockets of soil at the site that may be liquefiable during a seismic event. However, we did not observe a continuous zone of liquefiable soil in the borings, and we anticipate that liquefaction will be negligible under design levels of ground shaking.

8.1.2 Lateral Spread

Lateral spread is a liquefaction-related seismic hazard and occurs on gently sloping or flat sites underlain by liquefiable sediment adjacent to an open face (such as riverbanks). Liquefied soil adjacent to open faces will tend to flow, resulting in surface cracking and lateral displacement towards the open face. The magnitude of lateral spread decreases with distance from the open

face. Based on the soil encountered at the site and distance from an open face, lateral spreading is not considered a site hazard under design levels of ground shaking.

8.1.3 Fault Rupture

Active faults are not mapped beneath the site. Consequently, it is our opinion that the probability of surface fault rupture beneath the site is low over the life of the structures.

8.2 IBC DESIGN PARAMETERS

Based on our investigation, the following design parameters can be applied if the buildings are designed using the applicable provisions of the 2012 IBC. The parameters in Table 7 should be used to compute seismic base shear forces.

Table 7. IBC Seismic Design Parameters

	0.2 Second	1 Second
MCE Spectral Acceleration	S_s = 1.25 g	S_1 = 0.48 g
Site Class	D	
Site Coefficient	F_a = 1.00	F_v = 1.52
Adjusted Spectral Acceleration	S_{MS} = 1.25 g	S_{M1} = 0.73 g
Design Spectral Response Acceleration Parameters	0.84 g	0.49 g

9.0 RETAINING STRUCTURES

Our retaining wall design recommendations are based on the following assumptions: (1) the walls are a conventional, cantilevered retaining wall or embedded building wall, (2) the walls are less than 10 feet in height, and (3) the backfill is level, drained, and consists of imported granular material. Re-evaluation of our recommendations will be required if the retaining wall design criteria for the project vary from these assumptions.

For walls not restrained from rotation, an equivalent fluid pressure of 35 pcf should be used for design. An equivalent fluid pressure of 55 pcf should be used for design of walls restrained from rotation. For the embedded building walls, a superimposed seismic lateral force should be calculated based on a dynamic force of $6H^2$ pounds per lineal foot of wall (where H is the height of the wall in feet). The force should be applied as a distributed pressure with the resultant located at a distance of 0.6H from the base of the wall. Footings for the retaining walls should be designed as recommended for shallow foundations, including bearing pressure and resistance to lateral loads.

Drains that consist of a perforated drainpipe wrapped in a non-woven geotextile filter should be installed behind retaining walls. The pipe should be embedded in a zone of free-draining material containing no more than 2 percent by dry weight passing the U.S. Standard No. 200 Sieve (washed analysis) and should be sloped to drain toward a suitable outfall. The drain rock should be separated from the backfill with a geotextile that has suitable drainage properties.

Backfill material for retaining walls should consist of medium sand, sand and gravel, or well-graded sand or gravel, with not more than 8 percent by dry weight passing the U.S. Standard No. 200 Sieve. A suitable geotextile filter fabric should be placed between the granular material and the native soil to prevent movement of fines into the clean, granular material.

Backfill should be placed and compacted as recommended for structural fill, with the exception of backfill placed immediately adjacent to walls. Backfill adjacent to walls should be compacted to a lesser standard to reduce the potential for generating excessive earth pressures on the walls. Backfill located within a horizontal distance of 3 feet from the retaining walls should be compacted to approximately 90 percent of the maximum dry density, as determined by ASTM D 1557. Backfill placed within 3 feet of the wall should be compacted in lifts less than 6 inches thick using hand-operated tamping equipment (such as a jumping jack or vibratory plate compactor). If flatwork (slabs, sidewalk, or pavement) will be placed adjacent to the wall, we recommend that the upper 2 feet of fill be compacted to 95 percent of the maximum dry density, as determined by ASTM D 1557. Settlement of up to 1 percent of the wall height commonly occurs immediately adjacent to the wall as the wall rotates and develops active lateral earth pressures. Consequently, we recommend that construction of flatwork adjacent to retaining walls be postponed at least four weeks after wall construction, unless survey data indicates that settlement is complete prior to that time.

10.0 PAVEMENT DESIGN RECOMMENDATIONS

10.1 GENERAL

We understand that most of the existing pavement in the upper mall will be demolished. Some of the pavement in the lower mall will be demolished. As previously discussed, we observed areas of minor to moderate raveling, moderate rutting, and fatigue cracking at the time of our explorations. We have provided recommended pavement section thicknesses for new pavement.

10.2 NEW PAVEMENT

New pavements should be installed on competent subgrade or new engineered fills prepared in conformance with the “Site Preparation” and “Structural Fill” sections of this report. Given the building facility proposed, our pavement recommendations are based on the assumption that the standard-duty traffic section will be subject to passenger cars and occasional maintenance and delivery truck trucks. We do not have specific information on the frequency and type of vehicles that will use the area; however, we have assumed that standard traffic conditions will consist of a maximum of 2 trucks per day and a maximum of 200 cars per day. We recommend that the heavy-duty pavement section be constructed in areas that will be subject to higher traffic volumes (such as entrances and areas subject to repeated delivery vehicles). The heavy-duty section assumes that traffic will consist of up to 10 trucks per day.

Our pavement design recommendations were based on the following additional assumptions:

- Subgrade is undisturbed with a resilient modulus of 4,000 psi.
- A resilient modulus of 20,000 psi was estimated for base rock.
- Initial and terminal serviceability indices of 4.2 and 2.5, respectively.
- Reliability and standard deviations of 75 percent and 0.45, respectively.

- Structural coefficients of 0.42 and 0.10 for the asphalt and base rock, respectively.
- A traffic growth rate of 0 percent over a 10- and 20-year design life.

If any of these assumptions vary from project design values, our office should be contacted with the appropriate information so that the pavement designs can be revised. If actual traffic counts indicate that truck traffic exceeds our assumption, the recommended pavement sections may need to be increased. We calculated pavement sections using the above-referenced traffic conditions and AASHTO design methods.

We estimated traffic loads, as expressed in ESAL values, for each area as listed in Table 8.

Table 8. Estimated Traffic Loading

Traffic	10-Year ESAL	20-Year ESAL
Standard Duty	10,000	15,000
Heavy Duty (driveways)	28,000	56,000

Based on our assumptions, we calculated minimum pavement sections. Table 9 summarizes the recommended pavement sections.

Table 9. Minimum Pavement Section Thickness

Design Life (years)	Standard-Duty Section		Heavy-Duty Section	
	AC Thickness (inches)	Aggregate Base Thickness (inches)	AC Thickness (inches)	Aggregate Base Thickness (inches)
10	3.0	6.0	3.0	8.0
20	3.0	10.0	3.5	11.0

All thicknesses are intended to be the minimum acceptable. If the subgrade is stabilized with portland cement, the crushed base rock thickness can be reduced to 6 inches or to 4 inches in areas of car traffic only. The design of the recommended pavement section is based on the assumption that construction will be completed during an extended period of dry weather. Wet weather construction could require an increased thickness of aggregate base.

The AC should be Level 2, ½-inch, dense HMA according to WSS 5-04 (Hot Mix Asphalt) and compacted to 91 percent of the maximum specific gravity of the mix, as determined by AASHTO T-209. Minimum lift thickness for ½-inch HMA is 2.0 inches. Asphalt binder should be performance graded and conform to PG 64-22. The aggregate base should meet the specifications for aggregate base rock provided in the "Structural Fill" section of this report.

Construction traffic should be limited to non-building, unpaved portions of the site or haul roads. Construction traffic should not be allowed on new pavements. If construction traffic is to be allowed on newly constructed road sections, we recommend increasing the asphalt thickness by an additional ½ inch in construction traffic locations provided construction traffic does not

exceed two trucks per day. In addition, our AC pavement design does not take staged construction into account. If staged construction (placing AC layers during and then after construction at a later date) is selected, we recommend that the project team discuss paving requirements and thicknesses with GeoDesign prior to construction.

10.3 PAVEMENT REHABILITATION

Minor to moderate raveling and fatigue cracking was observed in isolated locations within the pavement areas of the upper and lower malls. Based on current records, the pavement is likely approximately 30 years old if it was built at the same time as the mall buildings. In the majority of the current and previous explorations, AC was not underlain by an aggregate base layer, but appeared to be placed directly on sand or gravel fill. We anticipate that pavement could be rehabilitated by placing a 2-inch overlay over existing pavement. Areas of distress should be identified in the field prior to paving and repaired using the minimum thicknesses presented in Table 9. More refined rehabilitation recommendations can be obtained by performing a more comprehensive pavement survey that includes falling weight deflectometer testing and pavement cores in the parking lot.

11.0 OBSERVATION OF CONSTRUCTION

Satisfactory earthwork and foundation performance depends to a large degree on the quality of construction. Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions often requires experience; therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those anticipated. In addition, sufficient observation of the contractor's activities is a key part of determining that the work is completed in accordance with the construction drawings and specifications.

12.0 LIMITATIONS

We have prepared this report for use by CenterCal Properties, LLC and other members of the design and construction team for the proposed development. The data and report can be used for design purposes, but our report, conclusions, and interpretations should not be construed as a warranty of the subsurface conditions and are not applicable to other sites.

Soil explorations indicate soil conditions only at specific locations and only to the depths penetrated. They do not necessarily reflect soil strata or water level variations that may exist between exploration locations. If subsurface conditions differing from those described are noted during the course of excavation and construction, re-evaluation will be necessary. Specifications include the data in this report for the convenience of the construction contractor and should not be considered as a warranty of the subsurface conditions.

The site development plans and design details were not finalized at the time this report was prepared. When the design has been finalized and if there are changes in the site grades or location, configuration, design loads, or type of construction for the buildings, the conclusions

and recommendations presented may not be applicable. If design changes are made, we should be retained to review our conclusions and recommendations and to provide a written evaluation or modification.

The scope of our services does not include services related to construction safety precautions, and 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.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

♦ ♦ ♦

We appreciate the opportunity to be of continued service to you. Please call if you have questions concerning this report or if we can provide additional services.

Sincerely,

GeoDesign, Inc.

Viola C. Lai, P.E.
Project Engineer

Brett A. Shipton, P.E.
Principal Engineer

REFERENCES

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PSI, 2004, *Geotechnical Engineering Study; Proposed Renovations to Totem Lake Malls; Totem Lake Boulevard and 120th Avenue Northeast; Kirkland, Washington,* submitted to Developers Diversified Realty, dated June 2, 2004.

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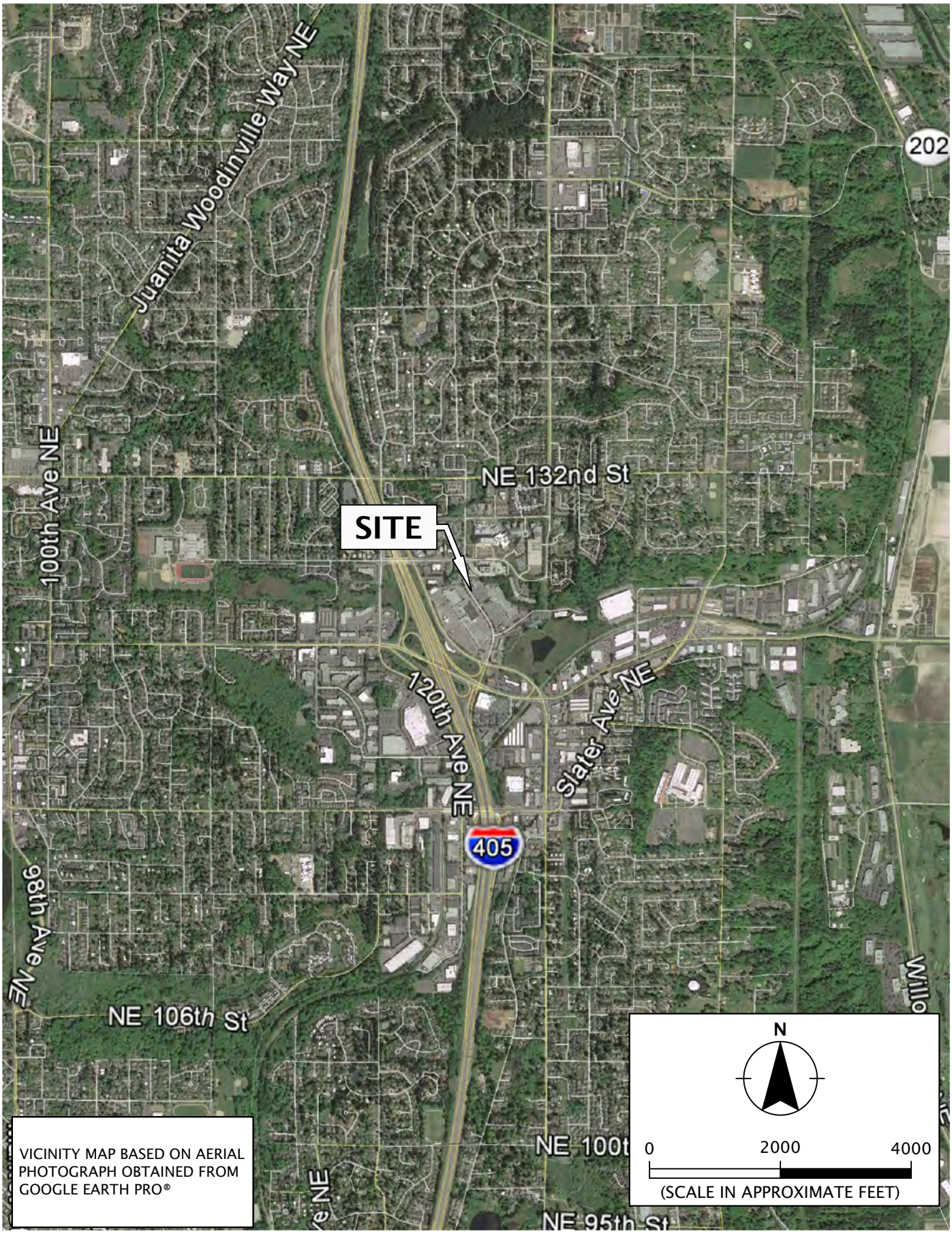
Wilmott, M. J. and T.R. Jack, 2000. Corrosion by Soils in Uhlig's Corrosion Handbook, 2nd Edition, p. 329-348.

FIGURES



VICINITY MAP BASED ON AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH PRO®

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CENTERCAL-23-01	VICINITY MAP	
JANUARY 2015	TOTEM LAKE MALL KIRKLAND, WA	FIGURE 1

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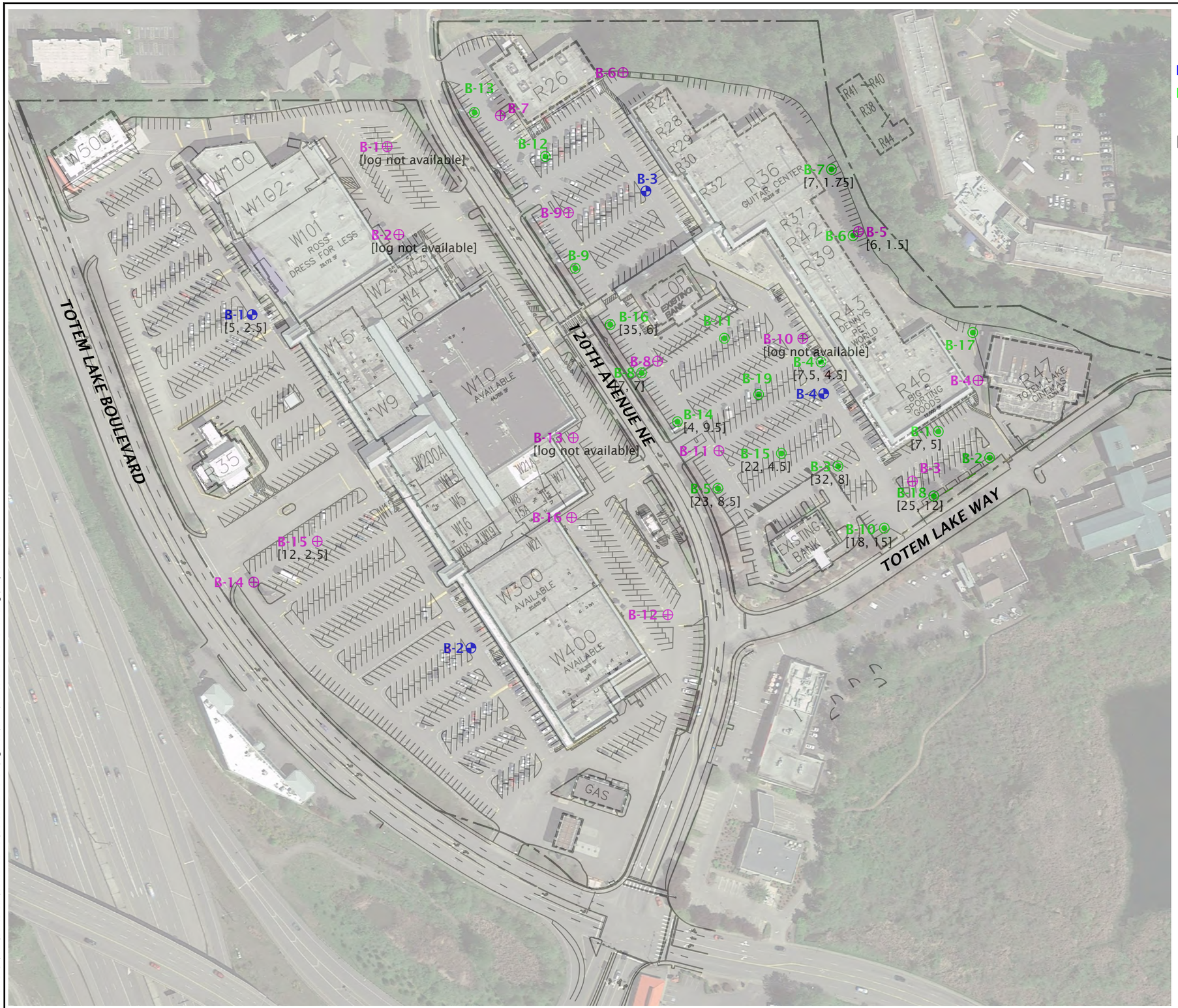

LEGEND:

B-1	BORING (GEODESIGN, 2014)
B-1	BORING (LANDAU ASSOCIATES, 2008)
B-1	BORING (PSI, 2004)
[5, 2.5]	PEAT AND WOOD ENCOUNTERED [DEPTH ENCOUNTERED, THICKNESS (FEET)]

N

0 150 300

(SCALE IN FEET)

SITE PLAN BASED ON DRAWING PROVIDED BY CENTERCAL AND IMAGE OBTAINED FROM GOOGLE EARTH PRO®, DECEMBER 26, 2014

FIGURE 2

SITE PLAN

TOTEM LAKE MALL
KIRKLAND, WA

CENTERCAL-23-01

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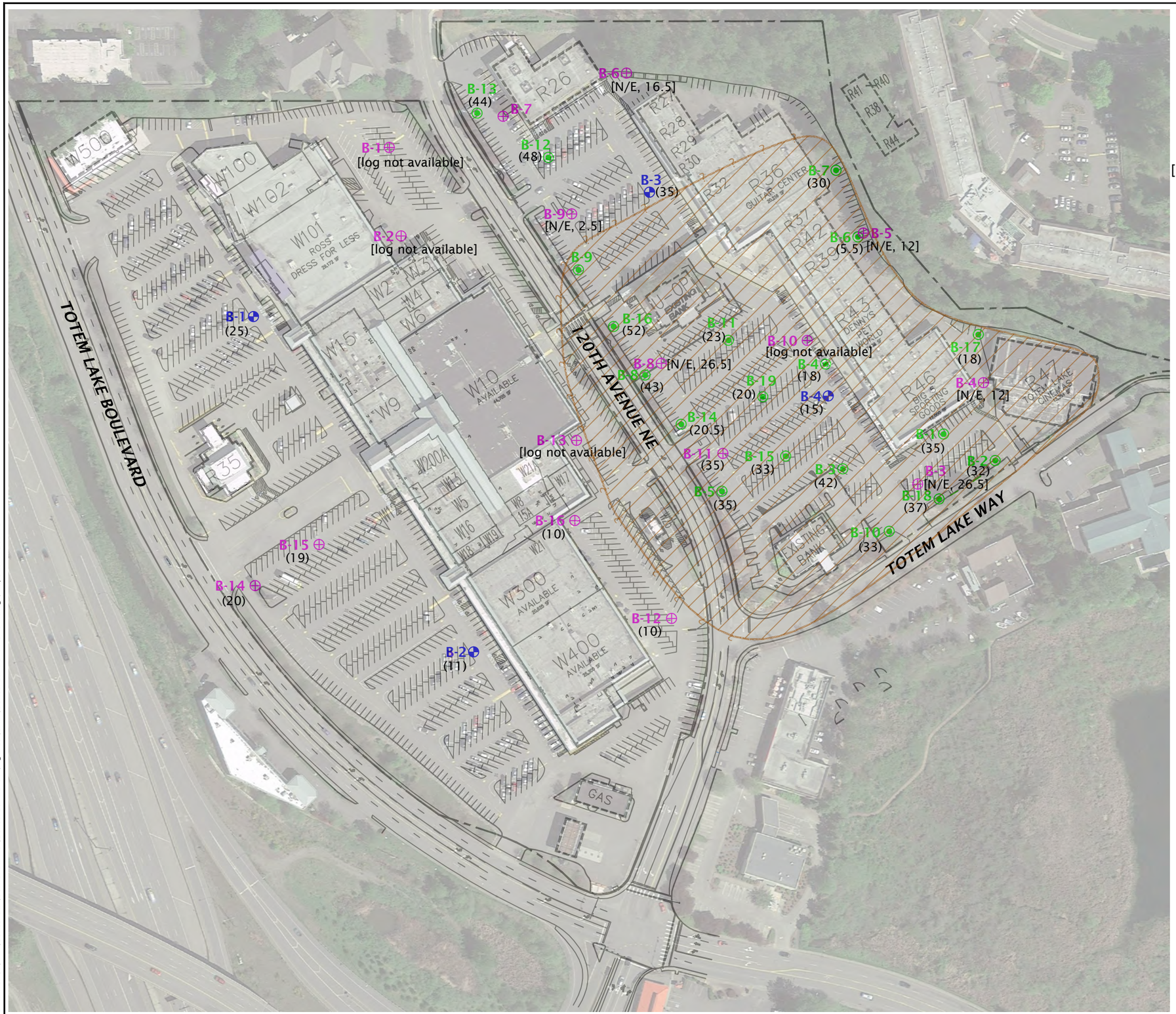
File Name: J:\A-D\CenterCal\CenterCal-23\CenterCal-23-01\Figures\CAD\CenterCal-23-01-SP01.dwg | Layout: FIGURE 2



LEGEND:

B-1	BORING (GEODESIGN, 2014)
B-1	BORING (LANDAU ASSOCIATES, 2008)
B-1	BORING (PSI, 2004)
(25)	DEPTH TO COMPETENT SOIL (FEET)
[N/E, 26.5]	BORING WAS NOT DRILLED TO COMPETENT SOIL LAYER, MAXIMUM DEPTH DRILLED (FEET)
	ZONE OF POTENTIAL PEAT IN SUBSURFACE, DEEP FOUNDATIONS RECOMMENDED

N

0 150 300

(SCALE IN FEET)

SITE PLAN BASED ON DRAWING PROVIDED BY CENTERCAL AND IMAGE OBTAINED FROM GOOGLE EARTH PRO®, DECEMBER 26, 2014

FIGURE 3

SITE PLAN - DEPTH TO COMPETENT SOIL

TOTEM LAKE MALL
KIRKLAND, WA

CENTERCAL-23-01

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APPENDIX A

APPENDIX A

FIELD EXPLORATIONS

GENERAL

We explored subsurface conditions at the site by completing four borings (B-1 through B-4) to depths ranging between 25.9 and 45.3 feet BGS. Holocene Drilling of Puyallup, Washington, provided drilling services using a truck-mounted drill rig utilizing hollow-stem auger drilling techniques between December 11 and 12, 2014.

