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GEOTECHNICAL ENGINEERING EVALUATION

ASKO PROCESSING, INC. BUILDING
15701 AND 15801 WOODINVILLE-REDMOND ROAD
WOODINVILLE, WASHINGTON

PREPARED FOR
MR. MIKE KELLY

RECEIVED
DEC 10 2012
CITY OF WOODINVILLE
DEVELOPMENT SERVICES

NGA

NELSON GEOTECHNICAL ASSOCIATES, INC.

GEOTECHNICAL ENGINEERS & GEOLOGISTS

Main Office
17311 – 135th Avenue NE, A-500
Woodinville, WA 98072
(425) 486-1669 FAX (425) 481-2510
(425) 337-1669 Snohomish County

Engineering-Geology Branch
437 East Penny Road
Wenatchee, WA 98801
(509) 665-7696 FAX (509) 665-7692

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November 30, 2012

ASKO Processing, Inc.
Mr. Mike Kelly
434 North 35th Street
Seattle, Washington 98103

Geotechnical Engineering Evaluation
ASKO Processing, Inc. Building
Woodinville, Washington
NGA File No. 867012

Dear Mr. Kelly:

We are pleased to submit the attached report titled "Geotechnical Engineering Evaluation – ASKO Processing, Inc. Building – Woodinville, Washington." This report summarizes our observations of the existing surface and subsurface conditions within the site and provides general recommendations for the proposed site development. Our services were completed in general accordance with our proposal, which you signed on October 31, 2012.

Proposed site development plans include constructing an 80,000-square-foot slab-on-grade building, a parking lot area, an underground detention vault, and underground utilities. Stormwater generated on this site will likely be directed to an underground detention vault. The property is open and mostly covered with grasses, a few scattered trees, and patches of blackberry bushes. The site is moderately sloping down to the east within the western half of the property, grading into gently sloping in the remainder of the site. Wetland areas delineated by others are currently located on the site.

We explored the site subsurface conditions with eight trackhoe-excavated test pits. Our explorations indicated that the site is generally underlain at relatively shallow depths by medium dense to dense older alluvium deposits. The upper one to three feet of material consisted of topsoil/modified ground with older landslide debris (colluvium). We have concluded that the site is generally compatible with the planned development and that the building can be supported on conventional shallow spread footings. Foundation excavations should be advanced through the loose and/or organic material to expose competent alluvium material interpreted to underlie the site for bearing capacity and settlement considerations.

Due to the silty and sensitive nature of most of the soil that was encountered on the site and overall wet site conditions, we recommend that the building foundations be placed on a minimum 12-inch thick layer of 2-inch crushed rock, and that an underslab drainage system be incorporated into the deisgn to help direct water away from the building.

In the attached report, we have also included recommendations for general site grading, erosion control, retaining walls, and drainage. We appreciate the opportunity to provide service to you on this project. Please contact us if you have any questions regarding this report or require further information.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

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Khaled M. Shawish, PE
Principal

Three Copies Submitted

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Geotechnical Engineering Evaluation
ASKO Processing, Inc. Building
Woodinville, Washington

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INTRODUCTION

This report presents the results of our geotechnical engineering investigation and evaluation of the new ASKO Processing, Inc. building located at 15701 and 15801 Woodinville-Redmond Road in Woodinville, Washington, as shown on the Vicinity Map in Figure 1. The purpose of this study is to explore and characterize the site's surface and subsurface conditions, and to provide general geotechnical recommendations for the planned site development. For our use, we have been provided with a site plan titled "ASKO Processing Inc," prepared by Harmsen and Associates, Inc., dated November 2, 2012, showing the site topography and planned building footprint.

The property is open and mostly covered with grasses and patches of blackberry bushes. The proposed project plans include constructing an 80,000-square-foot slab-on-grade building, a parking lot area, an underground detention vault, and underground utilities. Stormwater generated on this site will likely be directed to an underground detention vault. Wetland areas delineated by others are currently located across the site, and new wetland area is proposed to be located within the northwestern portion of the site. We anticipate some cuts and fills along with retaining walls will be generated as part of the site grading plans. The approximate location of the planned building and parking area are shown on the Site Plan in Figure 2.

SCOPE

The purpose of this study is to explore and characterize the site surface and subsurface conditions, and provide general recommendations for the planned development. Specifically, our scope of services includes the following:

1. Review available soil and geologic maps of the area.
2. Explore the subsurface soil and groundwater conditions within the site with trackhoe test pits. The trackhoe was subcontracted by NGA.
3. Install peizometer pipes within two or three test pits for the purpose of monitoring ground water levels, if needed.
4. Perform grain-size sieve analysis on soil samples, as necessary.
5. Provide recommendations for earthwork and foundation support.

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6. Provide recommendations for temporary and permanent slopes.
7. Provide recommendations for retaining walls.
8. Provide recommendations for slab and pavement subgrade preparation.
9. Provide recommendations for site drainage and erosion control.
10. Document the results of our findings, conclusions, and recommendations in a written geotechnical report.

SITE CONDITIONS

Surface Conditions

The property is a rhombus-shaped parcel consisting of two separate parcels for a total of roughly six acres in area. The site is moderately sloping down to the east within the western half of the property grading into gently sloping ground in the remainder of the site. The property is bounded to the north and south by commercial properties, to the east by Woodinville-Redmond Road, and to the west by Burlington Northern Santa Fe Railroad property. The property is covered with tall grasses, a few scattered trees, and scattered patches of blackberry bushes. We observed a few areas of surface water within the southern, northern, and middles areas of the site during our site visit.

