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December 13, 2006

JN 06417

Strider Group, LLC
914 – 164th Street Southeast, #1682
Mill Creek, Washington 98012

Attention: Ms. Chris Reum

Subject: **Transmittal Letter – Geotechnical Engineering Study**
Proposed Auto Dealership
26429, 26475, and 26505 Pacific Highway South
Des Moines, Washington

Dear Ms. Reum:

We are pleased to present this geotechnical engineering report for the proposed development of a new automobile dealership located on three adjacent tracts at 26429, 26475, and 26505 Pacific Highway South in Des Moines, Washington. The scope of our services consisted of exploring site surface and subsurface conditions, and then developing this report to provide recommendations for general earthwork, design criteria for business office foundations, and pavement design considerations. This work was authorized by your acceptance of our proposal P-7210, dated November 17, 2006.

The attached report contains a discussion of the study and our recommendations. Please contact us if there are any questions regarding this report, or for further assistance during the design and construction phases of this project.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

James H. Strange, P.E.
Geotechnical Project Manager

GB/JHS: jyb

GEOTECHNICAL ENGINEERING STUDY
Proposed Auto Dealership
26429, 26475, and 26505 Pacific Highway South
Des Moines, Washington

This report presents the findings and recommendations of our geotechnical engineering study for the site of a proposed automobile dealership to be located at 26429, 26475, and 26505 Pacific Highway South in Des Moines, Washington. The property consists of three adjacent tracts (Tracts 4, 5 and 6) totaling about 2.9 acres in size.

Development of the property is in the planning stage; therefore, detailed plans were not made available to us. However, based on discussions with Ms. Chris Reum of Strider Group, LLC, and a land title survey and topographic survey of the site by GeoDimensions, we understand that the partially cleared property would be graded to a relatively level condition, and that a business-sales office would be constructed on Tract 6, which is at 26429 Pacific Highway South. Except for a vegetation buffer along the west side of the property, the remainder of the site would be paved for an automobile sales lot. At this time no basement in the structure is anticipated. If a basement were to be considered, it could very well be impacted by the groundwater at the site. Similarly, a deep stormwater vault could be impacted by the groundwater. If either of these are anticipated, Geotech Consultants, Inc. should be contacted for further analysis and recommendations.

If the scope of the project changes from what we have described above, we should be provided with revised plans in order to determine if modifications to the recommendations and conclusions of this report are warranted.

SITE CONDITIONS

SURFACE

The Vicinity Map, Plate 1, illustrates the general location of the site, which is situated on the west side of Pacific Highway South. The property is bounded to the south by a manufactured wood shed sales lot, to the north by the Hanwoori Mission Church and associated parking lots, and to the west by an existing single-family residential subdivision.

The site has been graded in the past, perhaps several times. A cut slope, ranging from about 4 to 7 feet high, extends roughly 130 lineal feet east-west between the Hanwoori Mission Church and the north side of the property. The cut slope declines from the church property down into the subject site at grades ranging from 15 to about 30 percent. The front (eastern) portion of the site is nearly flat from periods of past grading. Portions of this area have been surfaced with gravel to form an entry road into the site. The west side of the site slopes upwards about 2 to 6 feet towards the backyards of the westerly adjacent residential subdivision. Past grading and filling in the southwest portion of the site has left several 5- to 8-foot-high mounds above the current grade in that area. These mounds appear to be spoil piles consisting mostly of fill material. Smaller bulldozer push piles and shallow cuts are present over much of the site. Small, shallow topographic depressions are located adjacent to the mounds at the southwest corner of the site and near the northwest corner of the property. It is unclear whether the topographic depressions are from grading or past geologic conditions.

Upper story site vegetation consists mostly of a few, scattered clusters of maple trees and a variable cover of mostly Red alder trees ranging from 1-inch-diameter saplings to trees about 6 inches in diameter. Lower story vegetation, where present, includes mostly grass and dense patches of Himalayan blackberry vines.