We selected boring locations based on a site plan provided to our office by CenterCal Properties, LLC. We determined the location of the explorations in the field by measuring off of determined locations. The locations of the explorations shown on Figure 2 should be considered approximate. A qualified member of GeoDesign's staff observed and documented field activities.

SOIL SAMPLING

A member of our geotechnical staff observed the explorations. We obtained representative samples of the various soil encountered in the explorations for geotechnical laboratory testing. Samples were obtained from the borings using 1½-inch-inside diameter, split-spoon sampler (SPT sampler) in general accordance with ASTM D 1586. The split-barrel sampler was driven 18 inches into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the exploration logs, unless otherwise noted. Samples were also obtained using a 3-inch-diameter California sampler to obtain more representative samples of the gravel. In addition, relatively undisturbed samples were obtained by pushing thin-walled standard Shelby tubes into the base of the boring in general accordance with ASTM D 1587.

SOIL CLASSIFICATION

The soil samples were classified in general accordance with ASTM D 2487 as shown on the "Exploration Key" (Table A-1) and "Soil Classification System" (Table A-2), which are included in this appendix. The exploration logs indicate the depths at which the soils or their characteristics change, although the change actually could be gradual. If the change occurred between sample locations, the depth was interpreted. Classifications and sampling intervals are presented on the exploration logs included in this appendix.

LABORATORY TESTING

CLASSIFICATION

The soil samples were classified in the laboratory to confirm field classifications. The laboratory classifications are presented on the exploration logs if those classifications differed from the field classifications.

MOISTURE CONTENT

We tested the natural moisture content of selected soil samples in general accordance with ASTM D 2216. The natural moisture content is a ratio of the weight of the water to soil in a test sample and is expressed as a percentage. The test results are presented in this appendix.

ATTERBERG LIMITS TESTING

Atterberg limits tests were performed on one selected sample in general accordance with ASTM D 4318. A test was attempted on a second selected sample; however, this sample was observed to be non-plastic in the laboratory and was not tested. Atterberg limits include the liquid limit, plastic limit, and the plasticity index of soil. These index properties are used to classify soil and for correlation with other engineering properties of soil. The test results are presented in this appendix

GRAIN-SIZE TESTING

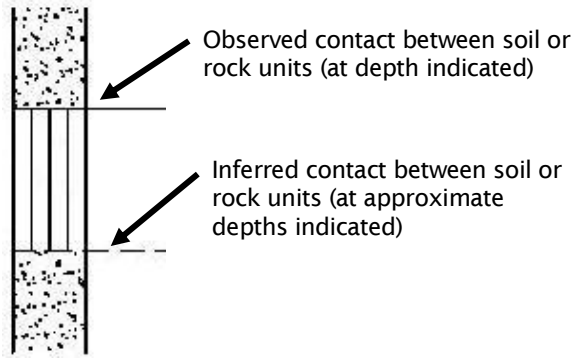
Grain-size testing was performed on selected soil samples to determine the distribution of soil particle sizes. The testing consisted of particle-size analysis completed in accordance with percent fines determination (percent passing the U.S. Standard No. 200 Sieve) completed in general accordance with the ASTM C 117 and ASTM D 1140 (P200). The test results are presented in this appendix

ORGANIC CONTENT

We determined the organic content of a selected soil sample in general accordance with ASTM D 2974. The organic content is a ratio of the weight of the volatile materials (organics) to the dry weight of the sample and is expressed as percentage. The test results are presented in this appendix

SYMBOL	SAMPLING DESCRIPTION
	Location of sample obtained in general accordance with ASTM D 1586 Standard Penetration Test with recovery
	Location of sample obtained using thin-wall Shelby tube or Geoprobe® sampler in general accordance with ASTM D 1587 with recovery
	Location of sample obtained using Dames & Moore sampler and 300-pound hammer or pushed with recovery
	Location of sample obtained using Dames & Moore and 140-pound hammer or pushed with recovery
	Location of sample obtained using 3-inch-O.D. California split-spoon sampler and 140-pound hammer
	Location of grab sample
	Rock coring interval
	Water level during drilling
	Water level taken on date shown

Graphic Log of Soil and Rock Types



GEOTECHNICAL TESTING EXPLANATIONS

ATT	Atterberg Limits	PP	Pocket Penetrometer
CBR	California Bearing Ratio	P200	Percent Passing U.S. Standard No. 200 Sieve
CON	Consolidation		
DD	Dry Density	RES	Resilient Modulus
DS	Direct Shear	SIEV	Sieve Gradation
HYD	Hydrometer Gradation	TOR	Torvane
MC	Moisture Content	UC	Unconfined Compressive Strength
MD	Moisture-Density Relationship	VS	Vane Shear
OC	Organic Content	kPa	Kilopascal
P	Pushed Sample		

ENVIRONMENTAL TESTING EXPLANATIONS

CA	Sample Submitted for Chemical Analysis	ND	Not Detected
P	Pushed Sample	NS	No Visible Sheen
PID	Photoionization Detector Headspace Analysis	SS	Slight Sheen
		MS	Moderate Sheen
ppm	Parts per Million	HS	Heavy Sheen

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EXPLORATION KEY

TABLE A-1

RELATIVE DENSITY - COARSE-GRAINED SOILS

Relative Density	Standard Penetration Resistance	Dames & Moore Sampler (140-pound hammer)	Dames & Moore Sampler (300-pound hammer)
Very Loose	0 – 4	0 - 11	0 - 4
Loose	4 – 10	11 - 26	4 - 10
Medium Dense	10 – 30	26 - 74	10 - 30
Dense	30 – 50	74 - 120	30 - 47
Very Dense	More than 50	More than 120	More than 47

CONSISTENCY - FINE-GRAINED SOILS

Consistency	Standard Penetration Resistance	Dames & Moore Sampler (140-pound hammer)	Dames & Moore Sampler (300-pound hammer)	Unconfined Compressive Strength (tsf)
Very Soft	Less than 2	Less than 3	Less than 2	Less than 0.25
Soft	2 - 4	3 – 6	2 - 5	0.25 - 0.50
Medium Stiff	4 - 8	6 – 12	5 - 9	0.50 - 1.0
Stiff	8 - 15	12 – 25	9 - 19	1.0 - 2.0
Very Stiff	15 - 30	25 – 65	19 – 31	2.0 - 4.0
Hard	More than 30	More than 65	More than 31	More than 4.0

PRIMARY SOIL 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)	CLEAN GRAVELS (< 5% fines)	GW or GP	GRAVEL
		GRAVEL WITH FINES (≥ 5% and ≤ 12% fines)	GW-GM or GP-GM	GRAVEL with silt
			GW-GC or GP-GC	GRAVEL with clay
		GRAVELS WITH FINES (> 12% fines)	GM	silty GRAVEL
			GC	clayey GRAVEL
			GC-GM	silty, clayey GRAVEL
	SAND (50% or more of coarse fraction passing No. 4 sieve)	CLEAN SANDS (<5% fines)	SW or SP	SAND
		SANDS WITH FINES (≥ 5% and ≤ 12% fines)	SW-SM or SP-SM	SAND with silt
			SW-SC or SP-SC	SAND with clay
		SANDS WITH FINES (> 12% fines)	SM	silty SAND
			SC	clayey SAND
			SC-SM	silty, clayey SAND
FINE-GRAINED SOILS (50% or more passing No. 200 sieve)	SILT AND CLAY	Liquid limit less than 50	ML	SILT
			CL	CLAY
			CL-ML	silty CLAY
			OL	ORGANIC SILT or ORGANIC CLAY
		Liquid limit 50 or greater	MH	SILT
			CH	CLAY
			OH	ORGANIC SILT or ORGANIC CLAY
HIGHLY ORGANIC SOILS			PT	PEAT

MOISTURE CLASSIFICATION

Term	Field Test
dry	very low moisture, dry to touch
moist	damp, without visible moisture
wet	visible free water, usually saturated

ADDITIONAL CONSTITUENTS

Secondary granular components or other materials such as organics, man-made debris, etc.

Percent	Silt and Clay In: Fine-Grained Soils	Silt and Clay In: Coarse-Grained Soils	Percent	Sand and Gravel In: Fine-Grained Soils	Sand and Gravel In: Coarse-Grained Soils
< 5	trace	trace	< 5	trace	trace
5 – 12	minor	with	5 – 15	minor	minor
> 12	some	silty/clayey	15 – 30	with	with
			> 30	sandy/gravelly	Indicate %

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SOIL CLASSIFICATION SYSTEM

TABLE A-2

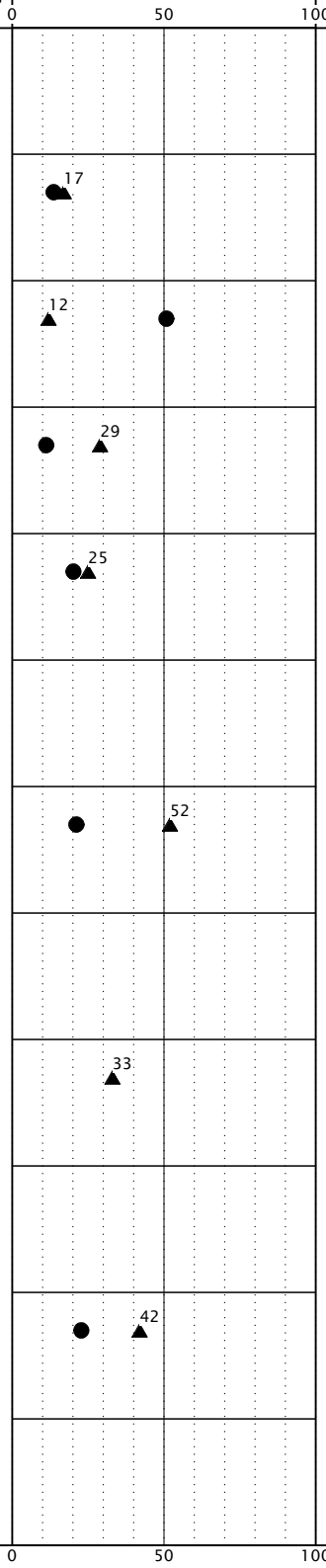
DRAFT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	INSTALLATION AND COMMENTS
0.0	ASPHALT CONCRETE (5.0 inches).			
	Gray GRAVEL with silt (GP-GM); round rock base course.	0.4		
	Stiff, light brown SILT with sand (ML); moist, sand is coarse.	1.4		
2.5				
5.0	Stiff, dark brown with gray and red mottled, sandy SILT with organics (MH); moist.	5.0	ATT OC	OC = 12% LL = 62% PL = 44%
7.5	Very stiff, gray SILT with gravel (ML); moist, ~30% coarse gravel.	7.5		
10.0	without gravel at 10.0 feet			
12.5				
15.0	hard at 15.0 feet			
17.5				
20.0	sandy, trace gravel at 20.0 feet			
22.5				
25.0	Dense, gray SAND with silt (SP-SM); moist, fine.	25.0	P200	P200 = 5%
27.5				Driller Comment: gravel at 28.0 feet.
30.0				

GRAPHIC LOG

SAMPLE

▲ BLOW COUNT
● MOISTURE CONTENT %
RQD% CORE REC%



DRILLED BY: Holocene Drilling, Inc.

LOGGED BY: AJF

COMPLETED: 12/11/14

BORING METHOD: hollow-stem auger (see document text)

BORING BIT DIAMETER: 4 1/4-inch

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BORING B-1

TOTEM LAKE MALL
KIRKLAND, WA

FIGURE A-1

DRAFT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	▲ BLOW COUNT ● MOISTURE CONTENT % ▥ RQD% ▨ CORE REC% (0 – 50 – 100)	INSTALLATION AND COMMENTS
30.0		Very dense, gray, silty SAND with gravel (SM); moist.	30.0			6-29-50/5" ▲	Sand heave, collapse, flush and continue at 30.0 feet.
32.5							
35.0		Very dense, gray SAND with silt and gravel (SP-SM); moist, ~30 to 35% gravel.	35.0			40-50/3" ▲	Surface elevation was not measured at the time of exploration.
		Exploration terminated at a depth of 35.8 feet due to refusal.	35.8				
37.5							
40.0							
42.5							
45.0							
47.5							
50.0							
52.5							
55.0							
57.5							
60.0							

DRILLED BY: Holocene Drilling, Inc. LOGGED BY: AJF COMPLETED: 12/11/14

BORING METHOD: hollow-stem auger (see document text) BORING BIT DIAMETER: 4 1/4-inch

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CENTERCAL-23-01

JANUARY 2015

BORING B-1
(continued)

TOTEM LAKE MALL
KIRKLAND, WA

FIGURE A-1

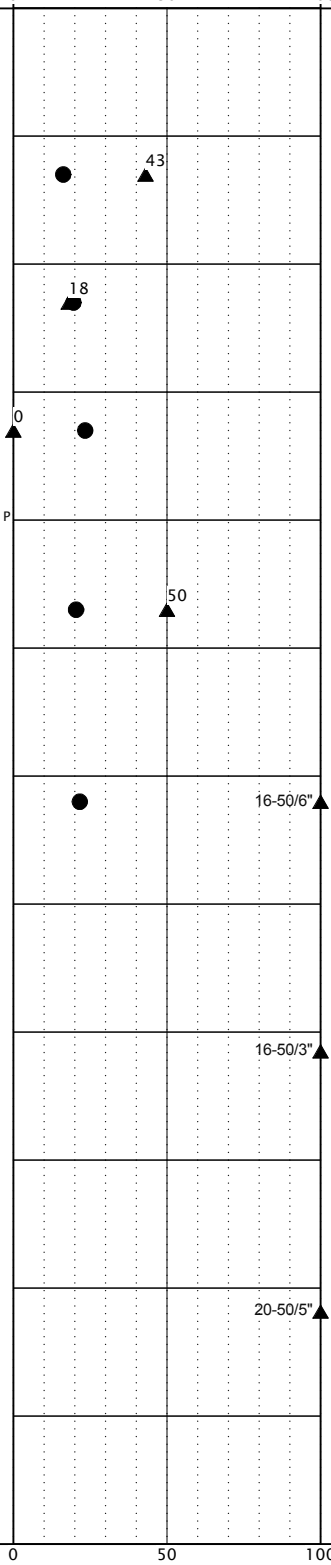
DRAFT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	INSTALLATION AND COMMENTS
0.0	ASPHALT CONCRETE (5.0 inches).	0.4		
	Hard, light brown to gray, gravelly, sandy SILT (ML); moist, ~30% gravel.			
2.5				
5.0	very stiff, light brown with red and gray mottles, trace gravel at 5.0 feet		P200	P200 = 57%
7.5	very soft, gray at 7.5 feet		ATT	LL = NP PL = NP Driller Comment: increasing resistance in pushing Shelby, could not push last 2 inches; rig lifted.
10.0	Dense, gray SAND (SP), trace silt; moist.	11.0		
12.5				
15.0	very dense, trace gravel, without silt at 15.0 feet			
17.5				Driller Comment: gravel at 17.0 feet.
20.0	with gravel, trace silt at 20.0 feet			Gravel and silt at bottom 2 inches - refusal layer.
22.5				
25.0	Very dense, gray GRAVEL with silt and sand (GP-GM); moist.	25.0		
	Exploration terminated at a depth of 25.9 feet due to refusal.	25.9		Surface elevation was not measured at the time of exploration.
27.5				
30.0				

GRAPHIC LOG

SAMPLE

▲ BLOW COUNT
● MOISTURE CONTENT %
RQD% CORE REC%



DRILLED BY: Holocene Drilling, Inc.

LOGGED BY: AJF

COMPLETED: 12/11/14

BORING METHOD: hollow-stem auger (see document text)

BORING BIT DIAMETER: 4 1/4-inch

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BORING B-2

TOTEM LAKE MALL
KIRKLAND, WA

FIGURE A-2

DRAFT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	INSTALLATION AND COMMENTS
0.0	ASPHALT CONCRETE (5.0 inches).			
	Medium dense, brown GRAVEL with sand (GP); moist, rounded - **FILL**.	0.4		No base rock observed.
2.5				
5.0	Hard, red-brown with gray mottled SILT (ML); moist.	5.0		
7.5	stiff at 7.5 feet			Only 1 inch advancement with Shelby before refusal.
10.0				No recovery.
12.5				Hard drilling, auger chatter at 13.0 feet. Drilling eases at 14.0 feet.
15.0	Dense, light brown GRAVEL with silt and sand (GP-GM); moist, coarse, ~30% sand, silty sand matrix.	15.0		Water in spoon.
17.5				
20.0	Dense, light brown, silty SAND (SM); moist, medium.	20.0		
22.5				
25.0	medium dense at 25.0 feet		P200	P200 = 16%
27.5				
30.0				

SAMPLE: P

BLOW COUNT: 22, 37, 14, 47, 43, 28-50/5", 17

MOISTURE CONTENT %

RQD% / CORE REC%

0 50 100

15.0 feet, during drilling

DRILLED BY: Holocene Drilling, Inc. LOGGED BY: AJF COMPLETED:

BORING METHOD: hollow-stem auger (see document text) BORING BIT DIAMETER: 4 1/4-inch

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CENTERCAL-23-01

BORING B-3

JANUARY 2015

TOTEM LAKE MALL
KIRKLAND, WA

FIGURE A-3

DRAFT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	▲ BLOW COUNT ● MOISTURE CONTENT % ▥ RQD% ▨ CORE REC% (0 – 50 – 100)	INSTALLATION AND COMMENTS
30.0		with gravel; ~30 to 35% fine to coarse gravel at 30.0 feet				28	
32.5							
35.0		Dense, light gray SAND with silt (SP-SM); moist.	35.0			48	
37.5							
40.0		Very dense, light gray GRAVEL with sand (GP), trace silt; moist, fine to coarse.	40.0			50/3"	
42.5							
45.0		Exploration terminated at a depth of 45.3 feet due to refusal.	45.3			50/3"	Surface elevation was not measured at the time of exploration.
47.5							
50.0							
52.5							
55.0							
57.5							
60.0							

DRILLED BY: Holocene Drilling, Inc. LOGGED BY: AJF COMPLETED:

BORING METHOD: hollow-stem auger (see document text) BORING BIT DIAMETER: 4 1/4-inch

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CENTERCAL-23-01

JANUARY 2015

BORING B-3
(continued)

TOTEM LAKE MALL
KIRKLAND, WA

FIGURE A-3

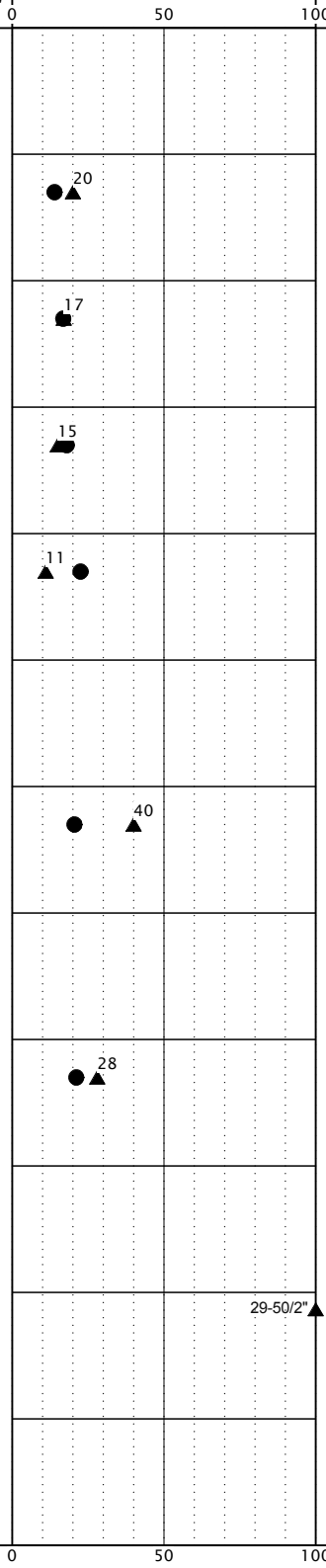
DRAFT

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION DEPTH	TESTING	INSTALLATION AND COMMENTS
0.0	ASPHALT CONCRETE (5.0 inches).			
	Medium dense, gray with red mottled, silty SAND (SM); moist.	0.4		No base rock observed.
5.0	Medium dense, green-gray, silty SAND (SM); moist, fine.	5.0		
7.5			P200	P200 = 46%
15.0	Dense, light gray SAND with silty and gravel (SP-SM); moist to wet, coarse, gravel is fine.	15.0	P200	Water in sample. P200 = 10%
20.0	medium dense at 20.0 feet			
25.0	grades to very dense, gray; ~30% gravel at 25.0 feet			
30.0				

GRAPHIC LOG

SAMPLE

▲ BLOW COUNT
● MOISTURE CONTENT %
RQD% CORE REC%



DRILLED BY: Holocene Drilling, Inc.