Subsurface Conditions

Geology: The geologic units for this area are shown on the Geologic Map of the Kirkland Quadrangle, Washington, by James P. Minard (USGS, 1983). The site is mapped as Qyal (Younger Alluvium) and Qoal (Older Alluvium). The Younger Alluvium is described as mostly sand and organic-rich mud with some peat. The Older Alluvium is described as mostly stratified sand and gravel with sandy organic-rich silts. Our explorations generally encountered silty fine to medium sand, sand with silt, and silt generally consistent with the description of Older Alluvium.

Explorations: The subsurface conditions within the site were explored on Saturday, November 10, 2012 by excavating eight test pits to depths ranging from 6.0 to 12.0 feet below the existing ground surface using a trackhoe. The approximate locations of our explorations are shown on the Site Plan in Figure 2. A geologist from NGA was present during the explorations, examined the soils and geologic conditions encountered, obtained samples of the different soil types, and maintained logs of the test pits.

The soils were visually classified in general accordance with the Unified Soil Classification System, presented in Figure 3. The logs of our test pits are attached to this report and are presented as Figures 4

and 5. We present a brief summary of the subsurface conditions in the following paragraph. For a detailed description of the subsurface conditions, the test pit logs should be reviewed.

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At the surface of Test Pit 1, we encountered about one foot of medium dense, silty fine to medium sand, interpreted to be undocumented fill, underlain by 1.5 feet of buried topsoil/modified ground. At the surface of the remaining test pits and below the buried topsoil in Test Pit 1, we generally encountered medium dense to dense, light gray-brown, fine to medium sand with silt, silty sand, and silt which we interpreted as part of the older alluvium deposits mapped within the site. Most of the test pits had varying amounts of iron-oxide staining. The test pits were terminated at approximate depths ranging between 6.0 to 12.0 feet below the existing ground surface.

Hydrologic Conditions

Groundwater seepage was not encountered in any of the Test Pit 1; however, we did observe three separate areas of ponded surface water during our site visits. This water is most likely associated with the wetlands mapped on the property. This site is approximately 1,000 feet away from the Sammamish River Slough. We did not encounter the groundwater table associated with the slough in our explorations; however, the groundwater table could be encountered in deeper excavations associated with this project. If this condition is encountered, site dewatering should be considered.

Also, a perched groundwater condition could develop on this site due to the silty nature of the site soils. Perched water occurs when surface water infiltrates through less dense, more permeable soils such as the topsoil and undocumented fill, and accumulates on top of a relatively low permeability material such as the dense to dense alluvial soils at depth. Perched water tends to vary spatially and is dependent upon the amount of rainfall. We would expect the amount of perched groundwater to decrease during drier times of the year and increase during wetter periods.

SENSITIVE AREA EVALUATION

Seismic Hazard

We reviewed the 2009 International Building Code (IBC) for seismic site classification for this project. Since medium dense to dense older alluvium soils were encountered at depth in our explorations, the site conditions best fit the description for Site Class D.

Hazards associated with seismic activity include liquefaction potential and amplification of ground motion by soft deposits. Liquefaction is caused by a rise in pore pressures in a loose, fine sand deposit beneath the groundwater table. The medium dense to dense older alluvium material interpreted to underlie the site has a low potential for liquefaction or amplification of ground motion.

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Erosion Hazard

The criteria used for determination of the erosion hazard for affected areas include soil type, slope gradient, vegetation cover, and groundwater conditions. The erosion sensitivity is related to vegetative cover and the specific surface soil types, which are related to the underlying geologic soil units. The Soil Survey of King County Area, Washington, by the Soil Conservation Service (SCS) was reviewed to determine the erosion hazard of the on-site soils. The surface soils for this site were mapped as Indianola loamy fine sand, 4 to 15 percent slopes. The erosion hazard for this material is listed as slight to moderate. It is our opinion that the erosion hazard for site soils should be low in areas where the site is not disturbed.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion from a geotechnical standpoint that the site is compatible with the planned development. Plans include the construction of an 80,000-square-foot building roughly within the middle portion of the site. Our explorations indicated that the site is generally underlain at relatively shallow depths by competent silty and sandy soils that we interpreted as older alluvium. Some undocumented fill/modified ground was encountered on the property. Though we did not encounter fill in most of our other explorations, other areas of fill may be encountered within unexplored areas of the site.

The native soils should provide adequate support for foundation, slab, and pavement loads; however, due to the silty and sensitive nature of most of the soils that will be encountered within the building and pavement areas, we recommend that the building foundation subgrade be over-excavated by a minimum 12 inches and the footings be supported on 12 inches of 2-inch crushed rock. We recommend that the planned structure be designed utilizing shallow foundations. Foundation excavations should extend through any undocumented fill or loose soil to expose the underlying medium dense or better native soil. The crushed rock should then be placed on the medium dense material which should typically be encountered approximately one to three feet below the existing surface, based on our explorations. This is further discussed in the **Foundation Support** subsection of this report.

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We recommend that the slab subgrade be underlain by six inches of clean crushed rock, and extra reinforcement and cold joints be incorporated within the slab. This crushed rock layer can be used as the capillary break. New wetland areas are proposed to be relocated to the northwestern portion of the property. This area is upslope of the planned building. Therefore, it is essential that ample waterproofing and drainage systems be incorporated into this project. Extensive water proofing will need to be installed on this site to prevent the building from experiencing dampness issues. We also recommend that an underslab drainage system be installed below the building slab. This is discussed further in the **Slab-on-Grade** and **Site Drainage** subsections of this report.