The site is littered with a considerable amount of trash and miscellaneous debris that has accumulated for many years. Several homeless encampments have developed under the cover of trees and blackberries. Much of the trash and debris appears to surround these camps.

We observed no signs or evidence of cutslope failures or other signs of significant mass wastage of soil on the site. No cutslope groundwater seepage or springs were observed.

SUBSURFACE

The subsurface conditions at the site were explored on December 5, 2006 by excavating 10 test pits (TP-1 through TP-10) using a rubber-tire (tractor) backhoe at the approximate locations shown on the Exploration Site Plan, Plate 2. Our exploration program was based on the possible layout of the proposed new car dealership, observed site conditions, anticipated subsurface conditions and those encountered during exploration, and the scope of work outlined in our proposal.

A senior engineering geologist from our staff observed the test pit excavations, logged the soils observed in the test pits, and obtained representative samples of the soil encountered. The Test Pit Logs are attached as Plates 3 through 7.

Soil Conditions

Our test pit explorations indicate that the site is covered with a thin layer of topsoil overlying native glacial recessional soil deposits. However, past grading and filling resulted in a variable thickness of man-placed fill overlying native soils on the south and west portions of the site.

Fill was observed in Test Pit TP-2 to a depth of 9 feet below ground surface (bgs), TP-3 (5 feet bgs), TP-4 (2 feet bgs), TP-8 (1 foot bgs), TP-9 (2 feet bgs), and TP-10 (2 feet bgs). No fill was observed in Test Pits TP-1, TP-5, TP-6, and TP-7. The fill distribution and depths vary because of the way the site was apparently graded. It appears that past grading in the northeast portion of the site created a relatively level, flat area with no fill observed; much of this area was cut and the cut soils were likely pushed to other portions of the site as fill. Thin layers of fill were observed in TP-8, TP-9, and TP-10, suggesting that the cut soils from the northeast corner were spread to level the southeast corner of the site. About 2 feet of fill was encountered in TP-4, suggesting that fill from the cut slope below the church was spread to the northwest corner of the site. TP-1, excavated at nearly the southwest property corner, showed that no fill had been placed in this immediate area. However, the overall topography and presence of isolated mounds in the southwest quarter of the site clearly indicates past grading and filling in this area. Test Pits TP-2 and TP-3, excavated near the tops of two mounds showed fill to 9 feet bgs, and 5 feet bgs, respectively. The amount of fill in the test pits suggests that fill was pushed to nearly the west border of the site and some left over fill was simply pushed or end-dumped as spoil piles. Please note that the depth of fill in the mounds is misleading; if the depth of the fill in the mounds is subtracted from the mound heights, it appears that the bottom of the fill is near the grade (elevation) of Pacific Highway. The fill varies in quality and is very loose to loose. The fill in TP-2 and TP-8 contained a considerable amount of miscellaneous debris and trash.

Underlying the fill, and exposed just below forest duff and about 6 to 12 inches of dark brown, sandy topsoil over the rest of the site, are native soils consisting of interlayered silt, sand, silty sand, and gravel in a loose to medium dense condition. We interpret these soils to be post-glacial recessional outwash deposits. These soils were deposited when the Vashon-age glacier that invaded the Puget Sound area about 14,000 years ago began melting back (receding) north towards Canada. Silt, sand, and gravel from outwash streams emanating from the receding glacier filled topographic depressions (kettles) formed by melting ice blocks. These soils were deposited in a very loose/very soft condition but locally may have been compacted to a medium dense condition by the weight of overburden soils. The recessional soils observed in the test pits extended to the bottom (maximum extent) of these explorations, which were typically taken to about 10 to 13 feet bgs. The loose/soft recessional soils became medium dense at about 6 feet bgs in TP-1, TP-3 and TP- 6, 11 feet bgs in TP-2, 2 feet in TP-4, 4 feet in TP-5 and TP-7, 3 feet bgs in TP-8 and TP-9, and 5 feet bgs in TP-10. Caving was observed in TP-1 through TP-4, and TP-7 and TP-8. We noted that the gravel layers in the recessional soils in TP-7 and TP-9 dip downwards about 30 to 40 degrees northward, indicating that portions of the site at one time may have sloped northward, perhaps as part of a topographic kettle depression.