LOGGED BY: AJF

COMPLETED: 12/12/14

BORING METHOD: hollow-stem auger (see document text)

BORING BIT DIAMETER: 4 1/4-inch

GEODESIGN INC
15575 SW Sequoia Parkway - Suite 100
Portland OR 97224
Off 503.968.8787 Fax 503.968.3068

CENTERCAL-23-01

JANUARY 2015

BORING B-4

TOTEM LAKE MALL
KIRKLAND, WA

FIGURE A-4

DRAFT

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	▲ BLOW COUNT ● MOISTURE CONTENT % ▥ RQD% ▨ CORE REC% (0 – 50 – 100)	INSTALLATION AND COMMENTS
30.0		Very dense, gray GRAVEL with sand (GP); moist, medium, ~30% sand.	30.0			8-40-50/2"	
32.5							
35.0						26-50/4"	
37.5							
40.0						30-50/5"	
42.5							
45.0		Exploration terminated at a depth of 45.3 feet due to refusal.	45.3			50/3"	Surface elevation was not measured at the time of exploration.
47.5							
50.0							
52.5							
55.0							
57.5							
60.0							

DRILLED BY: Holocene Drilling, Inc. LOGGED BY: AJF COMPLETED: 12/12/14

BORING METHOD: hollow-stem auger (see document text) BORING BIT DIAMETER: 4 1/4-inch

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CENTERCAL-23-01

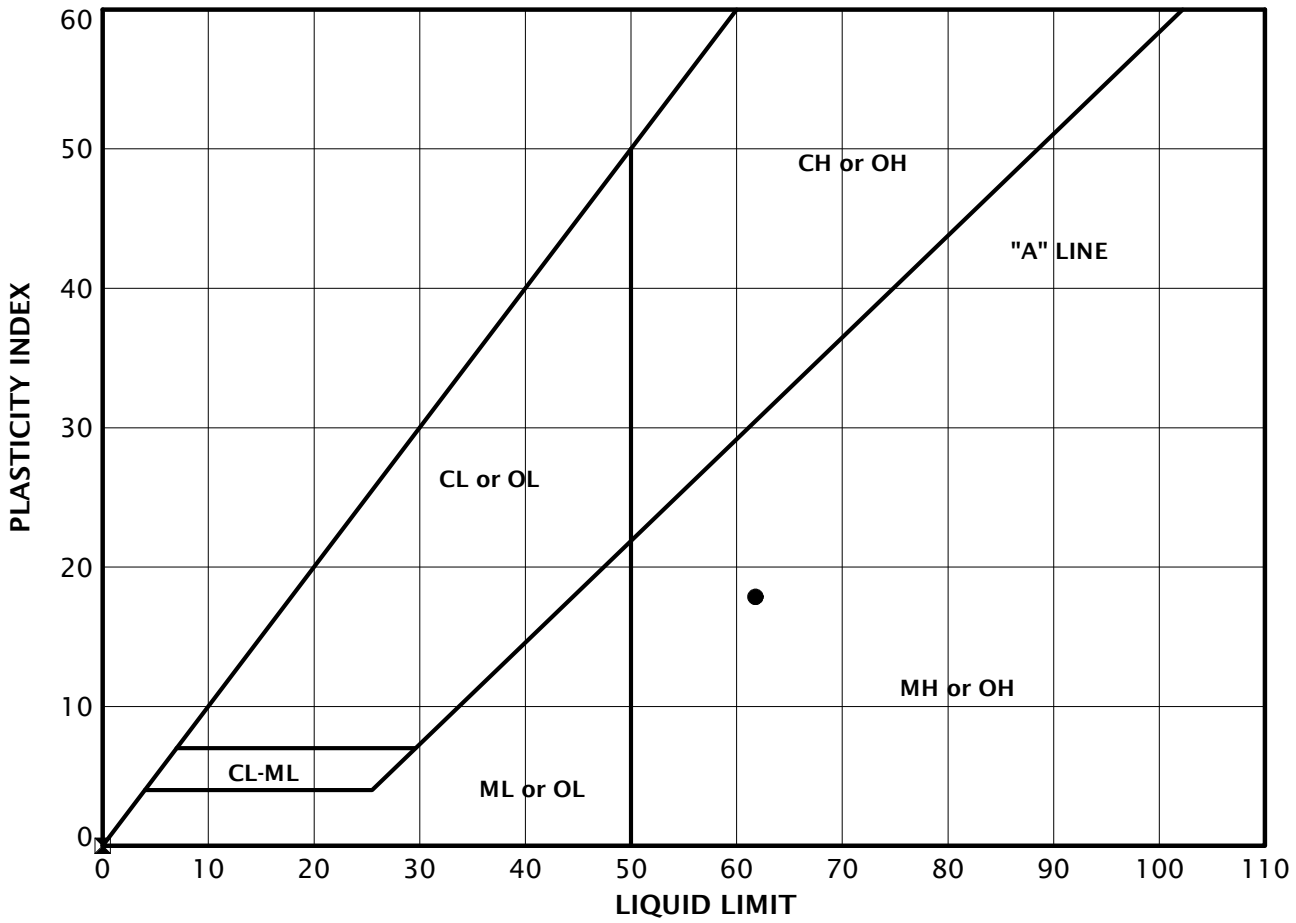
JANUARY 2015

BORING B-4
(continued)

TOTEM LAKE MALL
KIRKLAND, WA

FIGURE A-4

DRAFT



KEY	EXPLORATION NUMBER	SAMPLE DEPTH (FEET)	MOISTURE CONTENT (PERCENT)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
●	B-1	5.0	51	62	44	18
⊠	B-2	7.5	23	NP	NP	NP

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CENTERCAL-23-01

JANUARY 2015

ATTERBERG LIMITS TEST RESULTS

TOTEM LAKE MALL
KIRKLAND, WA

FIGURE A-5

ATTERBERG_LIMITS 7 CENTERCAL-23-01-B1_4.GPJ GEODESIGN.GDT PRINT DATE: 1/12/15:KT

DRAFT

SAMPLE INFORMATION			MOISTURE CONTENT (PERCENT)	DRY DENSITY (PCF)	SIEVE			ATTERBERG LIMITS		
EXPLORATION NUMBER	SAMPLE DEPTH (FEET)	ELEVATION (FEET)			GRAVEL (PERCENT)	SAND (PERCENT)	P200 (PERCENT)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
B-1	2.5		14							
B-1	5.0		51					62	44	18
B-1	7.5		11							
B-1	10.0		20							
B-1	15.0		21							
B-1	25.0		23				5			
B-2	2.5		16							
B-2	5.0		20				57			
B-2	7.5		23					NP	NP	NP
B-2	11.0		20							
B-2	15.0		22							
B-3	2.5		7							
B-3	5.0		29							
B-3	7.5		27							
B-3	20.0		22							
B-3	25.0		21				16			
B-4	2.5		14							
B-4	5.0		17							
B-4	7.5		18				46			
B-4	10.0		22							
B-4	15.0		21				10			
B-4	20.0		21							

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Off 503.968.8787 Fax 503.968.3068

CENTERCAL-23-01

JANUARY 2015

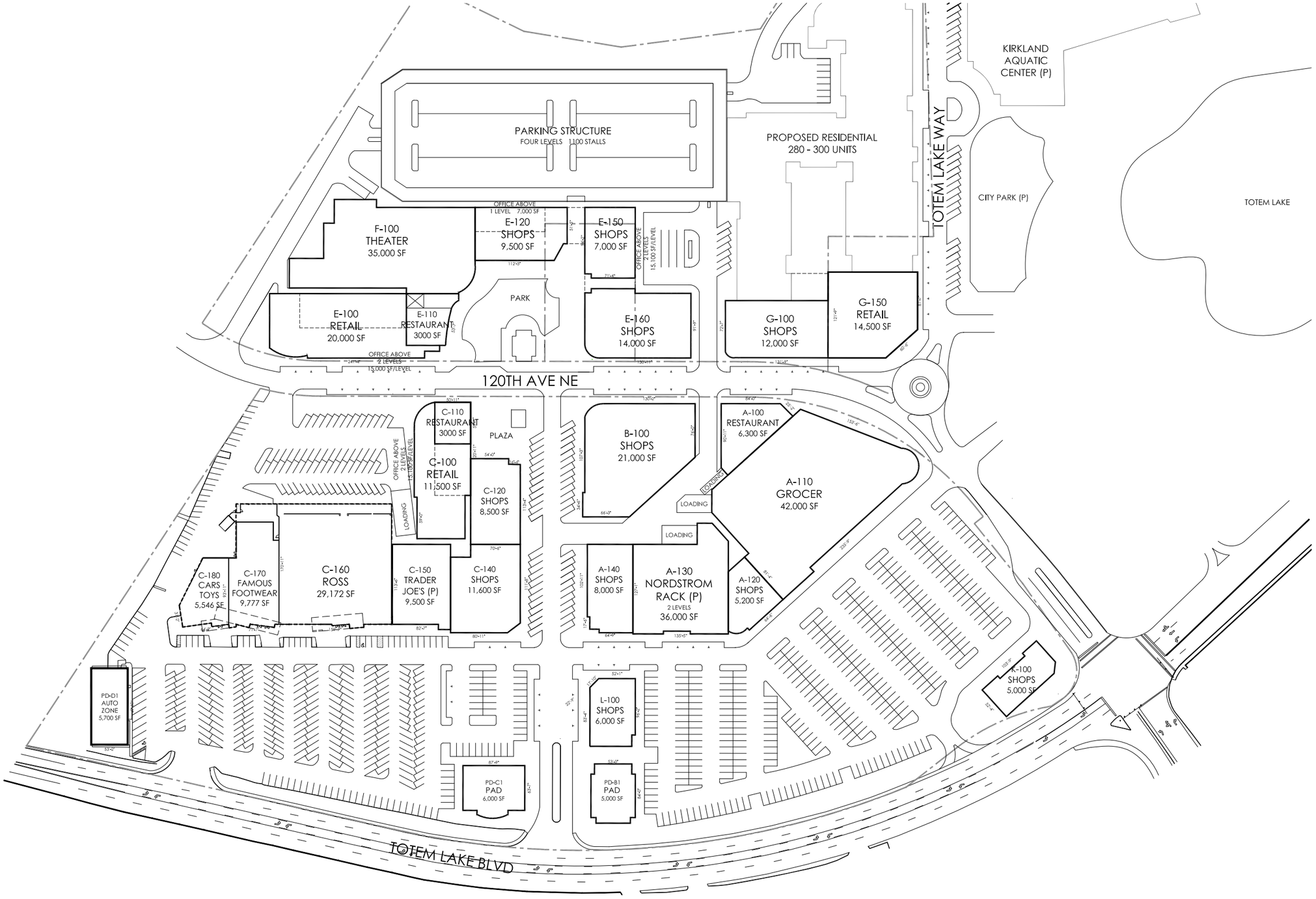
SUMMARY OF LABORATORY DATA

TOTEM LAKE MALL
KIRKLAND, WA

FIGURE A-6

APPENDIX B

TOTEM LAKE



PROJECT SUMMARY:

SITE AREA:

RETAIL	
BUILDING A:	97,500 SF
BUILDING B:	21,000 SF
BUILDING C:	88,695 SF
BUILDING E:	53,500 SF
BUILDING F:	35,000 SF
BUILDING G:	26,500 SF
BUILDING K:	5,000 SF
BUILDING L:	6,000 SF
BUILDING PD-B1:	5,000 SF
BUILDING PD-C1:	6,000 SF
BUILDING PD-D1:	5,700 SF
TOTAL:	349,795 SF
OFFICE	
BUILDING C:	30,200 SF
BUILDING E:	81,000 SF
TOTAL:	111,200 SF
TOTAL SF:	460,995 SF
TOTAL PROVIDED STALLS:	2041
PROJECT PARKING RATIO:	4.4/1000

CENTERCAL PROPERTIES, LLC

PRELIMINARY SITE PLAN

TOTEM LAKE KIRKLAND, WASHINGTON

16 December 2014

PRELIMINARY SITE PLAN

VERSION: PLP-02C

SCALE: 0 70 140' 280'

N

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APPENDIX C

APPENDIX C

PREVIOUS EXPLORATIONS BY PSI

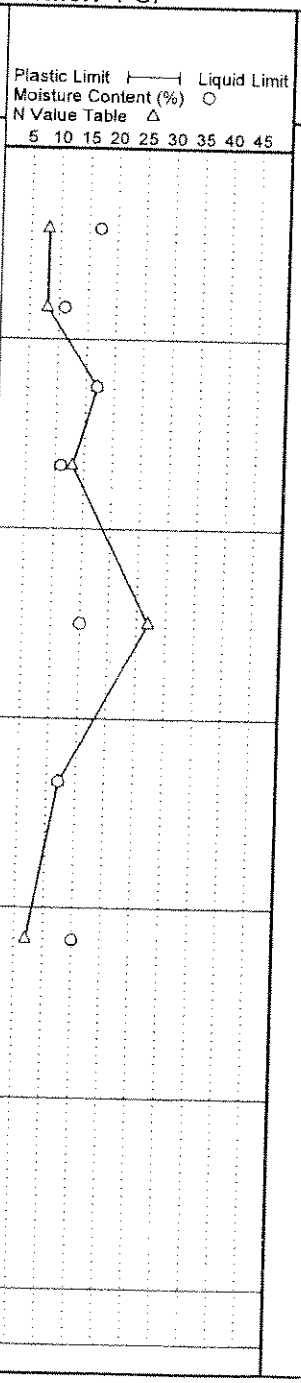
This appendix contains logs of the explorations that were completed on site in 2004 by PSI (PSI, 2004). Copies of the exploration logs for B-1, B-2, B-10, and B-13 were not available at the time of this report. The locations of these explorations are shown on Figure 2.

Boring B-3

Location: Upper mall, proposed hotel, west end
Elevation: 137 **feet** **Datum:** Assumed
Type of Boring: HSA with automatic SPT hammer
Started: 04/26/04 **Completed:** 04/26/04

Total Depth: 26.5 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
	0			Approx. 4" asphalt pavement					
			SM	Gray silty SAND with gravel (moist to wet, loose) (FILL)		3 5 3	8	17	
132	6		ML	Gray clayey SILT with scattered pockets of yellow- brown medium sand (moist, stiff)		2 4 4	8	11	
						4 8 9	17	17	
126	12		SM	Gray-brown silty fine to medium SAND with trace gravel (moist, medium dense)		3 5 8	13	11	
120	18			- interbedded with brown medium to coarse grained sand		6 11 16	27	15	
114	24		SM	Gray silty fine to coarse SAND with gravel (wet, medium dense)		1 7 5	12	12	GS: -#200 = 19%
108	30		GM	Gray silty GRAVEL with medium sand (wet, loose) (Blow counts suspect)		5 3 4	7	15	
				End of Boring.					
102	36								



Notes:
Stratigraphic contacts are based on interpretations and are approximate. Contacts may vary from those shown or may be more gradual.
Soil and groundwater conditions encountered during construction may differ from those shown on the log.

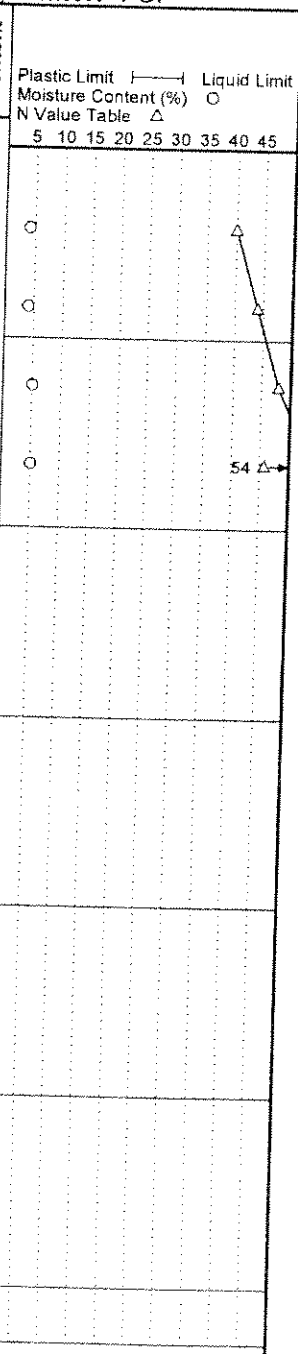
Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: S. Johnson	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-3 (1 of 1)

Boring B-4

Location: Upper mall, proposed garage, south end & hotel, east end
Elevation: 140 **feet** **Datum:** Assumed
Type of Boring: HSA with automatic SPT hammer
Started: 04/27/04 **Completed:** 04/27/04

Total Depth: 11.5 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
	0		SP	Approx. 4" asphalt pavement and 1" crushed rock base					
138				Brown fine to medium SAND with some coarse sand (damp, dense to very dense)		9 18 22	40	4	
	6					13 21 23	44	4	
132						13 23 25	48	5	
	12			End of Boring. No groundwater encountered.		8 24 30	54	5	
126									
	18								
120									
	24								
114									
	30								
108									
	36								



Notes:
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Soil and groundwater conditions encountered during construction may differ from those shown on the log.

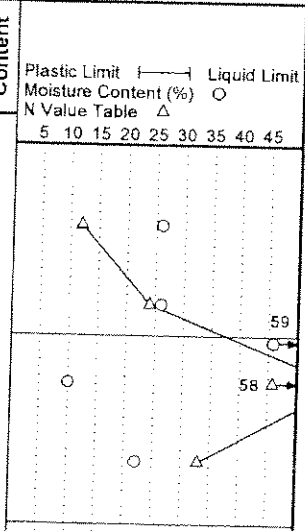
Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: T. Huntting	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-4 (1 of 1)

Boring B-5

Location: Upper mall, proposed garage, middle
Elevation: 140 **feet** **Datum:** Assumed
Type of Boring: HSA with automatic SPT hammer
Started: 04/27/04 **Completed:** 04/27/04

Total Depth: 11.5 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
	0		SM-ML	Approx. 4" asphalt pavement					
138				Gray silty very fine SAND to fine sandy SILT with trace organics (moist, medium dense)		3 6 6	12	26	
	6		OL	Dark brown organic SILT and PEAT to clayey SILT (wet, soft)		4 9 15	24	26 59	
132			SM	Gray silty fine to medium SAND (moist to wet, very dense)		13 25 33	58	10	
	12		ML	Gray fine sandy SILT with thin seam of peat (wet, hard)		8 14 19	33	22	
				End of Boring.					
126									
	18								
120									
	24								
114									
	30								
108									
	36								



Notes:
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Soil and groundwater conditions encountered during construction may differ from those shown on the log.

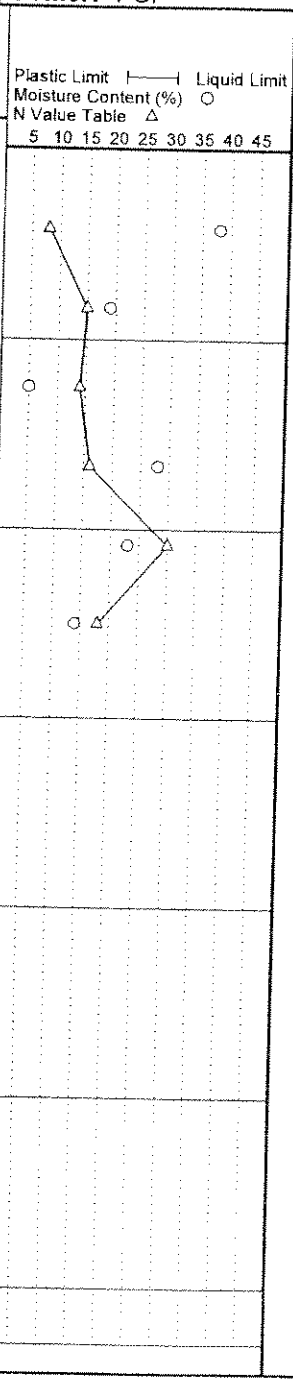
Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: T. Huntting	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-5 (1 of 1)

Boring B-6

Location: Upper mall, proposed north building, north corner
Elevation: 140 **feet** **Datum:** Assumed
Type of Boring: HSA with automatic SPT hammer
Started: 04/27/04 **Completed:** 04/27/04

Total Depth: 16.5 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
	0			Approx. 4" asphalt pavement					
138			SM	Brown to dark brown silty fine to medium SAND (moist, loose) (FILL)					
			ML	Yellow and light red-brown clayey SILT (moist, firm)	◥	2 2 6	8	38	
	6		SP-SM	Red-brown silty SAND interbedded with fine to coarse sand (moist, medium dense)	◥	4 7 8	15	19	
132			SW-SM	Gray-brown fine to coarse SAND with gravel and lenses of silty sand (moist, medium dense)	◥	2 7 7	14	5	
	12		ML	Dark red-brown, red-brown, and olive brown clayey and sandy SILT interbedded with lenses of fine sand and sandy gravel (moist, stiff)	◥	5 6 10	16	28	
126			GM	Red-brown silty GRAVEL (wet, medium dense)	◥	4 9 21	30	23	
			SM	Gray-brown silty SAND with gravel (wet, medium dense)	◥	5 7 11	18	14	
	18			End of Boring.					
120									
	24								
114									
	30								
108									
	36								



Notes:
Stratigraphic contacts are based on interpretations and are approximate. Contacts may vary from those shown or may be more gradual.
Soil and groundwater conditions encountered during construction may differ from those shown on the log.