Grading plans were not available at the time this report was written. Tall cuts may be anticipated on the western portion of the building to allow for building placement into sloping ground. If cuts taller than eight feet are needed for building construction, the cuts may need to be shored. A shoring system could include a soldier pile wall or a soil nail wall. This can be discussed with the designers and we can provide recommendations for such systems during final design, as needed.

We did not encounter the groundwater table associated with the slough in our explorations; however, the groundwater table could be encountered in deeper excavations associated with this project. If this condition is encountered, site dewatering should be considered. Project budget and schedule should include contingencies for dealing with the water table if such a condition is encountered.

The soils encountered on this site are considered moisture-sensitive, and can disturb easily when wet. We recommend that construction take place during the drier summer months, if possible. If construction is to take place during wet weather, the soils may disturb and additional expenses and delays may be expected due to the wet conditions. Additional expenses could include the need for placing a blanket of rock spalls to protect exposed subgrades and construction traffic areas. Some of the non-organic on-site soils could be used as structural fill provided they could be compacted to specifications. This will depend on the moisture content of the soils at the time of construction. NGA should be retained to determine if the on-site soils can be used as structural fill material during construction.

Under no circumstances, should water be allowed to flow on the sloping ground surface both during construction and after construction have been completed. We recommend that stormwater runoff from the roof drains and other hard surfaces be collected and tightlined to a suitable discharge system such as the detention vault planned at the site. The sloping ground should be protected from erosion. We

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recommend that all disturbed areas be replanted with vegetation to re-establish vegetation cover as soon as possible. Specific recommendations for erosion control are presented in the **Erosion Control and Slope Protection Measures** subsection of this report.

Erosion Control and Slope Protection Measures

The erosion hazard for the on-site soils is listed as slight to moderate, but the actual hazard will be dependent on how the site is graded and how water is allowed to concentrate. Best Management Practices (BMPs) should be used to control erosion. Areas disturbed during construction should be protected from erosion. Erosion control measures may include diverting surface water away from the stripped or disturbed areas. Silt fences and/or straw bales should be erected to prevent muddy water from leaving the site or flowing down the sloping ground surface. Stockpiles should be covered with plastic sheeting during wet weather. Disturbed areas should be planted as soon as practical and the vegetation should be maintained until it is established. The erosion potential for areas not stripped of vegetation should be low.

Protection of the site should be performed as required by the City of Woodinville. Specifically, we recommend that the sloping ground outside of the development areas not be disturbed or modified through placement of any fill or removal of the existing vegetation. Fill placed on sloping ground should be placed as structural fill. Landscaping areas and replacement of vegetation should be performed in accordance with the city code. Under no circumstances should water be allowed to concentrate on the sloping ground.

Site Preparation and Grading

After erosion control measures are implemented, site preparation should consist of removing loose soils, topsoil, and any undocumented fill, to expose medium dense or better native soils in building and pavement areas. The stripped soil should be removed from the site or stockpiled for later use as landscaping fill. Based on our observations, we anticipate native, medium dense or better soil to be encountered approximately one to three feet across the site, but these depths could increase in unexplored areas of the site.

After site preparation, if the exposed subgrade is deemed to be loose, it should be compacted to a non-yielding condition and then proof-rolled with a heavy rubber-tired piece of equipment. Areas observed to pump or weave during the proof-roll test should be reworked to structural fill specifications or over-excavated and replaced with properly compacted structural fill or rock spalls. If loose soils are

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encountered in the pavement areas, the loose soils should be removed and replaced with rock spalls or granular structural fill. If significant surface water flow is encountered during construction, this flow should be diverted around areas to be developed, and the exposed subgrades should be maintained in a semi-dry condition.

If wet conditions are encountered, alternative site grading techniques might be necessary. These could include using large excavators equipped with wide tracks and smooth buckets to complete site grading, and covering exposed subgrade with a layer of crushed rock for protection. If wet conditions are encountered or construction is attempted in wet weather, the subgrade should not be compacted, as this could cause further subgrade disturbance. In wet conditions, it may be necessary to cover the exposed subgrade with a layer of crushed rock as soon as it is exposed to protect the moisture sensitive soils from disturbance by machine or foot traffic. The prepared subgrade should be protected from construction traffic and surface water should be diverted around areas of prepared subgrade.

The site soils are considered to be moisture-sensitive and will disturb easily when wet. We recommend that construction take place during the drier summer months if possible. However, if construction takes place during the wet season, additional expenses and delays should be expected due to the wet conditions. Additional expenses could include the need for placing a blanket of rock spalls on exposed subgrades, construction traffic areas, and paved areas prior to placing structural fill. Wet weather grading will also require additional erosion control and site drainage measures. Some of the on-site soils may be suitable for use as structural fill, depending on the moisture and organic content of the soil at the time of construction. NGA should be retained to evaluate the suitability of all on-site and imported structural fill material during construction.

Temporary and Permanent Slopes

Temporary cut stability is a function of many factors, including the type and consistency of soils, depth of the cut, surcharge loads adjacent to the excavation, length of time a cut remains open, and the presence of surface or groundwater. It is exceedingly difficult under these variable conditions to estimate a stable, temporary, cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe slope configurations since he is continuously at the job site, able to observe the subsurface materials and groundwater conditions encountered and able to monitor the nature and condition of the cut slopes.

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The following information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Nelson Geotechnical Associates, Inc. assumes responsibility for job site safety. Job site safety is the sole responsibility of the project contractor.