Groundwater Conditions

Very slight groundwater seepage was observed in the fill at 4 feet bgs in TP-2. Moderate to strong groundwater flow was observed at about 9.5 feet bgs in the recessional soils in test pit TP-3 and 5 to 9 feet bgs in recessional soils in TP-4. The strong flow of groundwater into test pits TP-3 and TP-4, and presence of topographic depressions along the west side of the site, may indicate that prior to site grading and filling there might have been a small drainage or pond area that extended roughly northward across the site. The 30 to 40 degree northward dip of the recessional gravel layers in the test pits further suggests that the site may have sloped northward in the past, possibly as part of a kettle depression, as discussed above.

It should be noted that groundwater levels vary seasonally with rainfall and other factors. We anticipate that some groundwater will likely be found in the loose fill and recessional soils on the site. We believe that silt layers may interbed with the recessional soils, possibly creating localized, discontinuous, nearly impervious layers that might tend to restrict the infiltration of water that accumulates in the recessional soils. In this case, a seasonally-perched groundwater system might develop. Thus, some groundwater seepage might be observed in excavations on the site during particularly prolonged rainfall or during wet winter-spring months.

The final logs represent our interpretations of the field logs. The stratification lines on the logs represent the approximate boundaries between soil types at the exploration locations. The actual transition between soil types may be gradual, and subsurface conditions can vary between exploration locations. The logs provide specific subsurface information only at the locations tested. The relative densities and moisture descriptions indicated on the logs are interpretive descriptions based on the conditions observed during our explorations.

The compaction of backfill in the test pits was not in the scope of our services. Loose soil will therefore be found in the area of the test pits. The backfill will need to be removed and replaced with compacted structural fill during construction, especially in areas where pavements will be placed for automobile sales lots.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.

The approximate west portion of the site is covered with fill ranging in depth from 2 to 9.5 feet bgs. Please note that the depths of fill in TP-2 and TP-3 are misleading in that the test pits were dug near the tops of obvious fill mounds that extend 5 to 8 feet above the existing grade near the southwest corner of the site. Underlying the fill, and exposed near the surface over much of the east portion of the site, is very loose to medium-dense recessional soils, mostly consisting of sand and gravel. The loose recessional soils became medium dense at variable depths, ranging from 2 bgs to as deep as 11 feet bgs. Typically, the recessional soils became medium dense at depths below about 3 to 6 feet bgs except in fill mound areas. Substantial groundwater flow was encountered in recessional sand and gravel at 9.5 feet bgs in TP-3, and in recessional gravel at 5 to 9 feet bgs in TP-4. However, it is possible that some groundwater might be encountered in excavations anywhere on the site during or following intense rainstorms or in wet winter-spring conditions. If a basement were to be considered it could very well be impacted by the groundwater at the site. Similarly, a deep stormwater vault could be impacted by the groundwater. If either of these are anticipated, Geotech Consultants, Inc. should be contacted for further analysis and recommendations.

The anticipated main geotechnical engineering concerns for the project would be foundation support for a new business-sales office on Tract 6, and pavement support for the remainder of the site. The new business office may be supported on conventional concrete foundations bearing on minimum of 2 feet of newly-placed and compacted structural fill overlying, re-compacted recessional soils. The existing topsoil and fill on the site are not suitable for office foundation support. Based on the anticipated finished floor elevation of the building, it is likely that most of the topsoil and fill soils in the area of the new office building will be removed during the planned excavations for foundations. Similarly, the loose fill soils should be removed from the slab areas of the structure.

Due to their organic content and very loose consistency, the existing topsoil and fill should be removed from beneath the pavement areas. The exposed recessional soils at planned pavement subgrade should be prepared and re-compacted, as described in the ***General Earthwork and Structural Fill Section***.