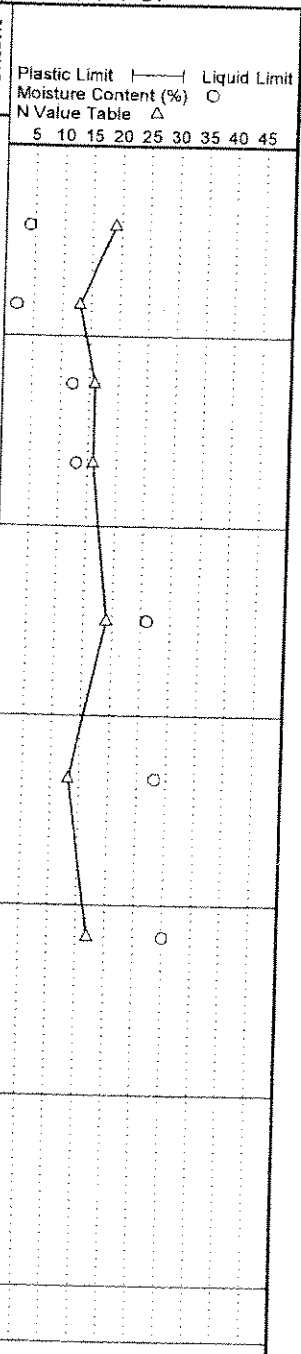
Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: T. Huntting	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-6 (1 of 1)

Boring B-7

Location: Upper mall, proposed north building, west corner
Elevation: 139 **feet** **Datum:** Assumed
Type of Boring: HSA with automatic SPT hammer
Started: 04/27/04 **Completed:** 04/27/04

Total Depth: 26.5 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
	0			Approx. 4" asphalt pavement					
138			SP-SM	Red-brown sandy GRAVEL with trace to some silt (damp to moist, medium dense) (Outwash?)		8 10 9	19	4	
	6		GW	Red-brown to gray-brown fine to coarse sandy GRAVEL with trace silt (damp, medium dense) (Outwash?)		5 6 7	13	2	
132			GM	Brown silty GRAVEL with sand (moist to wet, medium dense)		7 8 8	16	12	
	12					6 8 8	16	13	
126			SM-ML	Gray fine to medium SAND interbedded with very fine sandy silt with scattered organics (wet, medium dense)		5 9 10	19	26	
	18			- color change to gray and gray-brown, contains gravel		3 5 8	13	28	
120									
	24					2 7 10	17	30	
114				End of Boring.					
	30								
108									
	36								
102									



Notes:
Stratigraphic contacts are based on interpretations and are approximate. Contacts may vary from those shown or may be more gradual.
Soil and groundwater conditions encountered during construction may differ from those shown on the log.

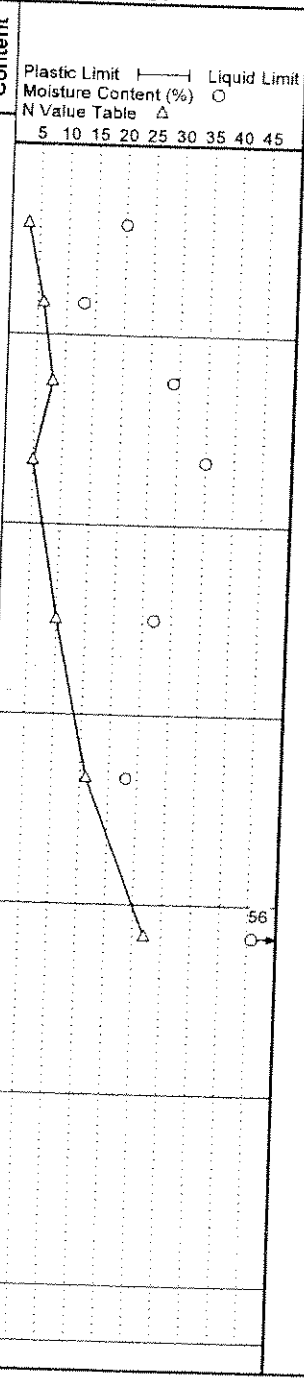
Project No.: 875-45083	**Developers Diversified Realty**	psi Information To Build On
Date: June 2004	**Totem Lake Malls Renovation**	Engineering • Consulting • Testing
Logged By: T. Huntting	**12500 Totem Lake Boulevard**	
Checked By: T. Hull	**Kirkland, Washington**	**Figure A-7** (1 of 1)

Boring B-8

Location: Upper mall, proposed south building, west corner
Elevation: 134 **feet** **Datum:** Assumed
Type of Boring: HSA with automatic SPT hammer
Started: 04/27/04 **Completed:** 04/27/04

Total Depth: 26.5 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
	0			Approx. 4" asphalt pavement					
132			SM	Dark brown silty GRAVEL with sand (moist, very loose) (FILL)					
			GM	Brown and gray silty GRAVEL with woody organics (moist to wet, very loose) (FILL)		3 1 2	3	20	
	6		ML	Mottled gray-brown, brown, and red SILT and sandy SILT with clay (moist, firm to stiff)		5 3 3	6	13	
126				- interbedded with orange-brown sand and gravel (moist, loose)		4 4 4	8	29	
	12		ML	Blue-gray fine sandy SILT interbedded with lenses of silty medium sand and gray mottled with red silt (moist, firm to stiff)		2 2 3	5	35	
120						2 4 6	10	27	
	18								
114			SM	Orange-brown silty fine to medium SAND interbedded with silty GRAVEL with sand (wet, loose to medium dense)		3 6 10	16	23	
	24		ML	Dark red-brown and gray-brown SILT with wood and other organic matter (wet, very stiff)		7 12 15	27	56	
108				End of Boring.					
	30								
102									
	36								



Notes:
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Soil and groundwater conditions encountered during construction may differ from those shown on the log.

Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: T. Huntting	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-8 (1 of 1)

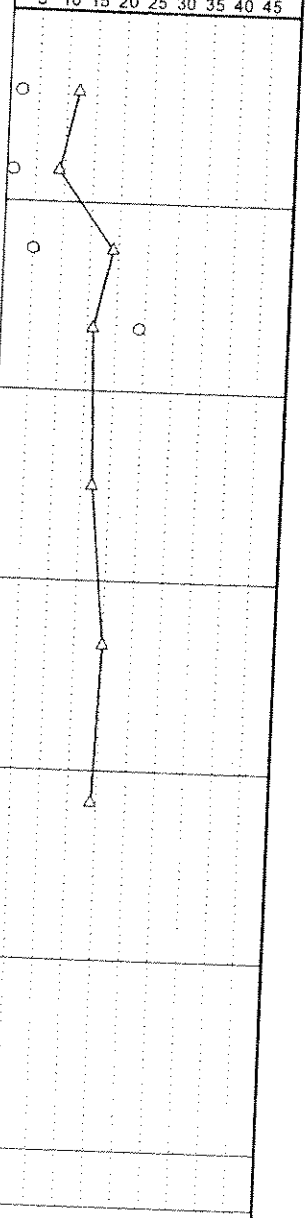
Boring B-9

Location: Upper mall, proposed north building, south corner
Elevation: 136 **feet** **Datum:** Assumed
Type of Boring: HSA with automatic SPT hammer
Started: 04/28/04 **Completed:** 04/28/04

Total Depth: 26.5 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
	0		GP-GM	Approx. 4" asphalt pavement					
				Red-brown sandy GRAVEL with silt (damp to moist, loose to medium dense) (Outwash?)		4 7 5	12	2	
132	6					4 4 5	9	1	
						7 9 10	19	5	
126			ML	Brown with lenses of orange fine sandy SILT (moist, stiff)		4 7 9	16	24	
	12		GP-GM	Light yellow and brown sandy GRAVEL with silt (wet, medium dense)					
120						4 7 10	17		GS: #200 = 12%
	18		ML	Brown sandy SILT with gravel (wet, stiff)					
114			GM	Brown silty GRAVEL with sand (wet, medium dense)		4 8 12	20		
	24		SM-ML	Blue-gray, brown-gray, and gray silty fine to medium SAND to sandy SILT with lenses of peat (wet, medium dense)		7 8 9	19		
108				End of Boring.					
	30								
102									
	36								

Plastic Limit ⊢—⊣ Liquid Limit
Moisture Content (%) ○
N Value Table △
5 10 15 20 25 30 35 40 45



Notes:
Stratigraphic contacts are based on interpretations and are approximate. Contacts may vary from those shown or may be more gradual.
Soil and groundwater conditions encountered during construction may differ from those shown on the log.

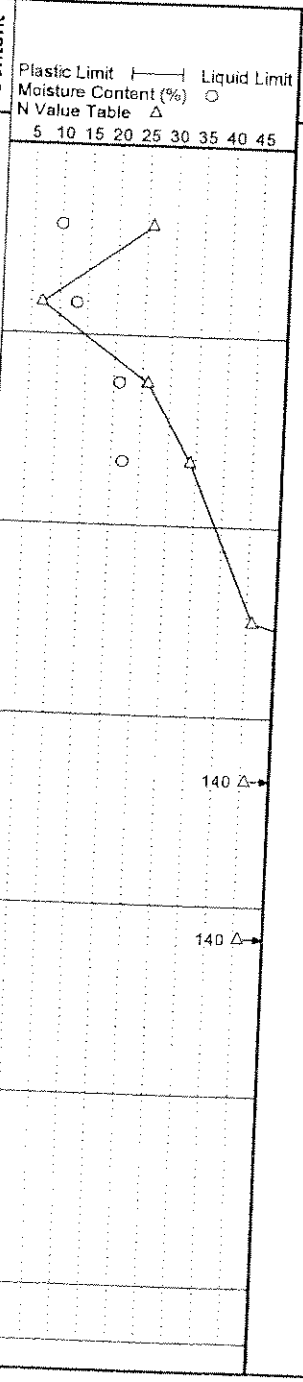
Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: T. Huntting	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-9 (1 of 1)

Boring B-12

Location: Lower mall, proposed south garage, south end
Elevation: 130 **feet** **Datum:** Assumed
Type of Boring: HSA/Mud Rotary with automatic SPT hammmer
Started: 04/28/04 **Completed:** 04/29/04

Total Depth: 25.5 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
	0			Approx. 4" asphalt pavement					
			GM	Gray-brown sandy GRAVEL with silt (damp to moist, medium dense) (FILL)					
126						7 10 16	26	10	
	6					2 3 4	7	13	
			SP-SM	Gray fine to medium SAND with trace to some silt (moist to wet, medium dense to dense)					
120				- with orange staining at 7.5'		4 11 15	26	21	
	12					5 14 20	34	22	GS: #200 = 17%
				- gravelly zone					
114				- with lense of medium sand, scattered fine gravel and scattered wood		5 16 30	46		
	18								
				- with gravel and possible cobbles					
108			GP-GM	Gray sandy fine to coarse GRAVEL with trace to some silt (wet, very dense)		14 35/3"	140		
	24								
				End of Boring.		35/6"	140		
102									
	30								
96									
	36								



Notes:
Stratigraphic contacts are based on interpretations and are approximate. Contacts may vary from those shown or may be more gradual.
Soil and groundwater conditions encountered during construction may differ from those shown on the log.
Started with hollow stem augers. Abandoned at 20 feet due to heaving gravel. Moved 4 feet and redrilled using mud rotary.

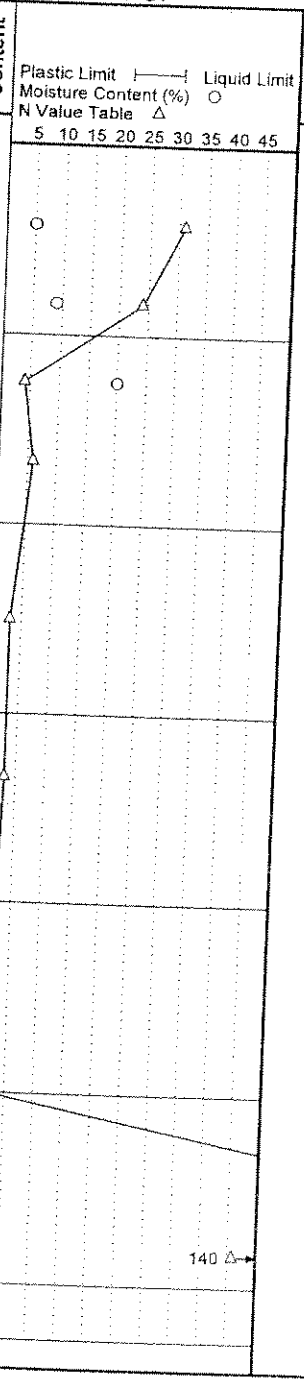
Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: T. Huntting	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-12 (1 of 1)

Boring B-11

Location: Upper mall, proposed south building, south corner
Elevation: 133 **feet** **Datum:** Assumed
Type of Boring: HSAm with automatic SPT hammer
Started: 04/28/04 **Completed:** 04/28/04

Total Depth: 35.8 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
132	0		SM	Approx. 4" asphalt pavement					
				Gray-brown silty fine to medium SAND with gravel (moist, loose) (FILL)					
			GM	Light gray silty fine to coarse GRAVEL with sand (damp, medium dense) (FILL)		6 16 15	31	5	
126	6					4 10 14	24	9	
			ML	Gray, blue-gray, and gray-brown sandy SILT with gravel (moist, soft) (FILL?)		1 2 2	4	20	
120	12		GM	Brown and gray silty fine to coarse GRAVEL with sand (wet, loose to very loose)		1 3 3	6		
114	18			- color change to orange-brown, interbedded with gravelly silt with sand		1 1 2	3		
				- color change to brown, more sandy		2 1 2	3		GS: #200 = 28%
108	24		PEAT	Dark red-brown to black PEAT and organic silt with wood (wet, very soft)		1 1 1	2		
				- gravelly zone		0 1 1	2		
96	36		GP-GM	Gray sandy GRAVEL with some silt (wet, very dense)		29 35/3"	140		
				End of Boring.					



Notes:
Stratigraphic contacts are based on interpretations and are approximate. Contacts may vary from those shown or may be more gradual.
Soil and groundwater conditions encountered during construction may differ from those shown on the log.

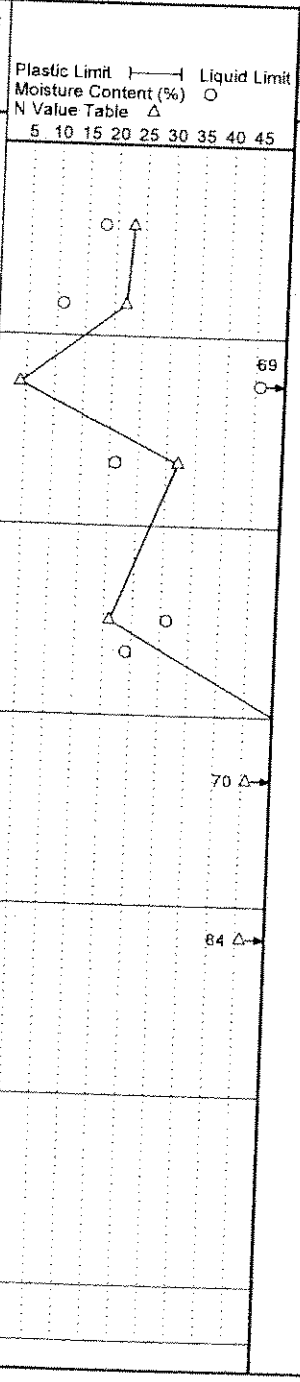
Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: T. Huntting	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-11 (1 of 1)

Boring B-14

Location: Lower mall, proposed restaurant, west end
Elevation: 127 **feet** **Datum:** Assumed
Type of Boring: Mud Rotary with automatic SPT hammer
Started: 04/30/04 **Completed:** 04/30/04

Total Depth: 25.4 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
	0			Approx. 4" asphalt pavement					
126			GM	Brown silty GRAVEL with sand (moist to wet, loose) (FILL)					
			SM	Gray with 3" lense of orange-brown silty fine to medium SAND interbedded with silty gravel with sand (mosit to wet, medium dense) (FILL)		6 11 12	23	18	
	6					12 12 12	22	11	
120			ML	Dark brown gravelly SILT with organics (wet, soft)		3 2 2	4	69	
			SM-ML	Light gray, orange-brown, and gray-brown silty fine SAND to very fine sandy SILT with scattered organics (wet, medium dense/very stiff)		5 11 21	32	21	
114	12								
			SP-SM	Gray fine to medium SAND with trace to some silt (wet, dense)		7 8 13	21	31 24	GS: #200 = 11%
108	18								
			GW-GM	Gray sandy fine to coarse GRAVEL with some silt (wet, very dense)	35/6"		70		
102	24								
				End of Boring. Depth to groundwater approximate.	35/5"		84		
96	30								
90	36								



Notes:
Stratigraphic contacts are based on interpretations and are approximate. Contacts may vary from those shown or may be more gradual.
Soil and groundwater conditions encountered during construction may differ from those shown on the log.

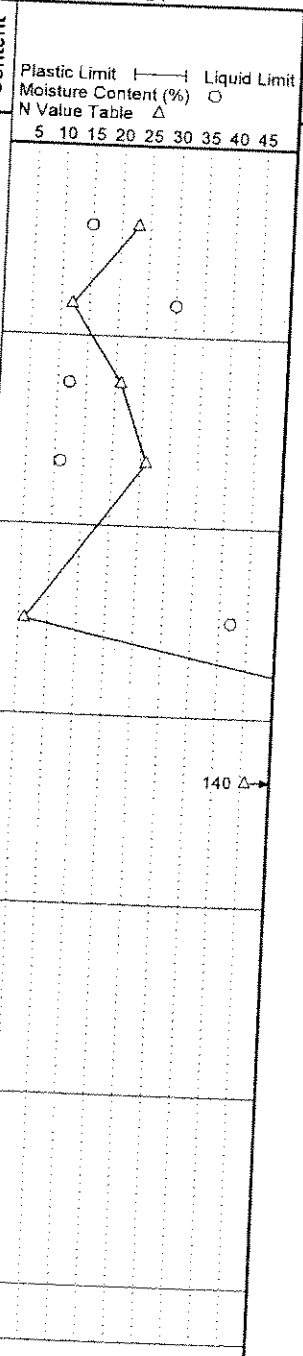
Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: T. Huntting	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-14 (1 of 1)

Boring B-15

Location: Lower mall, proposed restaurant, east end
Elevation: 127 **feet** **Datum:** Assumed
Type of Boring: Mud Rotary with automatic SPT hammer
Started: 04/30/04 **Completed:** 04/30/04

Total Depth: 20.3 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
126	0		GW	Approx. 4" asphalt pavement					
			GM	Brown-gray sandy GRAVEL (damp, medium dense) (Base Course)					
				Brown very silty GRAVEL to gravelly SILT (moist, medium dense) (FILL) - color change to gray, less silty		8 13 10	23	15	
120	6		SM	Brown medium to coarse SAND with silt (wet, medium dense) (FILL?)		7 6 6	12	30	
			GM-SM	Gray-brown silty SAND to silty GRAVEL (wet, medium dense)		5 10 11	21	12	
	12					11 16 10	26	11	
114			OL	Dark brown organic SILT (wet, very soft)					
			ML	Brown sandy silt with organics (wet, soft)					
	18		SP-SM	Brown very fine sandy SILT interbedded with gray fine to medium SAND with trace to some silt (wet, loose)		1 2 4	6	42	
108			GW-GM	Gray sandy fine to coarse GRAVEL with silt (wet, very dense)					
				End of Boring. Depth to groundwater approximate.	35/3"		140		
	24								
102									
	30								
96									
	36								
90									



Notes:
Stratigraphic contacts are based on interpretations and are approximate. Contacts may vary from those shown or may be more gradual.
Soil and groundwater conditions encountered during construction may differ from those shown on the log.

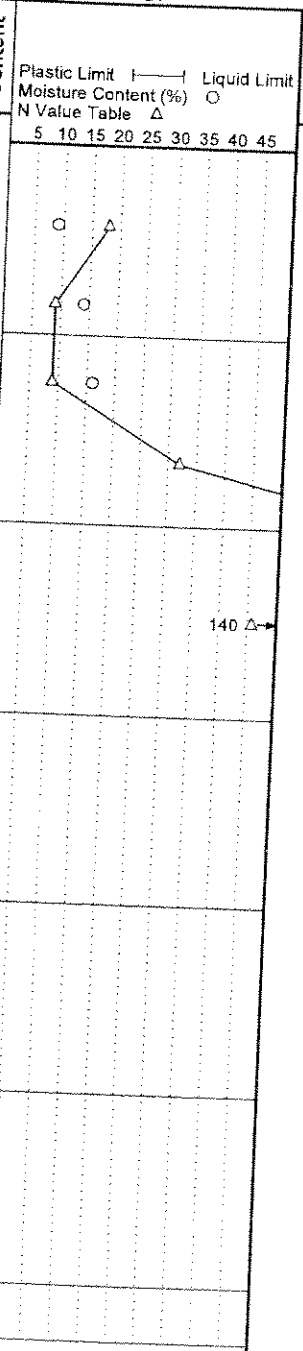
Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: T. Huntting	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-15 (1 of 1)

Boring B-16

Location: Lower mall, proposed expansion of south building, northeast side
Elevation: 129 **feet** **Datum:** Assumed
Type of Boring: Mud Rotary with automatic SPT hammer
Started: 04/30/04 **Completed:** 04/30/04

Total Depth: 15.8 **feet**
Drill Rig: CME 75
Driller: PSI

Elevation	Depth	Graphic Log	USCS	Description of Materials (Classification)	Sampler	Blows/6"	N-Value	Moisture Content	Remarks
	0			Approx. 4" asphalt pavement					
			GM	Red-brown to gray-brown silty GRAVEL with sand (moist, loose to medium dense) (FILL)		11 12 6	18	9	
126									
	6					7 6 3	9	14	
				Gray-brown silty GRAVEL with sand (wet, loose)		5 5 4	9	16	
120			SM	Gray-brown silty SAND with gravel (wet, very dense)		8 13 19	32		
	12								
114			GP-GM	Gray-brown sandy GRAVEL with silt (wet, very dense)		14 35/3"	140		
				End of Boring. Depth to groundwater approximate.					
	18								
108									
	24								
102									
	30								
96									
	36								



Notes:
Stratigraphic contacts are based on interpretations and are approximate. Contacts may vary from those shown or may be more gradual.
Soil and groundwater conditions encountered during construction may differ from those shown on the log.