For planning purposes, we recommend that temporary cuts in the on-site soils be no steeper than 2 Horizontal to 1 Vertical (2H:1V). If significant groundwater seepage or surface water flow were encountered, we would expect that flatter inclinations would be necessary. We recommend that cut slopes be protected from erosion. The slope protection measures may include covering cut slopes with plastic sheeting and diverting surface runoff away from the top of cut slopes. We do not recommend vertical slopes for cuts deeper than four feet, if worker access is necessary. We recommend that cut slope heights and inclinations conform to appropriate OSHA/WISHA regulations. Tall cuts may be needed on the western portion of the building. If tall cuts taller than eight feet are needed, the cuts may need to be shored. A shoring system could include a soldier pile wall or a soil nail wall. We are available to provide specific recommendations for such systems if they become necessary.

Permanent cut and fill slopes should be no steeper than 2H:1V, unless specifically approved by NGA. Also, flatter inclinations may be required in areas where loose soils are encountered. Permanent slopes should be vegetated and the vegetative cover maintained until established. This can be discussed with the designers and we can provide recommendations, as needed.

Foundation Support

Conventional shallow spread foundations for the planned structure should be placed on a minimum of 12 inches of 2-inch crushed rock founded on medium dense or better native soils. Medium dense soils should be encountered approximately one to three feet below ground surface based on our explorations. However, these depths may increase in unexplored areas of the site. Where undocumented fill or less dense soils are encountered at the planned elevations for crushed rock placement, the subgrade should be over-excavated to expose suitable bearing soil. The over-excavation may be filled with crushed rock. The crushed rock zone should extend outside the edges of the footing a distance equal to one half of the depth of the over-excavation below the bottom of the footing.

Footings should extend at least 18 inches below the lowest adjacent finished ground surface for frost protection and bearing capacity considerations. Foundations should be designed in accordance with the 2009 IBC. Footing widths should be based on the anticipated loads and allowable soil bearing pressure.

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Water should not be allowed to accumulate in footing trenches. All loose or disturbed soil should be removed from the foundation excavation prior to placing the rock spall layer.

For foundations constructed as outlined above, we recommend an allowable design bearing pressure of not more than 2,000 pounds per square foot (psf) be used for the design of footings placed on crushed rock that are founded on the medium dense or better native soils extending to the competent native material. The foundation bearing soil should be evaluated by a representative of NGA. We should be consulted if higher bearing pressures are needed. Current IBC guidelines should be used when considering increased allowable bearing pressure for short-term transitory wind or seismic loads. Potential foundation settlement using the recommended allowable bearing pressure is estimated to be less than one-inch total and ½-inch differential between adjacent footings or across a distance of about 20 feet, based on our experience with similar projects.

Lateral loads may be resisted by friction on the base of the footing and passive resistance against the subsurface portions of the foundation. A coefficient of friction of 0.35 may be used to calculate the base friction and should be applied to the vertical dead load only. Passive resistance may be calculated as a triangular equivalent fluid pressure distribution. An equivalent fluid density of 200 pounds per cubic foot (pcf) should be used for passive resistance design for a level ground surface adjacent to the footing. This level surface should extend a distance equal to at least three times the footing depth. These recommended values incorporate safety factors of 1.5 and 2.0 applied to the estimated ultimate values for frictional and passive resistance, respectively. To achieve this value of passive resistance, the foundations should be poured "neat" against the native medium dense soils or compacted fill should be used as backfill against the front of the footing. We recommend that the upper one foot of soil be neglected when calculating the passive resistance.

Structural Fill

General: Fill placed beneath foundations, pavement, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction. The area to receive the fill should be suitably prepared as described in the **Site Preparation and Grading** subsection of this report prior to beginning fill placement. Sloping areas to receive structural fill should be benched prior to fill

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placement to key the fill into the slope. The benches should be level and have a minimum width of six to eight feet. The benches should be constructed by cutting into the native sloping ground, then fill can be placed on the level benches.

Materials: Structural fill should consist of a good quality, granular soil, free of organics and other deleterious material, and be well graded to a maximum size of about three inches. All-weather structural fill should contain no more than five-percent fines (soil finer than U.S. No. 200 sieve, based on that fraction passing the U.S. 3/4-inch sieve). The use of some of the on-site soils as structural fill should be feasible, but will be highly dependent on moisture and organic contents of the material at the time construction takes place. We should be retained to evaluate proposed structural fill material prior to placement.

Fill Placement: Following subgrade preparation, placement of structural fill may proceed. All fill placements should be accomplished in uniform lifts up to eight inches thick. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts.

All structural fill underlying building areas and pavement subgrade should be compacted to a minimum of 95 percent of its maximum dry density. Maximum dry density, in this report, refers to that density as determined by the ASTM D-1557 Compaction Test procedure. The moisture content of the soils to be compacted should be within about two percent of optimum so that a readily compactable condition exists. It may be necessary to over-excavate and remove wet soils in cases where drying to a compactable condition is not feasible. All compaction should be accomplished by equipment of a type and size sufficient to attain the desired degree of compaction.

Slab-on-Grade

The site soils are relatively inconsistent and are highly moisture sensitive. We recommend that the slab subgrade be covered with a minimum of six inches of 1-1/4-inch clean crushed rock. This crushed rock layer could act as the capillary break. The new slab could be supported on the firm crushed rock subgrade, but the slab should be additionally reinforced and doweled cold joints incorporated in the slab design.