The surficial site soils, including the upper portions of the recessional soils, contain significant amounts of silt and therefore may be sensitive to disturbance when wet. As such, if the bottoms of the office excavations are wet at the time of foundation construction, it might be necessary to protect exposed subgrades with a thin layer of ballast rock, or crushed rock. The erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered. We anticipate that a silt fence will be needed around the downslope sides of any cleared areas until business office and pavement area excavations are lowered below the surrounding grades or are otherwise stabilized. The nearest downstream catch basins on Pacific Highway South should be protected with premanufactured silt socks. Rocked construction access roads should be extended from Pacific Highway South into the site to reduce the amount of mud carried off the property by trucks and equipment. Cut slopes and soil stockpiles should be covered with plastic tarps (visqueen) anchored with sandbags during wet weather. Following rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface.

The drainage and/or waterproofing recommendations presented in this report are intended only to prevent active seepage from flowing through concrete walls or slabs. Even in the absence of active seepage into and beneath structures, water vapor can migrate through walls, slabs, and floors from the surrounding soil, and can even be transmitted from slabs and foundation walls due to the concrete curing process. Water vapor also results from occupant uses, such as the coffee rooms or wash/restrooms that would normally be found in a car dealership showroom/office. Excessive water vapor trapped within structures can result in a variety of undesirable conditions, including, but not limited to, moisture problems with flooring systems, excessively moist air within occupied areas, and the growth of molds, fungi, and other biological organisms that may be harmful to the health of the occupants. The designer or architect must consider the potential vapor sources and likely occupant uses, and provide sufficient ventilation, either passive or mechanical, to prevent a build up of excessive water vapor within the planned structure.

Another geotechnical consideration for development of this site is the relatively silty site soils, particularly the silty sand portion of the underlying recessional soils glacial till soils at the site. These fine-grained silty soils are not considered free-draining and should not be used for backfill directly against walls. However, the cleaner sand portions of the recessional soils may be suitable. It will be difficult, unfortunately, to separate the silty portions from the cleaner sand in the recessional on-site soils. Thus, imported, washed builder's sand or very coarse clean sand and gravel may be needed for wall backfill.

Geotech Consultants, Inc. should be allowed to review the final development plans to verify that the recommendations presented in this report are adequately addressed in the design. Such a plan review would be additional work beyond the current scope of work for this study, and it may include revisions to our recommendations to accommodate site, development, and geotechnical constraints that become more evident during the review process.

We recommend including this report, in its entirety, in the project contract documents. This report should also be provided to any future property owners so they will be aware of our findings and recommendations.

SEISMIC CONSIDERATIONS

In accordance with Table 1615.1.1 of the 2003 International Building Code (IBC), the site soil profile within 100 feet of the ground surface is best represented by Soil Profile Type D (Stiff Soil Profile). The design criteria presented in this report consider the effects of a one-in-100-years seismic event. The native recessional soils have a low susceptibility to seismic liquefaction in areas of the site where the soils are freely drained (no groundwater seepage present). The groundwater encountered in the western portion of the site appears trapped in the medium-dense gravel beds which would be anticipated to have a relatively low susceptibility to seismic liquefaction, especially when considering the densification of the native soil proposed for the footing areas and the new compacted structural fill that will be used beneath the new footings.

CONVENTIONAL FOUNDATIONS

The new office building can be supported on conventional concrete continuous and spread footings bearing on a 2-foot minimum layer of newly placed compacted structural fill. The existing topsoil and fill should be removed from the building envelope and any footing areas. We recommend that the building foundation areas be over-excavated 2 feet below planned grade and that the existing recessional soils at that excavated grade be improved by moisture conditioning (if needed) and compaction to a firm, non-yielding condition. New structural fill should be placed in individual lifts with each lift not exceeding 1-foot in un-compacted thickness. The new fill should be compacted in accordance to recommendations provided in the following section entitled ***General Earthwork and Structural Fill***. The total compacted thickness of new structural fill should be a minimum of 2 feet. We recommend that the bearing layer be defined as the re-compacted recessional outwash deposits that underlie the fill and topsoil on the site.