Project No.: 875-45083	Developers Diversified Realty	psi Information To Build On
Date: June 2004	Totem Lake Malls Renovation	Engineering • Consulting • Testing
Logged By: T. Huntting	12500 Totem Lake Boulevard	
Checked By: T. Hull	Kirkland, Washington	Figure A-16 (1 of 1)

APPENDIX D

APPENDIX D

PREVIOUS EXPLORATIONS BY LANDAU ASSOCIATES

This appendix contains logs of the explorations (borings B-1 through B-19) that were completed on site in 2008 by Landau Associates (Landau, 2008) that were completed in the upper mall. The locations of these explorations are shown on Figure 2. Copies of the site plan and three geologic cross sections prepared by Landau are also included in this appendix.

B- 1

LAI Project No: 1057001.010

SAMPLE DATA | **SOIL PROFILE**

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 139.7 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/07/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Description
0							AC	ASPHALT PAVEMENT (3 inches)
							GP	Brown, sandy GRAVEL, rounded (3 inches)
							SM	Brown, silty, gravelly SAND (loose, moist to wet)
		S-1A, S-1B	b2	5	W = 11		SP-SM	**(FILL)** Gray, gravelly, fine to coarse SAND with silt (very loose to loose, moist)
5	135	S-2	b2	2	W = 6			
		S-3	b2	5			SM/WD	Gray, silty, fine to medium SAND with gravel and wood debris (loose, moist)
10	130	S-4	b2	4			SM/WD	Brown to dark brown, silty SAND with gravel and fine organics, mixed with burned wood debris and sandy silt (loose, moist)
		S-5	b2	4	W = 16		SM	Gray, very silty, fine to medium SAND (loose, wet) **(LACUSTRINE / ALLUVIUM)**
15	125	S-6	b2	16	W = 23 GS		SP-SM	Gray, fine to medium SAND with silt, trace gravel (medium dense, wet)
20	120	S-7	b2	22	W = 25		SM	Brown to light brown, silty, fine to medium SAND (medium dense, wet)
25	115	S-8	b2	39	W = 21		SP-SM	Light brown to orange-brown, fine to medium SAND with silt (dense, wet)
30	110	S-9	b2	7	W = 15		SP	Gray to brown, fine to coarse SAND, trace gravel and wood (loose, wet)
35	105						SW-SM	

Groundwater: ATD

Moisture Content (%) — Plastic Limit 10, 20, 30, 40 Liquid Limit
▲ SPT N-Value ▲ △ Non-Standard N-Value △ — 10, 20, 30, 40
× Fines Content (%) × — 10, 20, 30, 40

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 1

Figure A-2 (1 of 2)

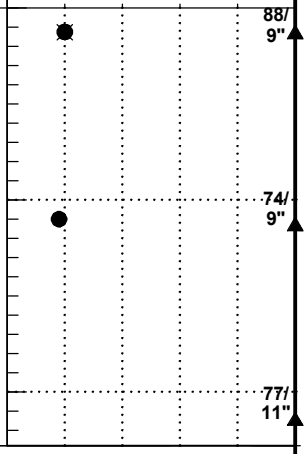
B- 1

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 139.7 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/07/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
35		S-10	b2	88/ 9"	W = 10 GS		SW-SM	Gray, very gravelly, fine to coarse SAND with silt (very dense, wet) **(ADVANCE OUTWASH)**	
40	100	S-11	b2	74/ 9"	W = 9				
							GP-GM	Gray, sandy GRAVEL with silt (very dense, wet)	
45	95	S-12	b2	77/ 11"					

Moisture Content (%) — Plastic Limit 10, 20, 30, 40 Liquid Limit
▲ SPT N-Value ▲ △ Non-Standard N-Value △ 10 20 30 40
× Fines Content (%) × 10 20 30 40



Boring Completed 01/07/08
Total Depth of Boring = 46.4 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 1

Figure A-2 (2 of 2)

B- 2

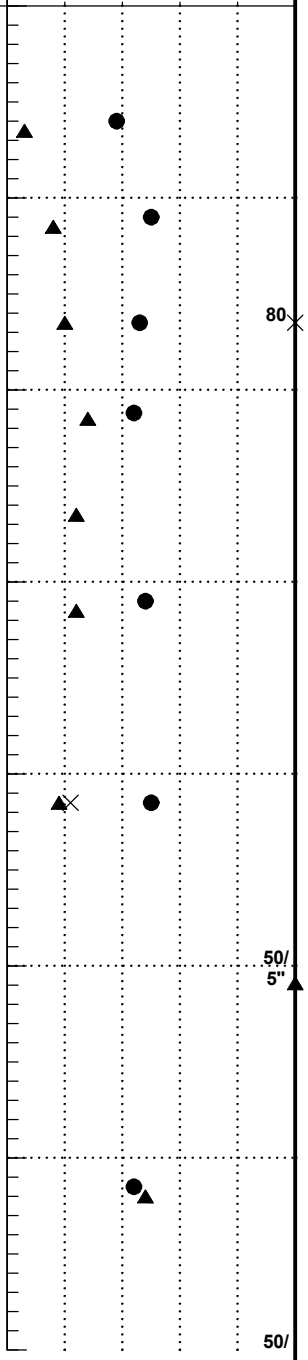
LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 141.7 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/07/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	SOIL PROFILE
0						AC	ASPHALT PAVEMENT (3 inches)
						SP	Brown, gravelly SAND
	140						
		S-1	b2	3	W = 19	SM	Light brown, very silty, fine SAND (very loose, moist) **(FILL)**
5		S-2	b2	8	W = 25	SM/ ML	Light brown to gray, very silty, fine SAND layered with sandy SILT with fine organics (roots), non-plastic, mottled (loose and medium stiff, moist)
	135						
		S-3	b2	10	W = 23 -200 = 80	ML	Blue-gray to light brown, fine sandy SILT (stiff, moist to wet) **(LACUSTRINE / ALLUVIUM)**
10		S-4	b2	14	W = 22		
	130						
		S-5	b2	12			- water in the bottom of 12.5 ft sample
15		S-6	b2	12	W = 24	SM/ ML	Brown to gray, mottled with orange, very silty, fine SAND to fine very sandy SILT, non-plastic (medium dense and stiff, wet)
	125						
20		S-7	b2	9	W = 25 -200 = 11	SP-SM	Gray to orange-brown, fine to medium SAND with silt, trace organics (decomposed wood) (loose, wet)
	120						
25		S-8	b2	50/ 5"		SM	Gray to light brown, silty, fine to medium SAND (very dense, wet) - sampler pounding on a rock at 25 ft
	115						
						SP	Gray, medium to coarse SAND with gravel (medium dense, wet)
30		S-9A S-9B	b2	24	W = 22	ML	Blue-gray, SILT with fine sand, trace gravel, non-plastic to low plasticity (very stiff, moist)
	110						
35						SP-SM	Gray, very gravelly, fine to coarse SAND with silt, zones of non-plastic silt (very dense, wet) **(ADVANCE OUTWASH)**

Groundwater: ATD

Moisture Content (%) — Plastic Limit 10, 20, 30, 40 Liquid Limit
▲ SPT N-Value ▲ △ Non-Standard N-Value △ 10 20 30 40
× Fines Content (%) × 10 20 30 40



Notes:
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2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 2

Figure A-3 (1 of 2)

B- 2

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 141.7 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/07/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater	Moisture Content (%) / SPT N-Value / Fines Content (%)
35	105	S-10	b2	50/ 5"	W = 11		SP-SM	Gray, very gravelly, fine to coarse SAND with silt, zones of non-plastic silt (very dense, wet) **(ADVANCE OUTWASH)**		5"
40	100	S-11	b2	50/ 5"	W = 7 GS					50/ 5"
45		S-12	b2	50/ 6"	W = 8		GP-GM	Gray, very sandy GRAVEL with silt (very dense, wet)		50/ 6"
50										
55										
60										
65										
70										

Moisture Content (%): Plastic Limit 10 — 20 — 30 — 40 Liquid Limit

▲ SPT N-Value ▲ △ Non-Standard N-Value △: 10 20 30 40

× Fines Content (%) ×: 10 20 30 40

Boring Completed 01/07/08
Total Depth of Boring = 46.0 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 2

Figure A-3 (2 of 2)

B- 3

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 137.2 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/08/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Soil Description
0						AC	ASPHALT PAVEMENT (3 inches)
						SP	Brown, SAND (9 inches)
	135	S-1	b2	5	W = 10	SM	Blue-gray, very silty, fine SAND with gravel (loose, moist) **(FILL)**
5		S-2	b2	15	W = 15	SM/ ML	Blue-gray to brown, silty SAND mixed with fine sandy SILT, non-plastic, trace gravel (medium dense and stiff, moist)
	130	S-3	b2	10		GM/ SM	Blue-gray, silty, sandy GRAVEL to silty, gravelly SAND, trace organics (medium dense, moist)
10		S-4	b2	5	W = 13	ML	Brown, sandy SILT with gravel, low plasticity, organic odor (medium stiff, moist to wet)
	125	S-5	b2	5	W = 12		
15		S-6	b2	6	W = 14 -200 = 40	SM	Blue-gray to brown, mottled with orange, very silty SAND with gravel, trace fine organics (loose, wet)
	120					ML	Gray to brown, very sandy SILT with gravel, low plasticity (medium stiff, wet)
20		S-7	b2	5	W = 15		- water in 20 ft sample
	115					CL-ML	Light brown to grayish-brown, sandy, silty CLAY with gravel (medium stiff, wet) **(LACUSTRINE / ALLUVIUM)**
25		S-8	b2	8	W = 14		
	110					CL	Light brown to blue-gray, sandy CLAY with gravel and fine organics (soft, wet)
30		S-9	b2	3	W = 20 AL		- 2 inch thick peat layer at 30 ft
	105					PT	Dark brown, PEAT, non-fibrous (stiff, moist to wet)
35							

Groundwater: ATD

Moisture Content (%) — Plastic Limit 10, 20, 30, 40 Liquid Limit
▲ SPT N-Value ▲ △ Non-Standard N-Value △ 10 20 30 40
× Fines Content (%) × 10 20 30 40

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 3

Figure A-4 (1 of 2)

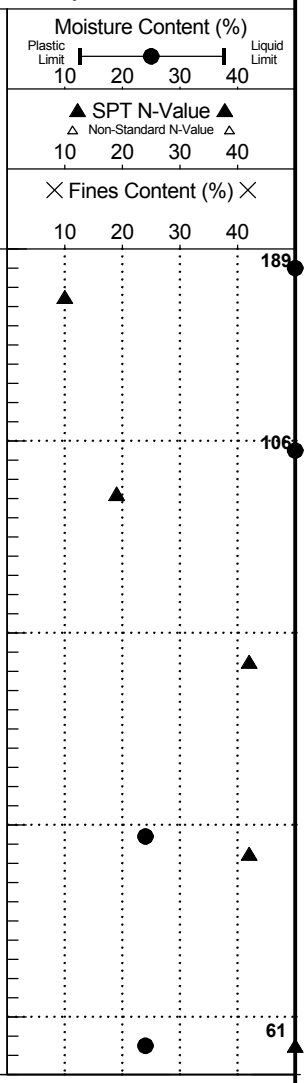
B- 3

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 137.2 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/08/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
35		S-10A, S-10B	b2	10	W = 189		PT		
							SP	Gray, fine to medium SAND, trace silt (medium dense, wet)	
	100						PT	Dark brown, PEAT, fibrous (very stiff, wet)	
40		S-11A, S-11B, S-11C, S-11D	b2	19	W = 106		SP-SM	Gravelly SAND with silt (medium dense, wet)	
	95						PT	Dark brown, PEAT layered with silty sand (very stiff, wet)	
							ML	SILT, non-plastic (very stiff, wet)	
							GP	Blue-gray, very sandy GRAVEL, trace silt (dense, wet) **(ADVANCE OUTWASH)**	
45		S-12	b2	42					
	90								
50		S-13	b2	42	W = 24		SM/ML	Gray, very silty fine SAND with gravel layered with fine sandy SILT, low plasticity, trace organics (thin interbeds) (dense and hard, moist) **(TRANSITIONAL BEDS)**	
	85								
							SM	Gray, very silty, fine SAND, trace fine organics (very dense, moist to wet)	
55		S-14	b2	61	W = 24				
60									
65									
70									

Boring Completed 01/08/08
Total Depth of Boring = 56.5 ft.



Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 3

Figure A-4 (2 of 2)

B- 4

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 139.8 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/08/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0							AC	ASPHALT PAVEMENT (3 inches)	
							SM	Gray, silty, gravelly SAND (moist) **(FILL)**	
		S-1	b2	24	W = 17		SM	Light brown to gray, mottled with orange, very silty, fine SAND (medium dense, moist) **(LACUSTRINE / ALLUVIUM)**	
5	135	S-2A, S-2B	b2	15	W = 22		SP-SM	Brown, fine to medium SAND with silt (medium dense, moist)	
							ML	Gray to brown, mottled with orange, fine sandy SILT, non-plastic (stiff, moist)	
		S-3	b2	26			WD	Brown to dark brown, WOOD with layers of silty sand (medium stiff to very stiff, wet) - 6 inch layer of silty, fine to medium sand at 7.5 ft - 2 inch layer of silty, fine sand at 10 ft	
10	130	S-4	b2	6					
		S-5	b2	32	W = 16 GS		SP-SM	Light brown, mottled with orange, fine to medium SAND with silt, trace gravel (loose to dense, wet)	ATD
15	125	S-6	b2	5	W = 20				
							SW-SM	Brown to gray, mottled with orange, fine to medium SAND with silt and gravel (very dense, wet) **(ADVANCE OUTWASH)**	
20	120	S-7	b2	75	W = 17 GS				
							SW	Light gray to blue-gray, fine to coarse SAND with gravel (very dense, wet)	
25	115	S-8	b2	66	W = 14				
							GW/SW	Gray, very sandy GRAVEL to gravelly, fine to coarse SAND (very dense, wet)	
30	110	S-9	b2	50/5"	W = 12				
35									

Moisture Content (%) — Plastic Limit 10, 20, 30, 40 Liquid Limit
▲ SPT N-Value ▲ — △ Non-Standard N-Value △ — 10, 20, 30, 40
× Fines Content (%) × — 10, 20, 30, 40

Boring Completed 01/08/08
Total Depth of Boring = 30.9 ft.

Notes:
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3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 4

Figure A-5

B- 5

LAI Project No: 1057001.010

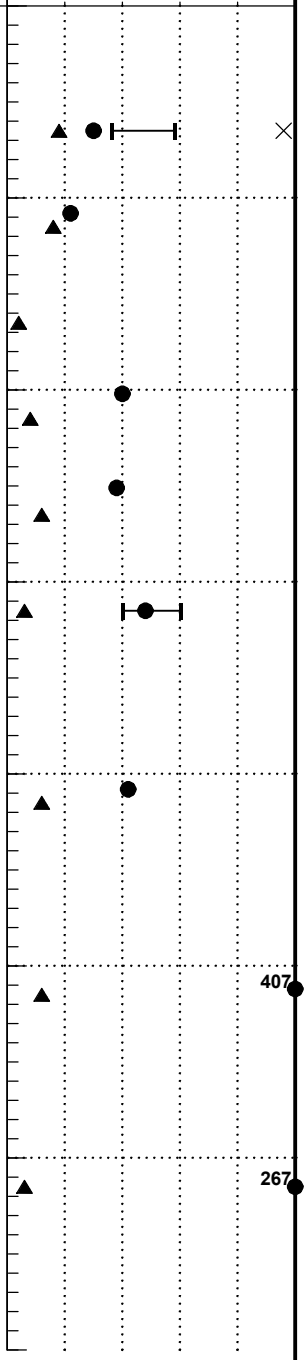
SAMPLE DATA | **SOIL PROFILE**

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 132.4 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/09/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Description
0						AC	ASPHALT PAVEMENT (3 inches)
						GP	Gray, sandy GRAVEL (moist)
	130	S-1	b2	9	W = 15 GS AL	SC	Blue-gray to brown, very clayey, gravelly, fine to coarse SAND, zones of organics (very loose to loose, moist to wet) **(FILL)**
5		S-2	b2	8	W = 11		
	125	S-3	b2	2			
10		S-4	b2	4	W = 20	CL	Light brown, gravelly CLAY with sand (soft, wet)
	120	S-5	b2	6	W = 19	SM/ SC	Light brown, silty SAND with gravel and clay (loose, wet)
15		S-6	b2	3	W = 24 AL	CL	Light brown to dark brown to green-gray, mottled with olive, sandy CLAY with gravel (soft to medium stiff, wet)
	115						
20		S-7	b2	6	W = 21		
	110					PT	Dark reddish-brown to black, PEAT, fibrous (soft to medium stiff, moist to wet) **(LACUSTRINE / ALLUVIUM)**
25		S-8	b2	6	W = 407		
	105						
30		S-9	b2	3	W = 267		
	100					SM/ ML	
35							

Groundwater: ATD

Moisture Content (%) — Plastic Limit 10, 20, 30, 40 Liquid Limit
▲ SPT N-Value ▲ △ Non-Standard N-Value △ — 10, 20, 30, 40
× Fines Content (%) × — 10, 20, 30, 40



Notes:
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2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 5

Figure A-6 (1 of 2)

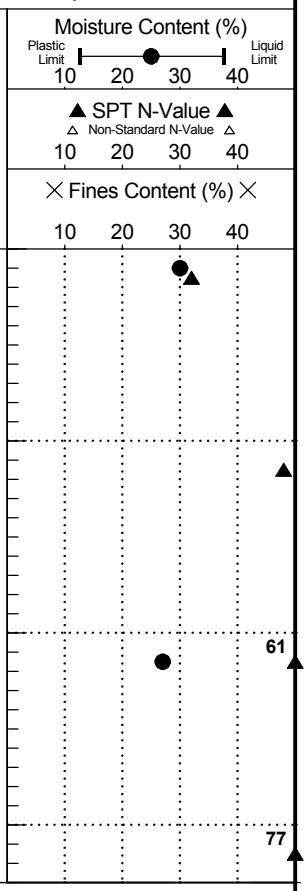
B- 5

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 132.4 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/09/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
35		S-10	b2	32	W = 30		SM/ ML	Gray, very silty, fine SAND interbedded with fine sandy SILT, trace fine organics, low plasticity silt interbedded with silty sand (dense to very dense and hard, moist to wet) **(TRANSITIONAL BEDS)**	
	95								
40		S-11	b2	48					
	90								
45		S-12	b2	61	W = 27				
	85								
							SP- SM	Gray, fine to medium SAND with silt, trace gravel (very dense, wet)	
50		S-13	b2	77					

Boring Completed 01/09/08
Total Depth of Boring = 51.5 ft.



Notes:
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3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

55 60 65 70

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 5

Figure A-6 (2 of 2)

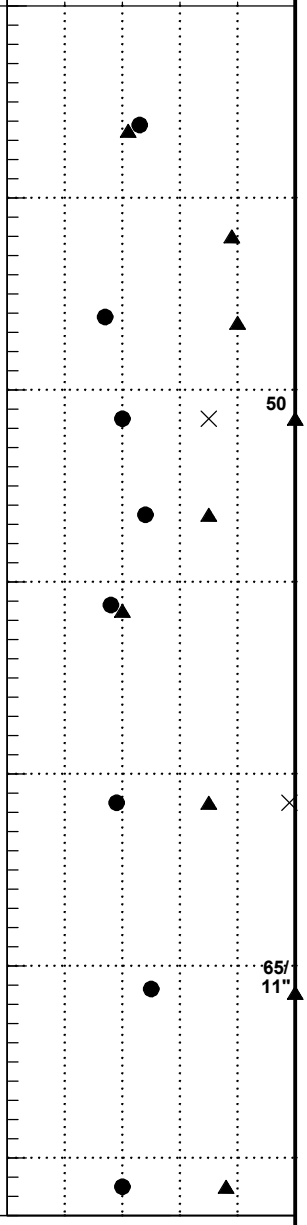
B- 6

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 140.0 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/09/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0	140						AC	ASPHALT PAVEMENT (2 inches)	
							GP	Light brown, sandy GRAVEL (6 inches)	
							SM/ ML	Gray, very silty, fine SAND interbedded with fine sandy SILT, non-plastic (medium dense and very stiff, moist) **(LACUSTRINE / ALLUVIUM)**	
		S-1	b2	21	W = 23				
							ML/ OL	Dark brown to gray-brown, fine sandy SILT with organics, non-plastic (hard, moist) - wood in cuttings at 4 ft	
5	135	S-2A S-2B	b2	39			SM	Light gray, very silty, fine SAND (dense, moist)	ATD
							SM/ ML	**(TRANSITIONAL BEDS)** Light gray to dark gray, very silty, fine SAND interbedded with fine sandy SILT, non-plastic, decomposed wood contained within the silt (dense and hard, moist to wet)	
		S-3	b2	40	W = 17				
							SM	- 6 inches of water in auger at 7.5 ft	
10	130	S-4	b2	50	W = 20 -200 = 35			Gray, very silty, fine SAND (very dense, moist to wet)	
		S-5	b2	35	W = 24			- trace organics (decomposed wood) at 12.5 ft	
							SM/ ML	Dark gray, very silty, fine SAND interbedded with fine sandy SILT, non-plastic, fine organics contained within the silt (medium dense and very stiff, moist to wet) - wet silty sand interbeds at 15 ft	
15	125	S-6	b2	20	W = 18				
							SM	Gray, very silty, fine SAND, layered with silty fine to medium sand (dense to very dense, wet) - water level in auger 19.5 ft at end of drilling	ATD
20	120	S-7	b2	35	W = 19 -200 = 49				
25	115	S-8	b2	65/ 11"	W = 25				
							SP	Gray, fine to coarse SAND with gravel, trace silt and organics (dense, wet)	
30	110	S-9	b2	38	W = 20			- 1 inch thick layer of wood (decomposed) at 30 ft	
35									

Moisture Content (%) — Plastic Limit 10, 20, 30, 40, Liquid Limit
▲ SPT N-Value ▲ (△ Non-Standard N-Value △) 10, 20, 30, 40
× Fines Content (%) × 10, 20, 30, 40



Boring Completed 01/09/08
Total Depth of Boring = 31.5 ft.