Slabs-on-grade should be supported on subgrade soils prepared as described above and in the **Site Preparation and Grading** subsection of this report. We recommend that all floor slabs be underlain by

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at least six inches of 1-1/4-inch crushed rock. The crushed rock should have less than three percent by weight of the material passing Sieve #200 if it is to be used as a capillary break. We recommend that an underslab drain system will be placed within the crushed rock layer. The drains should consist of 4-inch perforated PVC lateral pipes connected to a main 6-inch pipe that runs lengthwise down the building. This is further discussed in the **Site Drainage** subsection of this report. A suitable vapor barrier, such as heavy plastic sheeting (6-mil minimum), should be placed over the capillary break material. An additional 2-inch thick moist sand layer may be used to cover the vapor barrier. This sand layer is optional and is intended to protect the vapor barrier membrane during construction.

Retaining Walls

Retaining walls are anticipated to be needed for this project although final grading plans have not been finalized at the time this report was prepared. The lateral pressure acting on subsurface retaining walls is dependent on the nature and density of the soil behind the wall, the amount of lateral wall movement which can occur as backfill is placed, wall drainage conditions, and the inclination of the backfill. For walls that are free to yield at the top at least one thousandth of the height of the wall (active condition), soil pressures will be less than if movement is limited by such factors as wall stiffness or bracing (at-rest condition). We recommend that walls supporting horizontal backfill and not subjected to hydrostatic forces, be designed using a triangular earth pressure distribution equivalent to that exerted by a fluid with a density of 40 pcf for yielding (active condition) walls, and 60 pcf for non-yielding (at-rest condition) walls.

These recommended lateral earth pressures are for a drained granular backfill and are based on the assumption of a horizontal ground surface behind the wall for a distance of at least the subsurface height of the wall, and do not account for surcharge loads. Additional lateral earth pressures should be considered for surcharge loads acting adjacent to subsurface walls and within a distance equal to the subsurface height of the wall. This would include the effects of surcharges such as traffic loads, floor slab loads, slopes, or other surface loads. We could consult with the structural engineer regarding additional loads on retaining walls during final design, if needed.

The lateral pressures on walls may be resisted by friction between the foundation and subgrade soil, and by passive resistance acting on the below-grade portion of the foundation. Recommendations for frictional and passive resistance to lateral loads are presented in the **Foundations** subsection of this report.

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All wall backfill should be well compacted as outlined in the **Structural Fill** subsection of this report. Care should be taken to prevent the buildup of excess lateral soil pressures due to over-compaction of the wall backfill. This can be accomplished by placing wall backfill in 8-inch loose lifts and compacting the backfill with small, hand-operated compactors within a distance behind the wall equal to at least one-half the height of the wall. The thickness of the loose lifts should be reduced to accommodate the lower compactive energy of the hand-operated equipment. The recommended level of compaction should still be maintained.

Permanent drainage systems should be installed for retaining walls. Recommendations for these systems are found in the **Subsurface Drainage** subsection of this report. We recommend that we be retained to evaluate the proposed wall drain backfill material and observe installation of the drainage systems.

Pavement Subgrade

Pavement subgrade preparation and structural filling where required, should be completed as recommended in the **Site Preparation and Grading** and **Structural Fill** subsections of this report. The pavement subgrade should be proof-rolled with a heavy, rubber-tired piece of equipment, to identify soft or yielding areas that require repair. We should be retained to observe the proof-rolling and recommend subgrade repairs prior to placement of the asphalt or hard surfaces.

We recommend that the prepared subgrade be covered with a minimum 6-inch thick layer of 2-inch crushed rock prior to placement of the pavement base section. The intent of the crushed rock layer is to provide a firm subgrade for the planned pavement and to protect the site soils against disturbance by construction traffic.

Site Drainage

Surface Drainage: The finished ground surface should be graded such that runoff is directed to an appropriate stormwater collection system. Water should not be allowed to collect in any areas where footings, slabs, or pavements are to be constructed. Final site grades should allow for drainage away from the structures. We suggest that the finished ground be sloped at a minimum gradient of three percent, for a distance of at least 10 feet away from the structures. Surface water should be collected by permanent catch basins and drain lines, and be routed into an appropriate discharge system.

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Subsurface Drainage: If groundwater is encountered during construction, we recommend that the contractor slope the bottom of the excavation and collect the water into ditches and small sump pits where the water can be pumped from the excavation and routed to a suitable discharge point.

We recommend the use of footing drains around the structure along with ample waterproffing. Footing drains should be installed at least one foot below planned finished floor elevation. The drains should consist of a minimum 4-inch-diameter, rigid, slotted or perforated, PVC pipe surrounded by free-draining material wrapped in a filter fabric. We recommend that the free-draining material consist of an 18-inch-wide zone of clean (less than three-percent fines), granular material placed along the back of walls. Washed rock is an acceptable drain material, or drainage composite may be used instead. The free-draining material or the drainage composite should extend up the wall to one foot below the finished surface. The top foot of backfill should consist of low permeability soil placed over plastic sheeting or building paper to minimize the migration of surface water or silt into the footing drain. Footing drains should discharge into tightlines leading to an appropriate collection and discharge point with convenient cleanouts to prolong the useful life of the drains. Roof drains should not be connected to wall or footing drains.

We recommend that an underslab drainage system be installed within and below the capillary break material. The system should consist of a 6-inch perforated PVC pipe that runs lengthwise down the middle of the building. Four-inch perforated PVC lateral pipes that are spaced 10 to 20 feet apart should be connected perpendicularly to the main pipe. The main 6-inch drain should be sloped to drain towards the main drainage system that outlets into the detention vault.