We recommend that continuous and individual spread footings have minimum dimensions of 18 and 24 inches, respectively, when constructed as described above. The feasibility and cost implications of the above recommendations should be discussed with the foundation contractor.

An allowable bearing pressure of 2,500 pounds per square foot (psf) is appropriate for the new office building footings bearing on a minimum of two-feet of structural fill that has been placed on the defined prepared, compacted bearing layer soils, as recommended above. If an underground stormwater detention vault will be constructed at the site, the vault footings should bear directly on prepared, compacted recessional soils and can be designed for an allowable bearing capacity of 2,000 psf. A one-third increase in these design bearing pressures may be used when considering short-term wind or seismic loads. For the above design criteria, it is anticipated that the total post-construction settlement of footings founded on new structural fill placed over prepared, compacted recessional soils, will be less than 1 inch, with differential settlements also on the order of 3/4 inch between adjacent columns.

Lateral loads due to wind or seismic forces may be resisted by friction between the foundation and the bearing layer, or by passive earth pressure acting on the vertical, embedded portions of the foundation. For the latter condition, the foundation must be either poured directly against relatively level, and prepared glacial till bearing layer, or be surrounded by level structural fill. We recommend using the following ultimate values for the foundation's resistance to lateral loading:

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.50
Passive Earth Pressure	350 pcf

Where: (i) pcf is pounds per cubic foot, and (ii) passive earth pressure is computed using the equivalent fluid density.

If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. The values for friction and passive resistance are ultimate values and do not include a safety factor.

PERMANENT FOUNDATION AND RETAINING WALLS

Retaining walls backfilled on only one side should be designed to resist the lateral earth pressures imposed by the soil they retain. The following recommended parameters are for permanent walls that restrain level backfill:

PARAMETER	VALUE
Active Earth Pressure * 1) Yielding walls 2) Restrained walls	 1) 35 pcf 2) 22**H** psf
Soil Unit Weight	125 pcf

Where: (i) pcf is pounds per cubic foot and the active and passive earth pressure is computed using the equivalent fluid pressures, and (ii) psf is pounds per square foot. H is the effective design height of the wall, including surcharges.

*** Restrained walls are those that cannot deflect at least 0.002 times its height.**

The values given above are to be used to design permanent foundation and retaining walls only. It is not appropriate to back-calculate soil strength parameters from the earth pressures and soil unit weights presented in the table. Values for passive soil pressure and coefficient of friction are presented in the previous section. Restrained wall soil parameters should be utilized for a distance of 1.5 times the wall height from corners or bends in the walls. This is intended to reduce the amount of cracking that can occur where a wall is restrained by a corner.

The design values given above do not include the effects of any hydrostatic pressures behind the walls and assume that no surcharges, such as those caused by slopes, vehicles, or adjacent foundations will be exerted on the walls. If these conditions exist, those pressures should be added to the above lateral soil pressures. Where sloping backfill is desired behind the walls, we will need to be given the wall dimensions and the slope of the backfill in order to provide the appropriate design earth pressures. The surcharge due to traffic loads behind a wall can typically be accounted for by adding a uniform pressure equal to 2 feet multiplied by the above active fluid density.

Heavy construction equipment should not be operated behind retaining and foundation walls within a distance equal to the height of a wall, unless the walls are designed for the additional lateral pressures resulting from the equipment. The wall design criteria assume that the backfill will be well-compacted in lifts no thicker than 12 inches. The compaction of backfill near the walls should be accomplished with hand-operated equipment to prevent the walls from being overloaded by the higher soil forces that occur during compaction.

Retaining Wall Backfill and Waterproofing

Backfill placed behind retaining or foundation walls should be coarse, free-draining structural fill containing no organics. This backfill should contain no more than 3 percent silt- or clay-sized particles and have no gravel greater than 3 inches in diameter. The percentage of particles passing the No. 4 sieve should be between 25 and 70 percent. If the existing on-site native soils are used for backfill in the upper slope portions of the building walls, a minimum 18-inch width of free-draining builder's sand or coarse sand and gravel should be placed against the backfilled retaining walls. Free-draining backfill or gravel should be used for the entire width of the backfill where seepage is encountered. For increased protection, drainage composites should be placed along cut slope faces, and the walls should be backfilled entirely with free-draining soil.