Notes:
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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 6

Figure A-7

B- 7

LAI Project No: 1057001.010

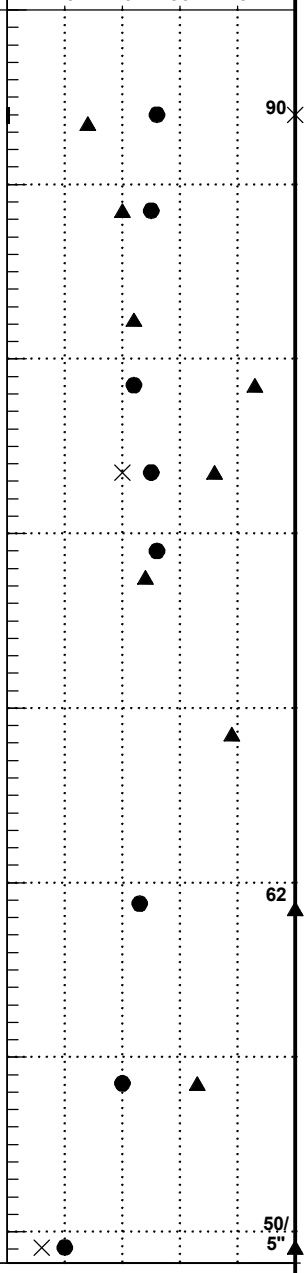
Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 141 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/10/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0							AC	ASPHALT PAVEMENT (2-1/2 inches)	
	140						GP	Light brown, sandy GRAVEL, 1-1/2-inch-minus pit run (8-1/2 inches)	
							ML	Gray, SILT with sand, trace organics (decomposed wood) (stiff to very stiff, moist to wet) **(LACUSTRINE / ALLUVIUM)**	
		S-1	b2	14	W = 26 -200 = 90				
5	135	S-2	b2	20	W = 25				
		S-3A					WD	Brown, WOOD	
		S-3B					SM	Gray, silty fine SAND (medium dense, wet)	
		S-3C	b2	22			WD	Brown to yellowish-brown, WOOD	
		S-3D					ML	Dark brown to gray, SILT with sand and organics (very stiff, moist)	ATD
10	130	S-4	b2	43	W = 22		SM	Gray, silty fine SAND, trace fine organics (medium dense to dense, wet) **(TRANSITIONAL BEDS)**	
		S-5	b2	36	W = 25 GS				
15		S-6A			W = 26				
	125	S-6B	b2	24			ML	Brown to gray, SILT with sand, layered with decomposed wood, low plasticity (very stiff, moist)	
							SM	- 4 inch thick layer of wood at 17 ft Gray, silty to very silty, fine SAND, layered with decomposed (dense, wet) - 5 inch layer of decomposed wood at 20 ft	
20	120	S-7	b2	39					
							SM/ ML	Gray to blue-gray to green, very silty, fine SAND interbedded with SILT, silt is moist and non-plastic to low plasticity, silty sand is wet (very dense and hard, moist to wet)	
25	115	S-8	b2	62	W = 23				
							SM	Gray, silty to very silty fine SAND (dense, wet)	
30	110	S-9	b2	33	W = 20				
							SP-SM	Gray, very gravelly, fine to coarse SAND with silt (very dense, wet)	
35		S-10	b2	50/ 5"	W = 10 GS				

Moisture Content (%) — Plastic Limit 10, 20, 30, 40 Liquid Limit

▲ SPT N-Value ▲ △ Non-Standard N-Value △ — 10, 20, 30, 40

× Fines Content (%) × — 10, 20, 30, 40



Boring Completed 01/10/08
Total Depth of Boring = 35.9 ft.

Notes:
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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 7

Figure A-8

B- 8

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 133.1 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/10/08

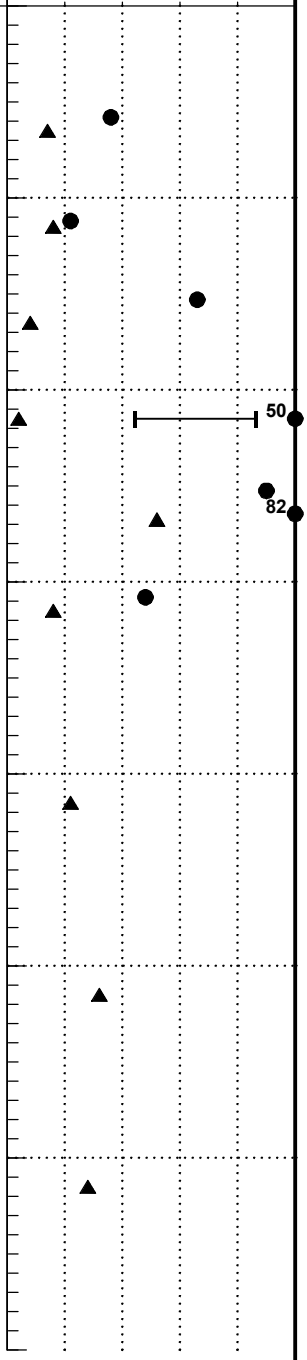
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Soil Description
0						AC	ASPHALT PAVEMENT (3 inches)
						GM	Brown, silty GRAVEL (2 inches)
						SM	Blue-gray, silty SAND (4 inches)
						ML	Dark brown, sandy SILT with gravel (medium stiff, wet) **(FILL)**
	130	S-1	b2	7	W = 18	CL-ML	
						SM/ML	Blue-gray, sandy, silty CLAY with gravel and fine organics (medium stiff, moist)
5		S-2	b2	8	W = 11		Dark brown, very silty, gravelly, fine to medium SAND to gravelly, sandy SILT, some organics (loose and medium stiff, wet)
	125	S-3	b2	4	W = 33	PT	Dark brown, PEAT and WOOD, trace gravel (soft, moist)
10		S-4	b2	2	W = 50 AL	CL	Green to gray, CLAY with sand and fine organics (very soft, moist) **(LACUSTRINE / ALLUVIUM)**
	120	S-5A	b2	26	W = 45		
		S-5B			W = 82	PT	Dark reddish-brown, PEAT layered with SILT, non-fibrous relatively dry peat layered with moist silt (very stiff, dry to moist)
15		S-6	b2	8	W = 24	CL	Yellowish-brown, mottled with orange, CLAY with sand, interbedded with gravelly, fine to coarse sand (medium stiff, wet) - saturated sand layer at 15.3 ft
	115					ML	Olive to gray to dark brown, SILT interbedded with peat and fine to coarse sand, low plasticity (stiff, wet)
20		S-7	b2	11			
	110						- water level at 23.35 ft at end of drilling
25		S-8	b2	16		CL	Blue, sandy CLAY with gravel (very stiff, wet)
	105					SM/ML	Orange-brown, mottled, silty fine to coarse SAND, interbedded with olive to gray SILT and brown, dry PEAT (medium dense and stiff, dry to wet)
30		S-9	b2	14			
	100					SP-SM	Yellow-brown mottled with orange, very gravelly, fine to coarse SAND with silt (medium dense, wet)
35							

Groundwater: ATD

Moisture Content (%) — Plastic Limit 10, 20, 30, 40 Liquid Limit

▲ SPT N-Value ▲ △ Non-Standard N-Value △ — 10, 20, 30, 40

× Fines Content (%) × — 10, 20, 30, 40



Notes:
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2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B- 8

Figure A-9 (1 of 2)

B- 8

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 133.1 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/10/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
35		S-10A, S-10B	b2	10	W = 25		CL/ CH	Blue-gray, CLAY, trace sand, medium to high plasticity (stiff, moist)	
	95						SP-SM	Brown, fine to medium SAND with silt, trace gravel (medium dense, wet)	
40		S-11A, S-11B	b2	24	W = 11		SC	Light brown to gray, mottled with orange, very clayey, fine to medium SAND with gravel (medium dense, wet) **(ABLATION TILL)**	
	90						SM	Gray, very silty, gravelly, fine to coarse SAND, interbedded with medium sand (very dense, moist to wet) **(GLACIAL TILL)**	
45		S-12	b2	64	W = 11 GS				
	85								
50		S-13	b2	50/ 5"					
	80						SM	Gray, silty, fine to medium SAND, trace gravel (dense to very dense, wet) **(ADVANCE OUTWASH)**	
55		S-14	b2	36	W = 18				
	75								
60		S-15	b2	50/ 5"					
65									
70									

Moisture Content (%) — Plastic Limit 10, 20, 30, 40 Liquid Limit
▲ SPT N-Value ▲ △ Non-Standard N-Value △ 10 20 30 40
× Fines Content (%) × 10 20 30 40

Boring Completed 01/10/08
Total Depth of Boring = 60.9 ft.

Notes:
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3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Kirkland, Washington

Log of Boring B- 8

Figure A-9 (2 of 2)

B- 9

LAI Project No: 1057001.010

SAMPLE DATA						SOIL PROFILE			Groundwater	Moisture Content (%) Plastic Limit 10 20 30 40 Liquid Limit; ▲ SPT N-Value ▲ △ Non-Standard N-Value △ 10 20 30 40; × Fines Content (%) × 10 20 30 40
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-Stem Auger Ground Elevation (ft): 133.6 (Approximate) Drilled By: Holocene Drilling Logged By: DLO Date: 01/10/08		
0							AC	ASPHALT PAVEMENT (4 inches)		
							GP	GRAVEL, base course (8 inches)		
							ML	Light brown, SILT (moist)		
							GM	Brown, silty GRAVEL (moist) - obstruction encountered at 2.5 ft		
	130	Boring Completed 01/10/08 Total Depth of Boring = 2.5 ft.								
5										
10										
15										
20										
25										
30										
35										

Notes:
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2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall
Redevelopment
Kirkland, Washington

Log of Boring B- 9

Figure
A-10

B-10

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 135 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/11/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0	135						AC	ASPHALT PAVEMENT (2 inches)	
							GP	GRAVEL BASE (4 inches)	
							SM	Light brown, silty, fine to medium SAND (medium dense, moist)	
		S-1	b2	14	W = 12		SM	**(FILL)** Gray, silty, fine to medium SAND with gravel (medium dense, moist to wet)	
5	130	S-2A, S-2B	b2	9	W = 21		ML	Brown to dark brown, fine sandy SILT with organics (decomposed wood) (stiff, moist to wet)	
							CL-ML	Olive-gray, fine sandy, silty CLAY, trace fine organics (stiff, moist)	
		S-3	b2	9	W = 13		SM	Gray to brown, mottled with orange, very silty, fine to medium SAND, trace gravel (loose, moist) **(LACUSTRINE / ALLUVIUM)**	
10	125	S-4	b2	8	W = 14 GS				
		S-5	b2	16	W = 16		SP-SM	Gray, fine to coarse SAND with silt and gravel (medium dense, wet)	ATD
15	120	S-6A, S-6B	b2	28			SM	Dark brown, gravelly, silty SAND with organics (medium dense, wet)	
							SM	Blue-gray, silty, gravelly, fine to coarse SAND (medium dense, wet)	
							PT	Dark brown to reddish-brown, PEAT, fibrous (very soft to stiff, moist)	
20	115	S-7	b2	1	W = 461				
25	110	S-8A, S-8B	b2	10	W = 290		WD	Yellowish-orange-brown, WOOD (soft to stiff, moist to wet)	
30	105	S-9	b2	4					
35	100						GW-GM		

Moisture Content (%): Plastic Limit 10 20 30 40 Liquid Limit

▲ SPT N-Value ▲ △ Non-Standard N-Value △: 10 20 30 40

× Fines Content (%) ×: 10 20 30 40

461

290

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-10

Figure A-11 (1 of 2)

B-10

LAI Project No: 1057001.010

SAMPLE DATA						SOIL PROFILE				
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-Stem Auger Ground Elevation (ft): 135 (Approximate) Drilled By: Holocene Drilling Logged By: DLO Date: 01/11/08	Groundwater	Moisture Content (%) (Plastic Limit 10, 20, 30, 40, Liquid Limit) ▲ SPT N-Value ▲ △ Non-Standard N-Value △ (10, 20, 30, 40) × Fines Content (%) × (10, 20, 30, 40)
35	100	S-10	b2	87/ 11"	W = 9 GS		GW-GM	Gray to blue-gray, very sandy GRAVEL with silt (very dense, wet) **(ADVANCE OUTWASH)**		87/ 11"
40	95	S-11	b2	77	W = 11					77
							SM/ ML	Gray, very silty, fine SAND to fine sandy SILT, non-plastic, trace fine organics (dense and hard, wet) **(TRANSITIONAL BEDS)**		
45	90	S-12	b2	48						

Boring Completed 01/11/08
Total Depth of Boring = 46.5 ft.

Notes:
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2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-10

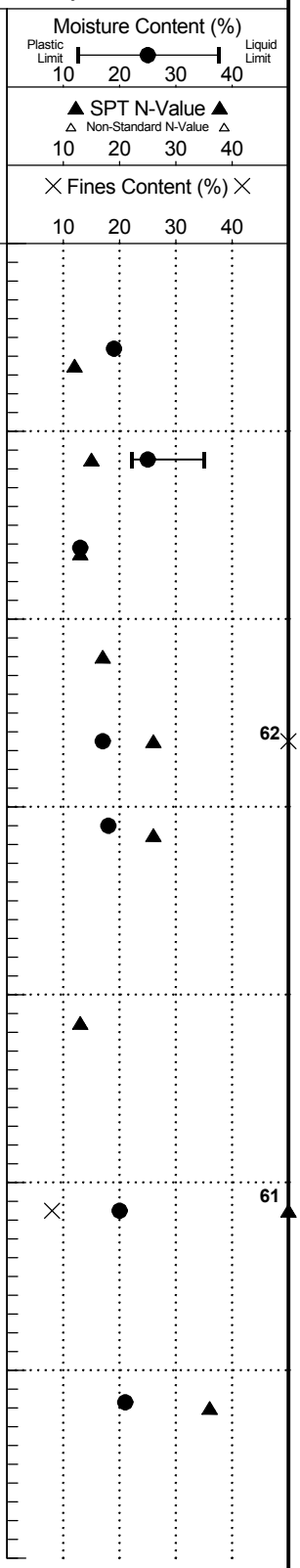
Figure A-11 (2 of 2)

B-11

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 136.8 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/11/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0							AC	ASPHALT PAVEMENT (3 1/2 inches)	
							GM	GRAVEL BASE (2 1/2 inches)	
							SM	Brown, silty SAND	
	135						SM	Gray, silty SAND	
		S-1	b2	12	W = 19		CL	Light brown to grayish-brown, mottled with orange, CLAY with sand and gravel (stiff, moist) **(LACUSTRINE / ALLUVIUM)**	
5		S-2	b2	15	W = 25 AL			- less sand and gravel at 5 ft	
	130						SM	Grayish-brown to light brown, mottled with orange, silty to very silty, fine to medium SAND with gravel (medium dense, moist)	
		S-3	b2	13	W = 13				
10		S-4A S-4B	b2	17			ML	- less gravel at 10 ft - wet at 10.5 ft Dark grayish-brown to dark brown, very sandy SILT, trace gravel and organics (very stiff, wet)	
	125								
		S-5	b2	26	W = 17 GS				
15		S-6	b2	26	W = 18				
	120								ATD
							SM	Gray to light brown, silty, fine to medium SAND interbedded with wood (medium dense, wet) - 2 inch and 4 inch layers of wood at 20 ft	
20		S-7	b2	13					
	115								
							SP-SM	Gray, medium SAND with silt (very dense, wet) **(TRANSITIONAL BEDS)**	
25		S-8	b2	61	W = 20 -200 = 8				
	110						GM	Gray, silty, very sandy GRAVEL (dense, wet)	
30		S-9A S-9B	b2	36	W = 21		SM	Gray, silty, fine to medium SAND, trace organics (wood) (dense, wet)	
	105								
35									



Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-11

Figure A-12
(1 of 2)

B-11

LAI Project No: 1057001.010

SAMPLE DATA						SOIL PROFILE				
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-Stem Auger Ground Elevation (ft): 136.8 (Approximate) Drilled By: Holocene Drilling Logged By: DLO Date: 01/11/08	Groundwater	Moisture Content (%) Plastic Limit 10 20 30 40 Liquid Limit ▲ SPT N-Value ▲ △ Non-Standard N-Value △ 10 20 30 40 × Fines Content (%) × 10 20 30 40
35										
	100	S-10	b2	61			GM	Gray, silty, sandy GRAVEL (very dense, wet)		61
40		S-11	b2	50/ 5"						50/ 5"

Boring Completed 01/11/08
Total Depth of Boring = 40.4 ft.

45
50
55
60
65
70

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

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Totem Lake Mall
Redevelopment
Kirkland, Washington

Log of Boring B-11

Figure
A-12
(2 of 2)

B-12

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 136.9 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/14/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Soil Profile	Groundwater
0						AC	ASPHALT PAVEMENT (3 inches)	
						GP	Brown, sandy GRAVEL (3 inches)	
	135					GM/ SM	Light brown, very sandy, silty GRAVEL to silty, gravelly SAND (medium dense, moist) **(FILL)**	
		S-1	b2	13				
						SM	Light brown, mottled with orange, silty, fine to medium SAND mixed with non-plastic silt, trace gravel (medium dense, moist)	
5		S-2	b2	15	W = 14			
	130					GM	Brown to gray, silty, sandy GRAVEL (medium dense, moist)	
		S-3	b2	12				
						SM	Light brown, silty, fine to coarse SAND with gravel, layered with silty clay (medium dense, moist to wet) - wet sand interbeds at 10 ft	ATD
10		S-4	b2	11	W = 24			
	125					CL	Brown to light brown, sandy CLAY, interbedded with medium to coarse sand (stiff, moist to wet) **(LACUSTRINE / ALLUVIUM)**	
		S-5	b2	14	W = 25 AL			
						ML/ CL	Brown to light brown, mottled with orange and gray, sandy SILT to sandy, silty CLAY, interbedded with silty, medium to coarse sand and gravel (very stiff, moist to wet)	
15		S-6	b2	21	W = 21			
	120					CL-ML	Gray to light brown, mottled with orange, silty, sandy CLAY layered with silty gravel (very stiff, wet)	
20		S-7	b2	16				
	115					CL-ML	Gray, silty CLAY with sand (stiff, wet)	
25		S-8A S-8B	b2	13	W = 25			
	110					CL	Brown to gray, CLAY with sand, interbedded with medium to coarse SAND (stiff, wet)	
30		S-9	b2	10	W = 22 AL			
	105					CL	Gray, CLAY with sand, trace gravel (soft, wet)	
35								

Moisture Content (%) — Plastic Limit 10, 20, 30, 40 Liquid Limit

▲ SPT N-Value ▲ △ Non-Standard N-Value △ — 10, 20, 30, 40

× Fines Content (%) × — 10, 20, 30, 40

Notes:
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2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-12

Figure A-13 (1 of 2)

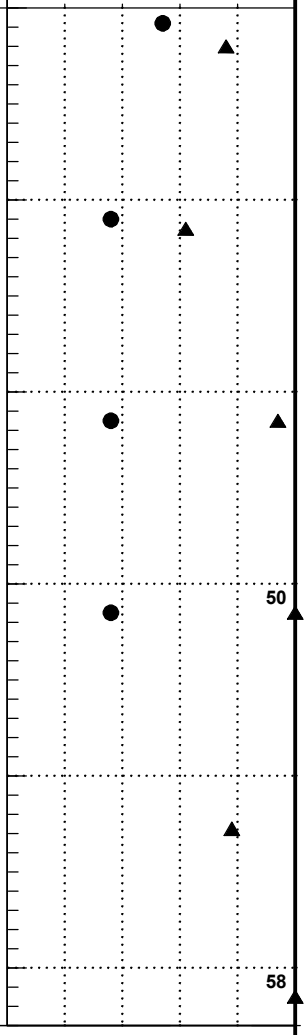
B-12

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 136.9 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/14/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
35		S-10A, S-10B	b2	38	W = 27		GM/ SM	Blue-gray, silty, very sandy GRAVEL to silty, gravelly SAND (dense, wet) **(ABLATION TILL)**	ATD
	100						ML	Gray, very sandy SILT, trace gravel and medium sand interbeds, non-plastic to low plasticity (hard, moist) **(TRANSITIONAL BEDS)**	
40		S-11	b2	31	W = 18				
	95						CL-ML	Gray, sandy, silty CLAY with gravel (hard, moist)	
45		S-12	b2	47	W = 18				
	90						SP-SM	Gray, fine to medium SAND with silt, trace gravel (dense to very dense, wet)	
50		S-13	b2	50	W = 18				
	85								
55		S-14A, S-14B	b2	39			SM	Gray, silty, fine SAND (dense, wet)	
	80						SP	Gray, fine to medium SAND, trace silt and gravel (very dense, wet)	
60		S-15	b2	58					
65									
70									

Moisture Content (%) — Plastic Limit 10, 20, 30, 40, Liquid Limit
▲ SPT N-Value ▲ △ Non-Standard N-Value △ — 10, 20, 30, 40
× Fines Content (%) × — 10, 20, 30, 40



Boring Completed 01/14/08
Total Depth of Boring = 61.5 ft.