CONSTRUCTION MONITORING

We should be retained to provide construction monitoring services during site grading to evaluate subgrade conditions, cut conditions, fill compaction, and drainage installation.

USE OF THIS REPORT

NGA has prepared this report for ASKO Processing, Inc. and their agents for use in the planning and design of the development planned on this site only. The scope of our work does not include services related to construction safety precautions and our recommendations are not intended to direct the contractors' methods, techniques, sequences, or procedures, except as specifically described in our report

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for consideration in design. There are possible variations in subsurface conditions between the explorations and also with time. Our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions. A contingency for unanticipated conditions should be included in the budget and schedule.

We recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications. We should be contacted a minimum of one week prior to construction activities and could attend pre-construction meetings if requested.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this report was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

o-O-o

EXHIBIT 7
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It has been a pleasure to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Bala Dodoye-Alali
Project Geologist

KHALED M. SHAWISH
STATE OF WASHINGTON
PROFESSIONAL ENGINEER
EXPIRES 7/28/13

11/30/12

Khaled M. Shawish, PE
Principal

Five Figures Attached

cc: Camie Anderson - Shockey Planning Group (via email)

BD:KMS:bd

EXHIBIT 7
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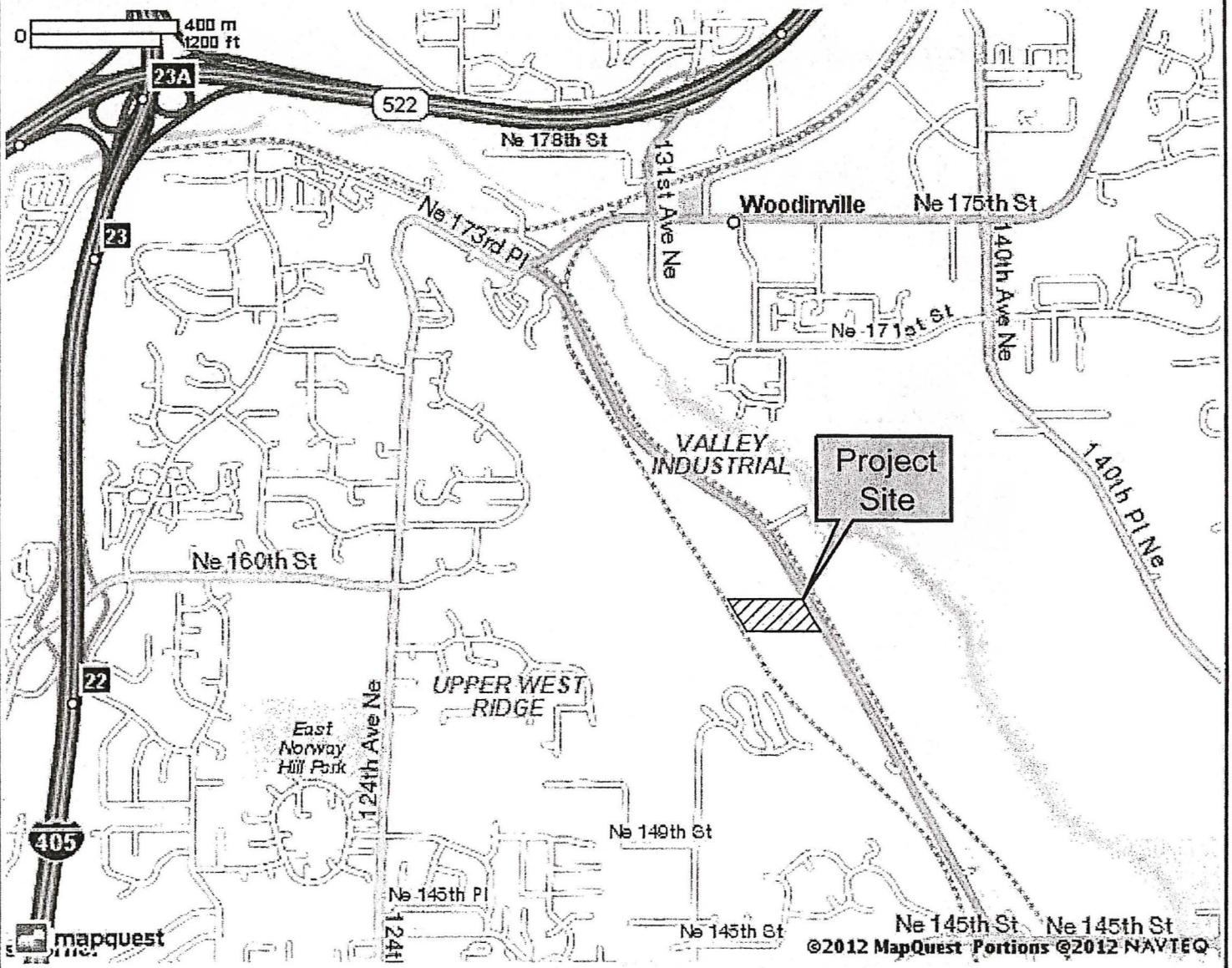
VICINITY MAP