The purpose of these backfill requirements is to ensure that the design criteria for a retaining wall are not exceeded because of a build-up of hydrostatic pressure behind the wall. The top 12 to 18 inches of the backfill should consist of a compacted, relatively impermeable soil or topsoil, or the surface should be paved. The ground surface must also slope away from backfilled walls to reduce the potential for surface water to percolate into the backfill. The section entitled ***General Earthwork and Structural Fill*** contains recommendations regarding the placement and compaction of structural fill behind retaining and foundation walls.

The above recommendations are not intended to waterproof below-grade walls or to prevent the formation of mold, mildew, or fungi in interior spaces. Over time, the performance of subsurface drainage systems can degrade, subsurface groundwater flow patterns can change, and utilities can break or develop leaks. Therefore, waterproofing should be provided where future seepage through the walls is not acceptable. This typically includes limiting cold-joints and wall penetrations, and using bentonite panels or membranes on the outside of the walls. Waterproofing systems should be installed by an experienced contractor familiar with the anticipated construction and subsurface conditions. Applying a thin coat of asphalt emulsion to the outside face of a wall is not considered waterproofing, and will only help to reduce moisture generated from water vapor or capillary action from seeping through the concrete. As with any project, adequate ventilation of basement areas is important to prevent a build up of water vapor that is commonly transmitted through concrete walls from the surrounding soil, even when seepage is not present. This is appropriate even when waterproofing is applied to the outside of foundation and retaining walls. We recommend that you contact a specialty consultant if detailed recommendations or specifications related to waterproofing design, or minimizing the potential for infestations of mold and mildew are desired.

SLABS-ON-GRADE

The building floors can be constructed as slabs-on-grade atop a minimum 1-foot-thick layer of structural fill that has been placed over prepared, re-compacted recessional outwash deposit soils. The existing fill and topsoils should be removed from the slab areas. For slabs-on-grade, the exposed recessional soils must have moisture conditioned (if needed) and compacted to a firm, non-yielding condition at the time of slab construction or underslab fill placement. Any soft areas encountered should be excavated and replaced with select, imported structural fill. If necessary to adjust grades or to provide a leveling surface, these overexcavations can be backfilled with structural fill.

All slabs-on-grade should be underlain by a capillary break or drainage layer consisting of a minimum 4-inch thickness of coarse, free-draining structural fill with a gradation similar to that discussed in ***Permanent Foundation and Retaining Walls***.

As noted by the American Concrete Institute (ACI) in the *Guides for Concrete Floor and Slab Structures*, proper moisture protection is desirable immediately below any on-grade slab that will be covered by tile, wood, carpet, impermeable floor coverings, or any moisture-sensitive equipment or products. ACI also notes that vapor *retarders*, such as 6-mil plastic sheeting, are typically used. A vapor retarder is defined as a material with a permeance of less than 0.3 US perms per square foot (psf) per hour, as determined by ASTM E 96. It is possible that concrete admixtures may meet this specification, although the manufacturers of the admixtures should be consulted. Where plastic sheeting is used under slabs, joints should overlap by at least 6 inches and be sealed with adhesive tape. The sheeting should extend to the foundation walls for maximum vapor protection. If no potential for vapor passage through the slab is desired, a vapor *barrier* should be used. A vapor barrier, as defined by ACI, is a product with a water transmission rate of 0.00 perms per square foot per hour when tested in accordance with ASTM E 96. Reinforced membranes having sealed overlaps can meet this requirement.

We recommend that the contractor, the project materials engineer, and the owner discuss these issues and review recent ACI literature and ASTM E-1643 for installation guidelines and guidance on the use of the protection/blotter material. Our opinion is that with impervious surfaces that all means should be undertaken to reduce water vapor transmission.