Notes:
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1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-12

Figure A-13 (2 of 2)

B-13

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 137.5 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/15/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Description
0							AC	ASPHALT PAVEMENT (4-1/2 inches)
							SW	Brown to light brown, very gravelly, fine to coarse SAND, trace silt (medium dense, moist) **(FILL)**
	135	S-1	b2	25	W = 3			
5		S-2	b2	13	W = 4 GS			
	130	S-3	b2	14			GM	Brown, very sandy, silty GRAVEL (medium dense, moist)
10		S-4	b2	12			GM/ ML	Brown, silty GRAVEL mixed with brown mottled with orange, SILT (medium dense and stiff, moist)
	125	S-5	b2	11	W = 29		ML	Grayish-green, SILT, thin interbeds of gravelly sand spaced at 8 inches, low plasticity (stiff, moist)
								(LACUSTRINE / ALLUVIUM)
15		S-6	b2	23	W = 14		SM/ ML	Gray, very silty, fine to medium SAND, interbedded with non-plastic SILT, trace gravel (medium dense and very stiff, wet)
	120						GP-GM	Gray, sandy GRAVEL with silt (medium dense, wet)
20		S-7	b2	15				
	115							
25		S-8	b2	14				
	110	S-9	b2	12	W = 24		ML	Blue-gray to brown, SILT with fine sand, interbeds of medium to coarse sand and gravel (stiff, wet)
30		S-10	b2	13	W = 26 AL		CL	Gray, CLAY with sand (stiff, wet)
	105						CL-ML	Gray, silty CLAY with sand, trace organics, trace sand and gravel interbeds (medium stiff, wet)
35								

Groundwater: ATD

Moisture Content (%): Plastic Limit 10 — 20 — 30 — 40 Liquid Limit

▲ SPT N-Value ▲ △ Non-Standard N-Value △: 10 20 30 40

× Fines Content (%) ×: 10 20 30 40

Notes:
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3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-13

Figure A-14 (1 of 2)

B-13

LAI Project No: 1057001.010

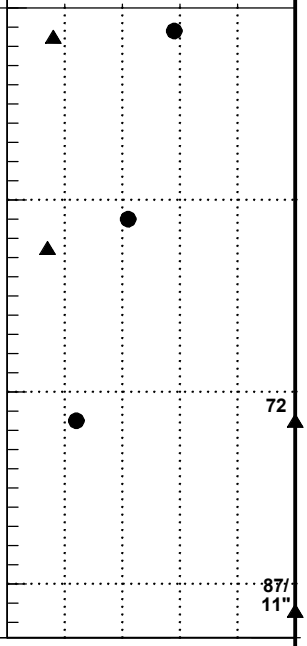
Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 137.5 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/15/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
35		S-11	b2	8	W = 29		CL-ML	Gray, silty CLAY with sand, trace organics, trace sand and gravel interbeds (medium stiff, wet)	
	100						SM	Gray, silty, fine to medium SAND, trace gravel (loose, wet)	
40		S-12A S-12B	b2	7	W = 21		SM/ML	Gray, very silty, fine SAND, interbedded with low plasticity SILT (loose and medium stiff, wet)	
	95						SM	Gray, silty to very silty, fine to medium SAND with gravel (very dense, moist to wet) **(GLACIAL TILL)**	
45		S-13	b2	72	W = 12				
	90								
50		S-14	b2	87/ 11"					
55									
60									
65									
70									

Moisture Content (%) — Plastic Limit 10, 20, 30, 40, Liquid Limit

▲ SPT N-Value ▲ — △ Non-Standard N-Value △ — 10, 20, 30, 40

× Fines Content (%) × — 10, 20, 30, 40



Boring Completed 01/15/08
Total Depth of Boring = 51.4 ft.

Notes:
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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-13

Figure A-14 (2 of 2)

B-14

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 132.6 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/15/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0							AC	ASPHALT PAVEMENT (4 inches)	
							GP	Brown, sandy GRAVEL, 1-inch-minus	
	130	S-1	b2	5	W = 27		SM/ ML	Brown to gray, very silty SAND with gravel to sandy SILT with gravel, abundant organics (wood) (loose and medium stiff, moist)	
								(FILL)	
5		S-2	b2	5	W = 99		OL	Brown to dark brown, sandy, organic SILT with gravel, PEAT, decomposed wood, topsoil (medium stiff, moist)	
	125	S-3	b2	2	W = 29 AL		CL	Greenish-gray, sandy CLAY, trace gravel and organics (soft, wet)	
10		S-4A			W = 31				
		S-4B	b2	3	W = 83		PT	Dark brown to black, PEAT, trace gravel, fibrous (soft, moist) **(LACUSTRINE / ALLUVIUM)**	
	120	S-5A			W = 143				ATD
		S-5B	b2	4	W = 21		CL-ML	Greenish-gray, very sandy, silty CLAY with gravel and fine organics (soft, moist)	
15		S-6	b2	16			SP	Gray, fine to medium SAND, trace silt and gravel (medium dense, wet)	
	115								
20		S-7A			W = 18				
		S-7B	b2	43	W = 12 GS		ML	Gray, very sandy SILT, trace gravel and organics, (hard, moist to wet) **(TRANSITIONAL BEDS)**	
	110								
25		S-8	b2	41	W = 12			- more gravel at 25 ft	
	105						SW-SM	Gray, fine to coarse SAND with silt and gravel, interbedded with low plasticity silt (dense, wet)	
30		S-9	b2	33					
	100						GM/ SM		
35									

Moisture Content (%) — Plastic Limit 10 20 30 40 Liquid Limit

▲ SPT N-Value ▲ — △ Non-Standard N-Value △ — 10 20 30 40

× Fines Content (%) × — 10 20 30 40

99 83 143 53

Notes:
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3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-14

Figure A-15 (1 of 2)

B-14

LAI Project No: 1057001.010

SAMPLE DATA						SOIL PROFILE				
Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Drilling Method: Hollow-Stem Auger Ground Elevation (ft): 132.6 (Approximate) Drilled By: Holocene Drilling Logged By: DLO Date: 01/15/08	Groundwater	Moisture Content (%) Plastic Limit 10 20 30 40 Liquid Limit ▲ SPT N-Value ▲ △ Non-Standard N-Value △ 10 20 30 40 × Fines Content (%) × 10 20 30 40
35		S-10	b2	77			GM/ SM	Gray, mottled with orange, silty, very sandy GRAVEL to silty, very gravelly, fine to medium SAND, interbedded with medium sand (very dense, wet)		77
	95						SM	Gray, silty, fine SAND, thin silt interbeds (very dense, wet)		
40		S-11	b2	63	W = 24					63

Boring Completed 01/15/08
Total Depth of Boring = 41.5 ft.

45
50
55
60
65
70

Notes:
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2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Redevelopment
Kirkland, Washington

Log of Boring B-14

Figure
A-15
(2 of 2)

B-15

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 135.4 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/16/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0	135						AC	ASPHALT PAVEMENT (3 1/2 inches)	
							GP	Brown, sandy GRAVEL	
		S-1	b2	15			GM/ ML	Brown, silty GRAVEL mixed with low plasticity, gravelly SILT (medium dense and stiff, moist)	
								(FILL)	
5	130	S-2	b2	3	W = 15 AL		CL	Blue-gray to green-gray to brown, sandy CLAY with gravel, trace organics (soft, wet)	
		S-3	b2	3					
10	125	S-4	b2	2	W = 13			- gravelly and with organics at 10 ft	
		S-5	b2	2	W = 16			- less gravel at 12.5 ft	ATD
15	120	S-6	b2	1	W = 14 -200 = 30		GC	Blue-gray to brown, sandy, very clayey GRAVEL (very loose, wet)	
							CL	Greenish-gray to light brown, sandy CLAY with gravel, trace organics (peat) (soft, wet)	
20	115	S-7	b2	3	W = 23				
							PT	Brown to dark brown, PEAT (stiff, moist) **(LACUSTRINE / ALLUVIUM)**	
25	110	S-8	b2	14	W = 223				
							GW-GM	Gray, very sandy GRAVEL with silt, trace organics (medium dense, wet)	
30	105	S-9	b2	27	W = 7 GS				
							GM		
35									

Moisture Content (%): Plastic Limit 10 20 30 40 Liquid Limit
▲ SPT N-Value ▲ △ Non-Standard N-Value △: 10 20 30 40
× Fines Content (%) ×: 10 20 30 40

223

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-15

Figure A-16 (1 of 2)

B-15

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 135.4 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/16/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater	Moisture Content (%) / SPT N-Value / Fines Content (%)
35	100	S-10	b2	73/ 11"	W = 9		GM	Gray, silty, very sandy GRAVEL (very dense, wet) **(ADVANCE OUTWASH)**		73/ 11"
							SP	Gray, fine to medium SAND with gravel, trace silt (very dense, wet)		
40	95	S-11	b2	57						57
							SP-SM	Gray, fine to medium SAND with silt and gravel (very dense, wet)		
45	90	S-12A			W = 14					
		S-12B	b2	79			GM	Gray, silty, very sandy GRAVEL (very dense, wet)		79

Moisture Content (%): Plastic Limit 10 — 20 — 30 — 40 Liquid Limit
▲ SPT N-Value ▲ △ Non-Standard N-Value △: 10 20 30 40
× Fines Content (%) ×: 10 20 30 40

Boring Completed 01/16/08
Total Depth of Boring = 46.5 ft.

50
55
60
65
70

Notes:
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2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-15

Figure A-16 (2 of 2)

B-16

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 133.9 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/17/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	USCS Symbol	Soil Profile
0						AC	ASPHALT PAVEMENT (4 inches)
						GP	Brown, GRAVEL (4 inches)
						GP	Brown, GRAVEL, 1-1/2 inch-minus pit run
		S-1	b2	17	W = 9	SM/ ML	Brown to light brown, gravelly, silty SAND mixed with sandy SILT with gravel, non-plastic (medium dense and very stiff, moist)
	130					SM	**(FILL)** Orange-brown, mottled, silty to very silty, fine to coarse SAND with gravel (medium dense, moist)
5		S-2	b2	18	W = 7		
		S-3A			W = 22	CL-ML	Brown to light brown, mottled with orange and gray, sandy, silty CLAY, trace gravel (stiff, moist)
	125	S-3B	b2	9	W = 32	CL	
10						GC/ CL	Blue-green, mottled with brown, CLAY, low plasticity (stiff, moist)
		S-4	b2	9			Gray, GRAVEL mixed with CLAY (loose and stiff, wet)
		S-5	b2	19	W = 26	ML/ CL	Gray to brown, sandy SILT mixed with sandy CLAY (very stiff, moist)
	120						
15		S-6	b2	18			
		S-7	b2	26		GC	Light brown, sandy, clayey GRAVEL, trace organics (medium dense, wet)
	115						
20		S-8	b2	26	W = 17	SM/ ML	Brown, mottled with orange, silty, fine SAND with gravel mixed with gravelly SILT (medium dense and very stiff, wet)
	110					ML	Gray, SILT with fine sand, low-plasticity (very stiff, moist) **(LACUSTRINE / ALLUVIUM)**
25		S-9	b2	19	W = 25 AL		
	105					SM	Gray, very silty, fine to medium SAND with gravel, interbedded with medium sand (medium dense, moist to wet)
30		S-10	b2	29	W = 12		
	100						
35							

Groundwater: ATD

Moisture Content (%) — Plastic Limit 10, 20, 30, 40, Liquid Limit
▲ SPT N-Value ▲ — △ Non-Standard N-Value △ — 10, 20, 30, 40
× Fines Content (%) × — 10, 20, 30, 40

Notes:
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2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-16

Figure A-17 (1 of 2)

B-16

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 133.9 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/17/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
35		S-11A, S-11B, S-11C, S-11D	b2	26	W = 63		CL-ML / PT / SC/CL / PT	Brown to gray, silty CLAY (very stiff, moist); Dark brown to gray, PEAT, interbedded with clay and coarse sand (very stiff, wet); Green to gray, gravelly, clayey SAND interbedded with sandy CLAY with gravel (medium dense and very stiff, wet); Dark brown, PEAT, fibrous (very stiff to hard, dry to moist)	
	95								
40		S-12A, S-12B	b2	81	W = 66		GM/SM	Brown, mottled with orange, very silty, sandy GRAVEL to very silty, gravelly SAND (very dense, wet)	
	90						SP-SM	Brown to orange-brown, fine SAND with silt and gravel (medium dense, wet)	
45		S-13	b2	14	W = 22 GS				
	85						SP-SM	Brown, fine SAND with silt (medium dense, wet)	
50		S-14A, S-14B	b2	13	W = 19 GS		SM / SM	Brown to gray, very silty, fine SAND, thin organic (peat) interbeds (medium dense, wet); Gray, silty, fine to medium SAND with gravel, interbedded with medium sand (very dense, moist to wet) **(GLACIAL TILL)**	
	80								
55		S-15	b2	62					
	75								
60		S-16	b2	77	W = 11				
	70								
65		S-17	b2	71					
70									

Moisture Content (%) — Plastic Limit 10, 20, 30, 40, Liquid Limit
▲ SPT N-Value ▲ (△ Non-Standard N-Value △) 10, 20, 30, 40
× Fines Content (%) × 10, 20, 30, 40

Boring Completed 01/17/08
Total Depth of Boring = 66.5 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-16

Figure A-17 (2 of 2)

B-17

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 142.3 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/17/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0							AC	ASPHALT PAVEMENT (2-1/2 inches)	
							GP	GRAVEL, 1-inch-minus, crushed (9-1/2 inches)	
	140	S-1	b2	29	W = 6		SW	Light brown, fine to coarse SAND, trace silt and gravel (medium dense, moist) **(LACUSTRINE / ALLUVIUM)**	
5		S-2	b2	30			SP-SM	Light brown, fine to medium SAND with silt (medium dense, moist)	
	135	S-3	b2	25	W = 4				
10		S-4	b2	21					
	130	S-5A, S-5B, S-5C	b2	13	W = 8		SW-SM	Orange-brown, mottled, fine to coarse SAND with silt and gravel (medium dense, moist)	
							SM	Gray, silty, fine SAND (medium dense, moist)	ATD
15		S-6	b2	12	W = 16		SP	Orange-brown, mottled, fine to coarse SAND with silt and gravel (medium dense, moist) - wet at 15 ft	
	125						SM	Brown, mottled with orange, medium to coarse SAND, trace silt (medium dense, wet)	
20		S-7	b2	40				Gray, very silty, fine SAND, trace organics (dense, wet) **(TRANSITIONAL BEDS)** - 1/2-inch thick peat layer at 21.0 ft	
	120						SM/ML	Gray, very silty, fine SAND interbedded with fine sandy SILT, non-plastic (dense and hard, moist to wet)	
25		S-8	b2	31	W = 20				
	115						CL	Blue-green, CLAY, trace fine sand, interbedded with silt (hard, moist to wet)	
30		S-9	b2	31	W = 23 AL				
	110						SP-SM	Gray, gravelly, fine to coarse SAND with silt (very dense, wet)	
35									

Moisture Content (%): Plastic Limit 10 — 20 — 30 — 40 Liquid Limit

▲ SPT N-Value ▲ (△ Non-Standard N-Value △): 10 20 30 40

× Fines Content (%) ×: 10 20 30 40

50/

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-17

Figure A-18 (1 of 2)

B-17

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 142.3 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/17/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater	Moisture Content (%) / SPT N-Value / Fines Content (%)
35		S-10	b2	50/ 5"			SP-SM	Gray, gravelly, fine to coarse SAND with silt (very dense, wet)		5"
	105									
40		S-11	b2	63/ 11"			GP-GM	Gray, very sandy GRAVEL with silt (very dense, wet)		63/ 11"
45										
50										
55										
60										
65										
70										

Moisture Content (%): Plastic Limit 10 20 30 40 Liquid Limit
▲ SPT N-Value ▲ △ Non-Standard N-Value △: 10 20 30 40
× Fines Content (%) ×: 10 20 30 40

Boring Completed 01/17/08
Total Depth of Boring = 41.4 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
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3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-17

Figure A-18
(2 of 2)

B-18

LAI Project No: 1057001.010

Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 137.8 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/18/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0							AC	ASPHALT PAVEMENT (3 inches)	
							GM	Brown to gray, very silty GRAVEL (2 inches)	
							SM	Dark brown to gray to blue-gray, silty, fine SAND with gravel, layered with peat and organics (loose to medium dense, moist to wet) **(FILL)**	
	135	S-1	b2	8	W = 17				
5		S-2	b2	22	W = 12				
	130	S-3	b2	23					
							GM	Gray, silty, very sandy GRAVEL, trace wood debris (roots) (medium dense, moist)	
10		S-4	b2	19	W = 4				
	125	S-5	b2	22			SM	Dark brown to brown to blue-gray, silty to very silty, fine to medium SAND with gravel, trace organics (medium dense, moist to wet)	ATD
15		S-6	b2	37	W = 12 GS		SW-SM	Blue-gray to light brown, gravelly, fine to coarse SAND with silt, mixed with green mottled with orange, low plasticity silt (dense, wet)	
	120						DB	Dark brown to black, DEBRIS and WOOD, burned rubber odor (stiff, wet)	
20		S-7	b2	11				- one Remington bullet shell (7.6mm) found in 20 ft sampler	
	115								
25		S-8	b2	7	W = 312		PT	Dark brown to reddish-brown, PEAT, fibrous (soft to stiff, wet) **(LACUSTRINE / ALLUVIUM)** - layered with wood at 25 ft	
	110								
30		S-9	b2	4	W = 222				
	105								
35									

Moisture Content (%) — Plastic Limit 10, 20, 30, 40, Liquid Limit
▲ SPT N-Value ▲ — △ Non-Standard N-Value △ — 10, 20, 30, 40
× Fines Content (%) × — 10, 20, 30, 40

312
222

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-18

Figure A-19 (1 of 2)

B-18

LAI Project No: 1057001.010

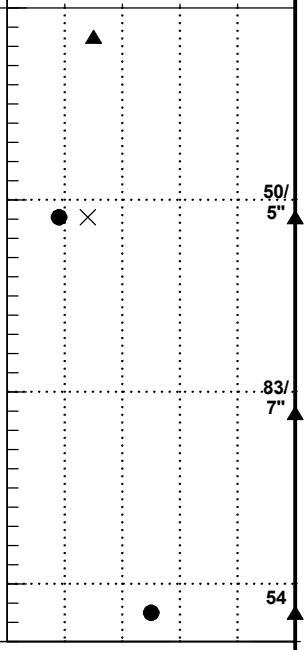
Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 137.8 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/18/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
35		S-10	b2	15			PT	- layered with medium to coarse sand at 35 ft	
	100						GP-GM	Gray, very sandy GRAVEL with silt (very dense, wet) **(ADVANCE OUTWASH)**	
40		S-11	b2	50/5"	W = 9 GS				
	95								
45		S-12	b2	83/7"					
	90						ML	Gray, SILT with fine sand to fine sandy SILT, trace organics, non-plastic (hard, wet) **(TRANSITIONAL BEDS)**	
50		S-13	b2	54	W = 25			- 1 mm organic interbed at 50.5 ft	
55									
60									
65									
70									

Moisture Content (%) — Plastic Limit 10, 20, 30, 40, Liquid Limit

▲ SPT N-Value ▲ — △ Non-Standard N-Value △ — 10, 20, 30, 40

× Fines Content (%) × — 10, 20, 30, 40



Boring Completed 01/18/08
Total Depth of Boring = 51.5 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

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Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-18

Figure A-19 (2 of 2)

B-19

LAI Project No: 1057001.010

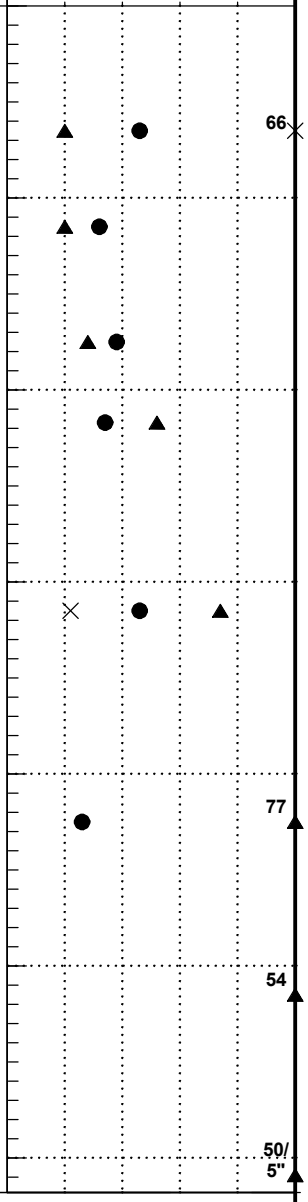
Drilling Method: Hollow-Stem Auger
Ground Elevation (ft): 136.6 (Approximate)
Drilled By: Holocene Drilling
Logged By: DLO Date: 01/18/08

Depth (ft)	Elevation (ft)	Sample Number & Interval	Sampler Type	Blows/Foot	Test Data	Graphic Symbol	USCS Symbol	Soil Profile	Groundwater
0							AC	ASPHALT PAVEMENT (3 inches)	
							GP	Brown, sandy GRAVEL (3-1/2 inches)	
	135						ML	Gray to brown, mottled with orange, very sandy SILT, trace gravel (stiff, moist) **(LACUSTRINE / ALLUVIUM)**	
		S-1	b2	10	W = 23 -200 = 66				
5								- grades light olive-green to gray at 5 ft	
		S-2	b2	10	W = 16				
	130						SM/ ML	Light brown, mottled with orange, very silty, fine SAND, interbedded with non-plastic SILT (medium dense and stiff, moist)	
		S-3A							
		S-3B	b2	14	W = 19		SM/ ML	Blue-gray, mottled with orange-brown, silty, fine to medium SAND, interbedded with low plasticity SILT (medium dense and very stiff, moist to wet)	
10		S-4A							ATD
		S-4B	b2	26	W = 17		SP-SM	Green to gray, fine to medium SAND with silt and gravel (medium dense, wet)	
	125								
15								- grades light brown to gray, less gravel at 15 ft - possible high SPT at 15 ft, pounding on center-plug at 12.5 ft sampler	
		S-5	b2	37	W = 23 GS				
	120								
20								- grades to medium sand with silt at 20 ft	
		S-6A							
		S-6B	b2	77	W = 13		SM	Gray, silty, gravelly, fine SAND, interbedded with medium sand, trace organics (very dense, moist to wet) **(TRANSITIONAL BEDS)**	
	115								
25							SW-SM	Gray, gravelly, fine to coarse SAND with silt (very dense, wet)	
		S-7	b2	54					
	110								
							GP-GM	Gray, very sandy GRAVEL with silt (very dense, wet)	
30		S-8	b2	50/ 5"					
35									

Moisture Content (%) — Plastic Limit 10, 20, 30, 40, Liquid Limit

▲ SPT N-Value ▲ — △ Non-Standard N-Value △ — 10, 20, 30, 40

× Fines Content (%) × — 10, 20, 30, 40



Boring Completed 01/18/08
Total Depth of Boring = 30.9 ft.

Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key" figure for explanation of graphics and symbols.