Not to Scale

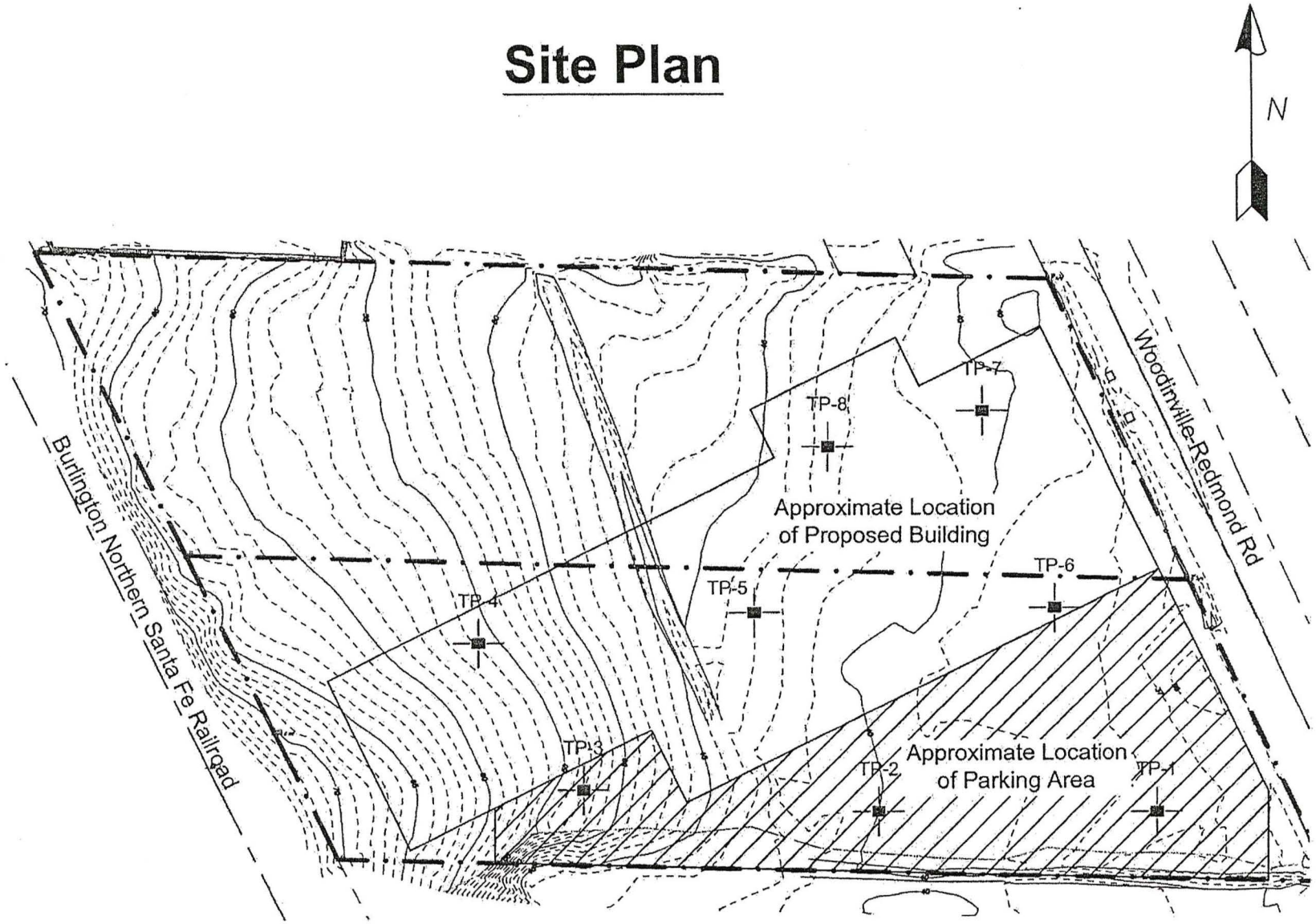


Woodinville, WA

Project Number 867012	ASKO Processing, Inc. Vicinity Map	NELSON GEOTECHNICAL ASSOCIATES, INC. NGA GEOTECHNICAL ENGINEERS & GEOLOGISTS	No.	Date	Revision	By	CK
Figure 1		17311-135th Ave. NE, A-500 Woodinville, WA 98072 (425) 486-1669 / Fax 481-2510; Snohomish County (425) 339-1569 Wenatchee/Chelan (509) 665-7696 www.nelsongeotech.com	1	11/14/12	Original	DPN	BD

VGA Drafting 2012\867012 ASKO\VM.dwg

Site Plan



LEGEND

Property line

TP-1 Number and approximate location of test pit

0 100 200

Scale: 1 inch = 100 feet

EXHIBIT 7
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Reference: Site plan based on a plan dated November 2, 2012 titled "ASKO Processing Inc." and, prepared by Harmsen & Associates, Inc.

NGA Drafting 2012\867012 ASKO\SP.dwg

Project Number 867012

Figure 2

ASKO Processing, Inc.
Site Plan

NELSON GEOTECHNICAL ASSOCIATES, INC.
GEOTECHNICAL ENGINEERS & GEOLOGISTS
17311-135th Ave. NE, A-500
Woodinville, WA 98072
(425) 486-1669 / Fax 481-2510
Snohomish County (425) 337-1669
Wenatchee/Chelan (509) 885-7998
www.nelsongeotech.com

No.	Date	Revision	By	CK
1	11/14/12	Original	DPN	BD

UNIFIED SOIL CLASSIFICATION SYSTEM

EXHIBIT 7
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MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE - GRAINED SOILS MORE THAN 50 % RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE - GRAINED SOILS MORE THAN 50 % PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50 %	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 % OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FLAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.

2) Soil classification using laboratory tests is based on ASTM D 2488-93.

3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water.

Wet - Visible free water or saturated, usually soil is obtained from below water table

Project Number 867012	ASKO Processing, Inc. Soil Classification Chart	NGA Nelson Geotechnical Associates, Inc. Geotechnical Engineers & Geologists	No.	Date	Revision	By	CK
Figure 3		17311-135th Ave. NE, A-500 Woodinville, WA 98072 (425) 488-1669 / Fax 481-2510; Snohomish County (425) 337-1669 Wenatchee/Chelan (509) 665-7698 www.nelsongeotech.com	1	11/14/12	Original	DPN	BD

NGA Drafting 2012\867012 ASKO\SC.dwg

LOG OF EXPLORATION

DEPTH (FEET)	USC	SOIL DESCRIPTION
TEST PIT ONE		
0.0 – 0.1		GRASSES
0.1 – 1.0		LIGHT BROWN-GRAY, SILTY FINE TO MEDIUM SAND (MEDIUM DENSE, MOIST) (**FILL**)
1.0 – 2.5		BROWN, SILTY SAND **(BURIED TOPSOIL /MODIFIED GROUND)** (LOOSE, MOIST)
2.5 – 9.3	SM\ML	LIGHT BROWN-GRAY, SILTY FINE SAND WITH IRON-OXIDE STAINING AND TRACE ORGANICS TO SILT WITH SAND (MEDIUM DENSE, MOIST)
		SAMPLES WERE COLLECTED AT 0.8, 4.0, AND 9.3 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 9.3 FEET ON 11/10/12
TEST PIT TWO		
0.0 – 0.1		GRASSES
0.1 – 2.0		TOPSOIL
2.0 – 3.9	SM	LIGHT GRAY-BROWN, SILTY FINE TO MEDIUM SAND WITH TRACE ROOTS AND IRON-OXIDE STAINING (MEDIUM DENSE, DRY TO MOIST)
3.9 – 8.8	SM/SP-SM	LIGHT GRAY-BROWN, SILTY FINE TO MEDIUM SAND WITH IRON-OXIDE STAINING TO FINE SAND WITH SILT LENSES (MEDIUM DENSE, MOIST)
		SAMPLES WERE COLLECTED AT 2.8 AND 6.5 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 8.8 FEET ON 11/10/12
TEST PIT THREE		
0.0 – 0.1		GRASSES
0.1 – 1.4		TOPSOIL WITH ROOTS
1.4 – 8.0	SP-SM	LIGHT GRAY-BROWN, FINE SAND WITH SILT (MEDIUM DENSE, MOIST)
8.0 – 10.5	SP-SM	GRAY, FINE TO COARSE SAND WITH GRAVEL AND SILT (MEDIUM DENSE, MOIST TO WET)
		SAMPLES WERE COLLECTED AT 5.0 AND 10.5 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 10.5 FEET ON 11/10/12
TEST PIT FOUR		
0.0 – 0.1		GRASSES
0.1 – 0.2		TOPSOIL WITH ROOTS
0.2 – 2.0	SM	GRAY-BROWN, SILTY FINE TO COARSE SAND WITH ROOTS (MDEIUM DENSE, MOIST) (MODIFIED GROUND)
2.0 – 12.0	SP-SM/ SM	BROWN-GRAY, FINE TO COARSE SAND WITH SILT AND GRAVEL TO SILTY FINE TO COARSE SAND WITH IRON-OXIDE STAINING IN UPPER 2 TO 4 FEET (MEDIUM DENSE, MOIST TO WET)
		SAMPLE WAS COLLECTED AT 7.5 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 12.0 FEET ON 11/10/12

BD:bd

LOG OF EXPLORATION

DEPTH (FEET)	USC	SOIL DESCRIPTION
TEST PIT FIVE		
0.0 – 0.1		GRASSES
0.1 – 1.5		TOPSOIL WITH ROOTS
1.5 – 7.5	SP-SM	LIGHT BROWN-GRAY, FINE TO MEDIUM SAND WITH SILT, SILT LENSES, IRON-OXIDE STAINING, AND TRACE GRAVEL (MEDIUM DENSE, MOIST)
		SAMPLE WAS COLLECTED AT 7.5 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 7.5 FEET ON 11/10/12
TEST PIT SIX		
0.0 – 0.1		GRASSES
0.1 – 1.3		TOPSOIL WITH ROOTS
1.3 – 6.0	SM	BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH IRON-OXIDE STAINING (MEDIUM DENSE TO DENSE, MOIST)
		SAMPLE WAS COLLECTED AT 6.0 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 6.0 FEET ON 11/10/12
TEST PIT SEVEN		
0.0 – 0.1		GRASSES
0.1 – 1.8		TOPSOIL WITH ROOTS
1.8 – 5.0	SM	BROWN-GRAY, FINE SAND WITH SILT AND IRON-OXIDE STAINING (MEDIUM DENSE TO DENSE, MOIST)
5.0 – 6.2	ML	BROWN-GRAY SILT WITH FINE SAND (MEDIUM DENSE, MOIST)
		SAMPLES WERE COLLECTED AT 4.0 AND 6.2 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 6.2 FEET ON 11/10/12
TEST PIT EIGHT		
0.0 – 0.1		GRASSES
0.1 – 1.5		TOPSOIL WITH ROOTS
1.5 – 7.0	SP-SM	BROWN-GRAY, FINE TO MEDIUM SAND WITH SILT, SILT LENSES, AND IRON-OXIDE STAINING (MEDIUM DENSE TO DENSE, MOIST)
		SAMPLE WAS COLLECTED AT 7.0 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 7.0 FEET ON 11/10/12