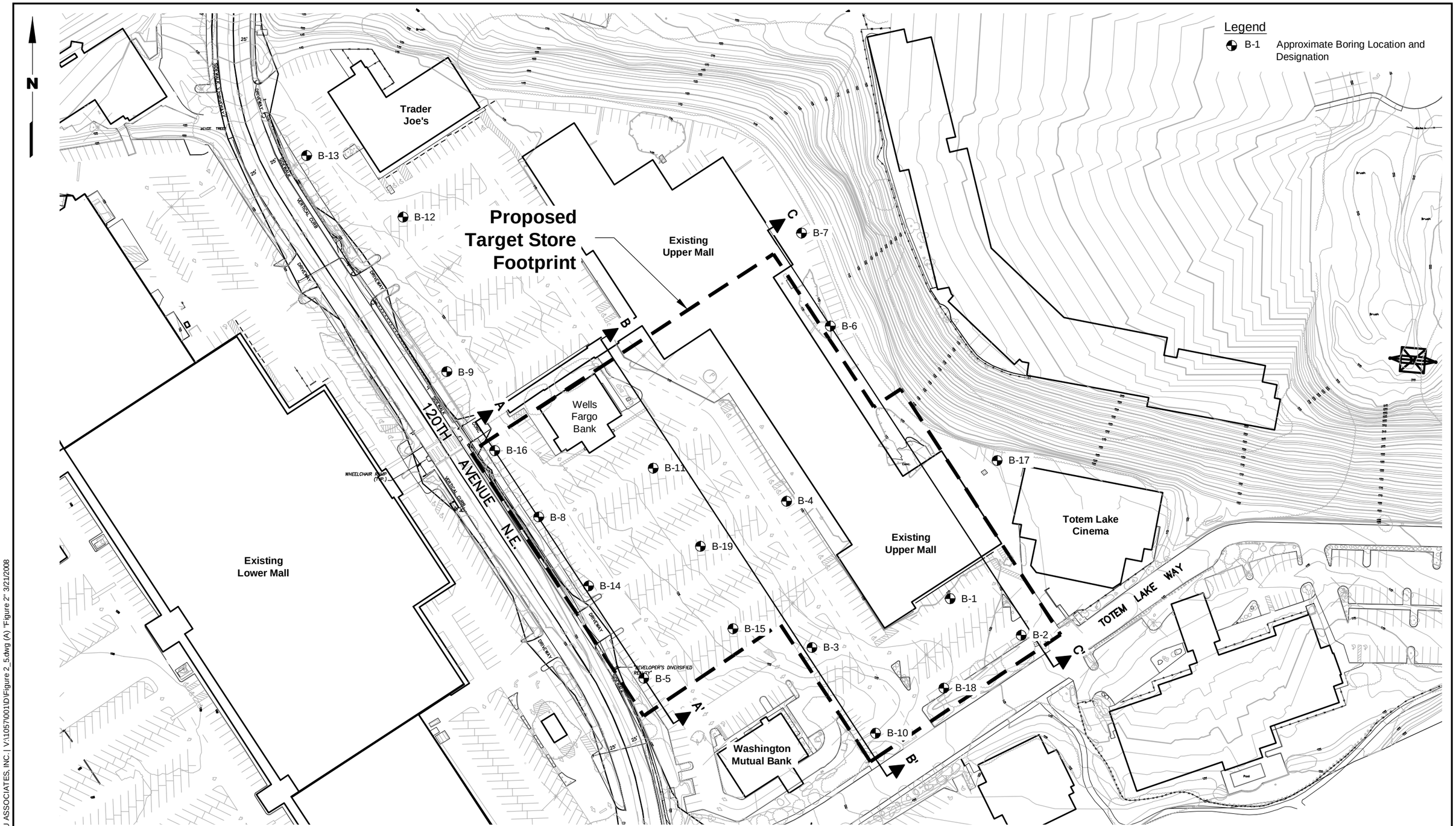
1057001.01 3/13/08 \\EDMDATA\GINT\GINT7\PROJECTS\1057001.010.GPJ SOIL BORING LOG WITH GRAPH

LANDAU ASSOCIATES

Totem Lake Mall Redevelopment
Kirkland, Washington

Log of Boring B-19

Figure A-20



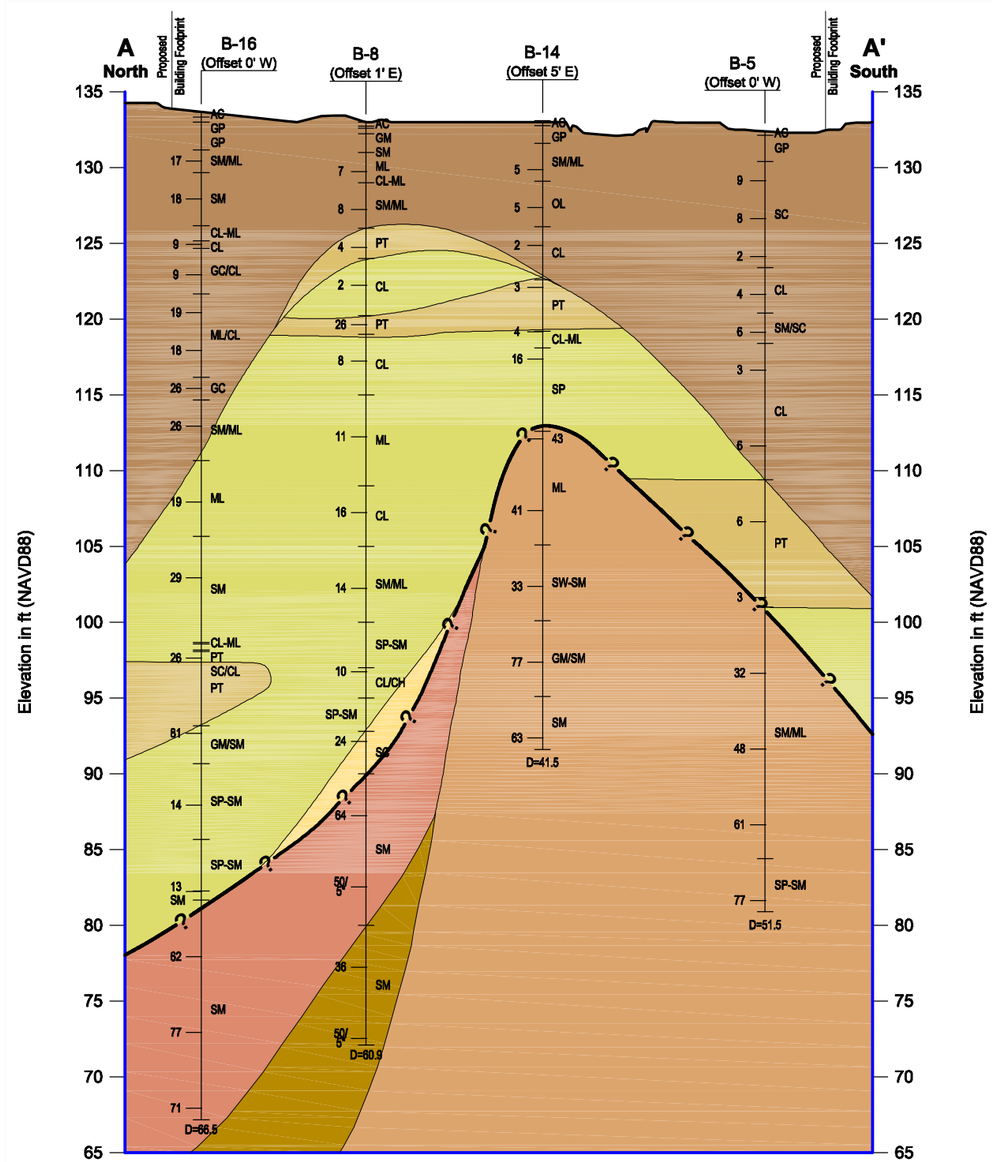
Base map source: Triad Associates (2005)

0 100 200
Scale in Feet

LANDAU ASSOCIATES, INC. | V:\1057\001\D\Figure 2_5.dwg (A) "Figure 2" 3/21/2008

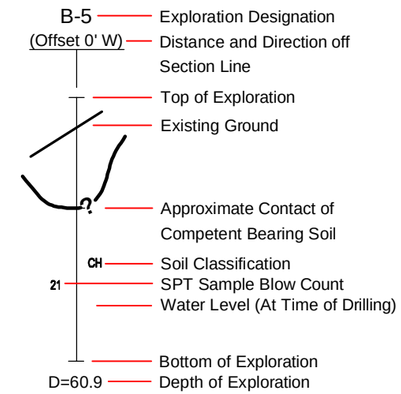
LANDAU ASSOCIATES

Totem Lake Mall Redevelopment Kirkland, Washington	**Site and Exploration Plan**	Figure 2



Geologic Profile Section A-A'

Horizontal Scale in Feet: 1"=80'
Vertical Scale in Feet: 1"=10'



Legend

- FILL - Very loose to medium dense, silty fine sand and silty and clayey gravel. Also contains soft to stiff silt, silty clay, clay, highly organic soil, peat, wood, and debris (refuse)
- LACUSTINE / ALLUVIUM - Loose to medium dense, fine to medium sand with varying amounts of silt and silty gravel. Also contains sandy clay, silty clay, silt, wood, and peat
- PEAT AND WOOD - Generally encountered within the lacustrine / alluvium deposits. Majority of the peat is normally consolidated, although some of the peat encountered appears to be glacially overridden
- ABLATION TILL - Medium dense to dense, silty to very silty sand with gravel and clayey sand. Exhibits similar grain-size structure to glacial till, but lacks the density typical of glacial till
- GLACIAL TILL - Very dense, silty to very silty sand with varying amounts of gravel. This unit can be interbedded with medium sand
- ADVANCE OUTWASH - Dense to very dense, fine to coarse sand with varying amounts of silt and gravel
- TRANSITIONAL BEDS - Dense to very dense, silty to very silty fine sand interbedded with fine sandy silt. Also contain layers of hard, sandy clay and silt. Fine-grained deposits generally observed to contain trace organics

Notes

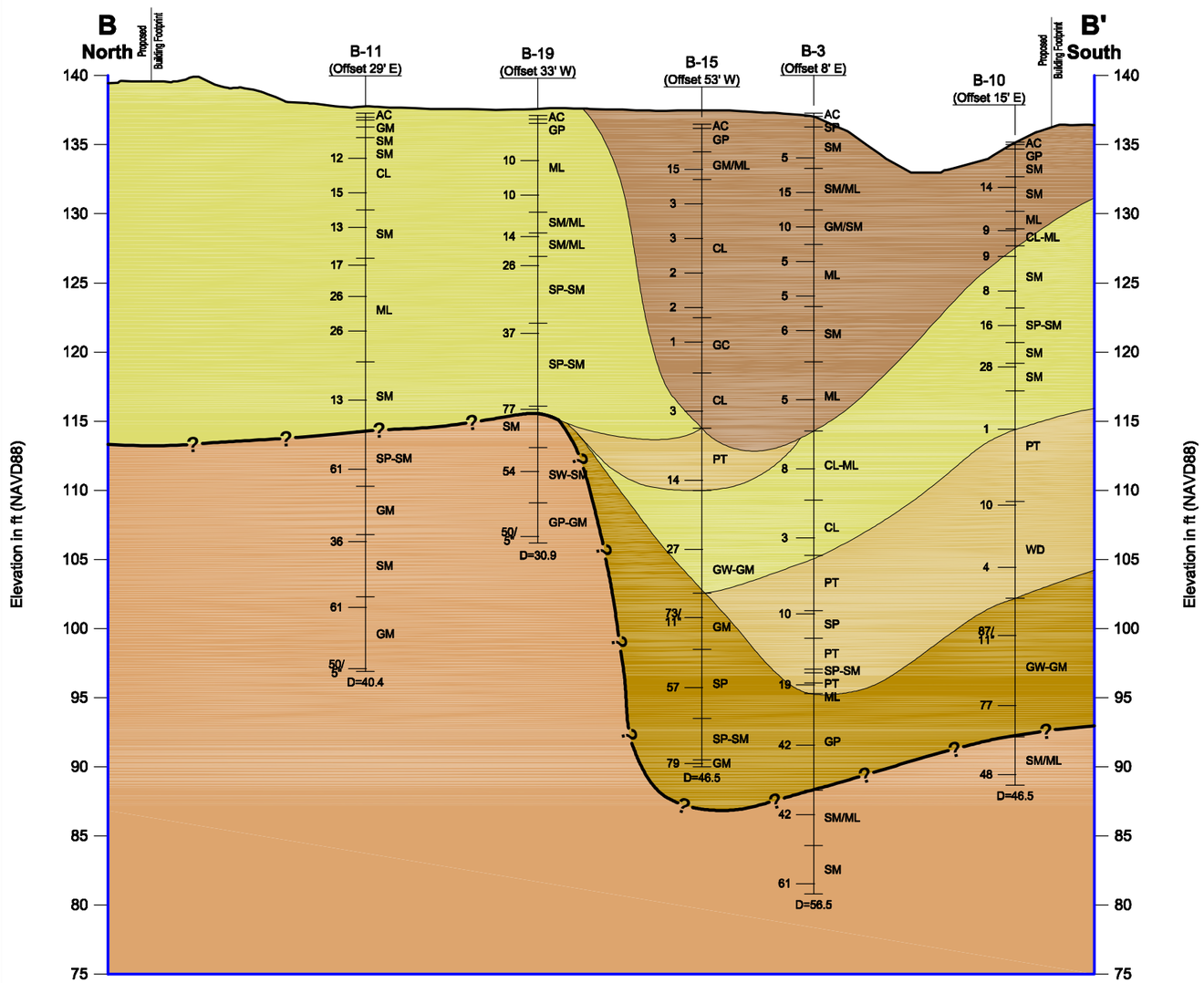
1. Contacts shown are approximate and interpreted from the explorations conducted for this project. Actual transitions may vary laterally and vertically.
2. Soil descriptions are generalized, based on interpretation of field and laboratory data. Stratigraphic contacts are interpolated between widely-spaced explorations and based on topographic features; actual conditions may vary.
3. See report text for descriptions of geologic units.
4. For subsurface profile location, see the Site and Exploration Plan, Figure 2.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160
Scale in Feet

LANDAU ASSOCIATES

Totem Lake Mall Redevelopement Kirkland, Washington	Section A-A'	Figure 3

LANDAU ASSOCIATES, INC. | V:\1057001\D\Figure 2_5.dwg (A) "Figure 3" 3/20/2008



Geologic Profile Section B-B'

Horizontal Scale: 1"=80'
Vertical Scale: 1"=10'

B-5 — Exploration Designation
(Offset 0' W) — Distance and Direction off Section Line
Top of Exploration
Existing Ground
Approximate Contact of Competent Bearing Soil
CH — Soil Classification
21 — SPT Sample Blow Count
Water Level (At Time of Drilling)
Bottom of Exploration
D=60.9 — Depth of Exploration

Legend

- FILL - Very loose to medium dense, silty fine sand and silty and clayey gravel. Also contains soft to stiff silt, silty clay, clay, highly organic soil, peat, wood, and debris (refuse)
- LACUSTINE / ALLUVIUM - Loose to medium dense, fine to medium sand with varying amounts of silt and silty gravel. Also contains sandy clay, silty clay, silt, wood, and peat
- PEAT AND WOOD - Generally encountered within the lacustrine / alluvium deposits. Majority of the peat is normally consolidated, although some of the peat encountered appears to be glacially overridden
- ADVANCE OUTWASH - Dense to very dense, fine to coarse sand with varying amounts of silt and gravel
- TRANSITIONAL BEDS - Dense to very dense, silty to very silty fine sand interbedded with fine sandy silt. Also contain layers of hard, sandy clay and silt. Fine-grained deposits generally observed to contain trace organics

Notes

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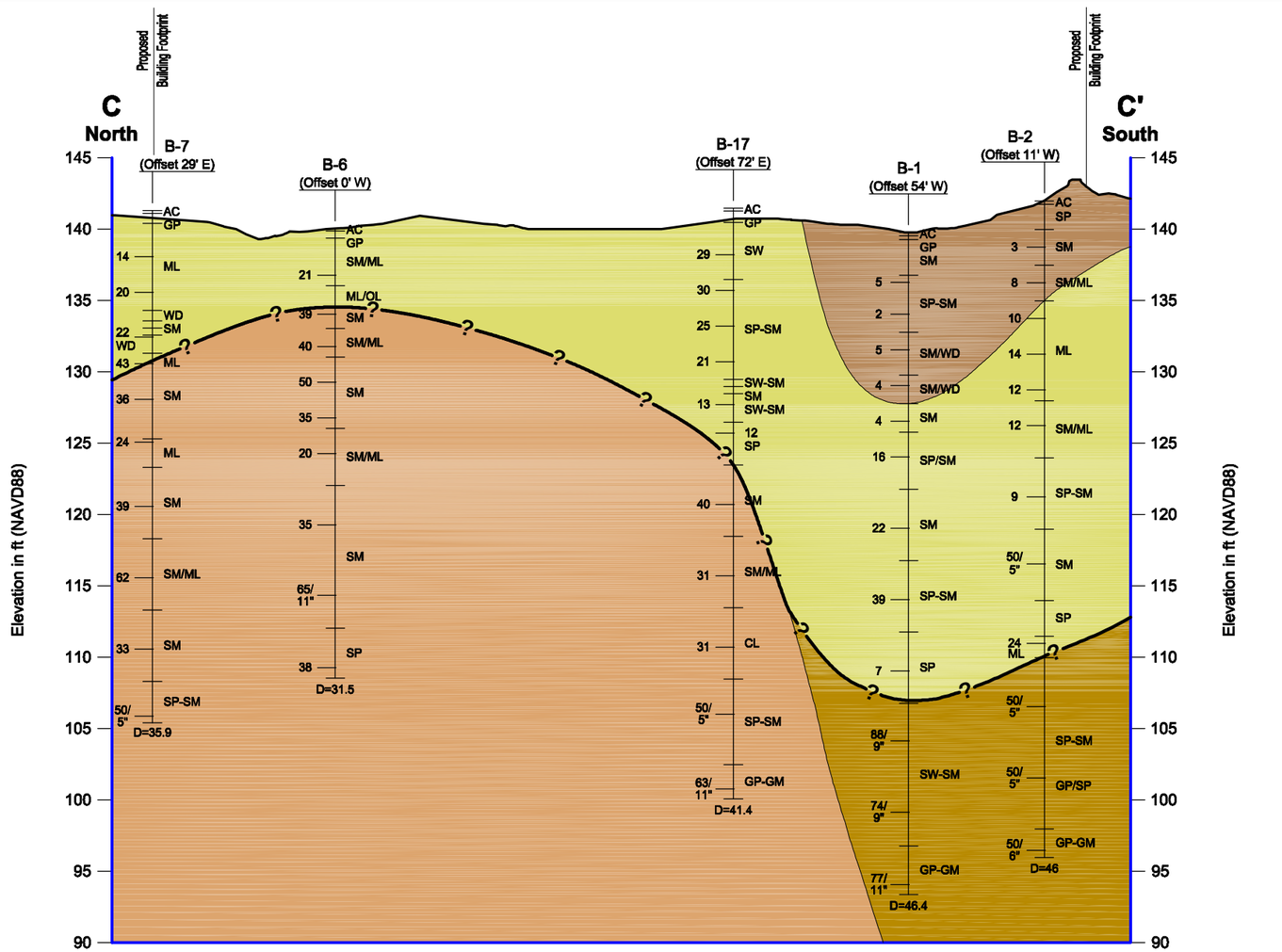
3. See report text for descriptions of geologic units.
4. For subsurface profile location, see the Site and Exploration Plan, Figure 2.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160
Scale in Feet

LANDAU ASSOCIATES

Totem Lake Mall Redevelopement Kirkland, Washington	Section B-B'	Figure 4

LANDAU ASSOCIATES, INC. | V:\1057\001\D\Figure 2_5.dwg (A) "Figure 3" 3/20/2008



Geologic Profile Section C-C'

Horizontal Scale in Feet: 1"=80'
Vertical Scale in Feet: 1"=10'

B-5 — Exploration Designation
(Offset 0' W) — Distance and Direction off Section Line
Top of Exploration
Existing Ground
Approximate Contact of Competent Bearing Soil
CH — Soil Classification
21 — SPT Sample Blow Count
Water Level (At Time of Drilling)
Bottom of Exploration
D=60.9 — Depth of Exploration

Legend

FILL - Very loose to medium dense, silty fine sand and silty and clayey gravel. Also contains soft to stiff silt, silty clay, clay, highly organic soil, peat, wood, and debris (refuse)

LACUSTINE / ALLUVIUM - Loose to medium dense, fine to medium sand with varying amounts of silt and silty gravel. Also contains sandy clay, silty clay, silt, wood, and peat

ADVANCE OUTWASH - Dense to very dense, fine to coarse sand with varying amounts of silt and gravel

TRANSITIONAL BEDS - Dense to very dense, silty to very silty fine sand interbedded with fine sandy silt. Also contain layers of hard, sandy clay and silt. Fine-grained deposits generally observed to contain trace organics

Notes

1. Contacts shown are approximate and interpreted from the explorations conducted for this project. Actual transitions may vary laterally and vertically.
2. Soil descriptions are generalized, based on interpretation of field and laboratory data. Stratigraphic contacts are interpolated between widely-spaced explorations and based on topographic features; actual conditions may vary.
3. See report text for descriptions of geologic units.
4. For subsurface profile location, see the Site and Exploration Plan, Figure 2.
5. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 80 160
Scale in Feet

LANDAU ASSOCIATES

Totem Lake Mall Redevelopement Kirkland, Washington	Section C-C'	Figure 5

LANDAU ASSOCIATES, INC. | V:\1057\001\D\Figure 2_5.dwg (A) "Figure 3" 3/20/2008

ACRONYMS

ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
AC	asphalt concrete
ASTM	American Society for Testing and Materials
BGS	below ground surface
ESAL	equivalent single-axle load
g	gravitational acceleration (32.2 feet/second^2)
H:V	horizontal to vertical
HMA	hot mix asphalt
IBC	International Building Code
MCE	maximum considered earthquake
MSL	mean sea level
NA	not applicable
ohm-cm	ohm-centimeter
OSHA	Occupational Safety and Health Administration
pcf	pounds per cubic foot
pci	pounds per cubic inch
PG	performance grade
ppm	parts per million
psf	pounds per square foot
psi	pounds per square inch
PSI	Professional Service Industries, Inc.
SPT	standard penetration test
WEAP	wave equation analysis program
WSS	Washington Standard Specifications for Road, Bridge, and Municipal Construction (2014)