PAVEMENT DESIGN CONSIDERATIONS

We recommend that all topsoil, trash, debris, and existing fill be removed from the pavement areas prior to pavement subgrade preparation. The pavement section may be supported on a minimum of 12 inches of structural fill compacted to a 95 percent density. Because the exposed site soils will likely consist of loose recessional soils, we recommend that the pavement subgrade be moisture conditioned as appropriate, and compacted to a firm, non-yielding condition at the time of paving. Granular structural fill or geotextile fabric may be needed to stabilize soft, wet, or unstable areas. To evaluate pavement subgrade strength, we recommend that a proof roll using a fully loaded 10- to 12-cubic yard dump truck be completed immediately before paving. In most instances where unstable subgrade conditions are encountered, an additional 12 inches of granular structural fill will stabilize the subgrade, except for very soft areas where additional fill could be required. The subgrade should be evaluated by Geotech Consultants, Inc., after the site is stripped and cut to grade. Recommendations for the compaction of structural fill beneath pavements are given in the section entitled ***General Earthwork and Structural Fill***. The performance of site pavements is directly related to the strength and stability of the underlying subgrade.

The pavement for lightly loaded traffic and parking areas should consist of 2 inches of asphalt concrete (AC) over 4 inches of crushed rock base (CRB), or 3 inches of asphalt-treated base (ATB). We recommend providing heavily loaded areas with 3 inches of AC over 6 inches of CRB or 4 inches of ATB. Heavily loaded areas are typically main driveways, dumpster sites, or areas with truck traffic.

Water from planter areas and other sources should not be allowed to infiltrate into the pavement subgrade. The pavement section recommendations and guidelines presented in this report are based on our experience in the area and on what has been successful in similar situations. We can provide recommendations based on expected traffic loads and California Bearing Ratio (CBR) tests, if requested. As with any pavements, some maintenance and repair of limited areas can be expected as the pavement ages. To provide for a design without the need for any repair would be uneconomical.

EXCAVATIONS AND SLOPES

Temporary cuts are those that will remain unsupported for a relatively short duration to allow for the construction of foundations, retaining walls, or utilities. Temporary cut slopes should be protected with plastic sheeting during wet weather. The cut slopes should also be backfilled or retained as soon as possible to reduce the potential for instability.

Excavation slopes should not exceed the limits specified in local, state, and national government safety regulations. Typically, temporary cuts to a depth of about 4 feet may be attempted vertically in unsaturated soil, if there are no indications of slope instability. However, vertical cuts should not be made near property boundaries, or existing utilities and structures without appropriate shoring measures. Based upon Washington Administrative Code (WAC) 296, Part N, the on-site loose recessional outwash deposit soils would generally be classified as Type C soil and should not be excavated any steeper than a 1.5:1 (Horizontal:Vertical) inclination. Deeper cuts should encounter medium dense recessional soils that would generally be classified as Type B soil and should generally not be excavated any steeper than a 1:1 (H:V) (Horizontal:Vertical) inclination. Also, unshored cuts should not be made within a 1.5:1 (H:V) inclination of any adjacent building footings or existing utilities without the express consent of the geotechnical engineer of record.

Groundwater can rapidly destabilize open cuts. If groundwater is encountered in the excavation, we recommend immediately backfilling the excavation to above the line of seepage and contacting the project geotechnical engineer for further recommendations that could include a decreased excavation inclination, dewatering, or temporary shoring.

The above-recommended temporary slope inclinations are based on what has been successful at other sites with similar soil conditions. However, these inclinations are only rough guidelines. Our explorations encountered some caving of the existing fill and loose recessional outwash deposit soils. Thus, the contractor should be prepared for caving and sloughing of any cuts made into the site soils. This may require flatter cut slope inclinations or temporary shoring.

All permanent cuts into native soil should be inclined no steeper than 2.5:1 (H:V). Water should not be allowed to flow uncontrolled over the top of any temporary or permanent slope. All permanently exposed soil should be landscaped to reduce erosion and improve the stability of the surficial layer of soil.

DRAINAGE CONSIDERATIONS

We anticipate that the foundation walls will be constructed with a perimeter footing drain. A typical foundation drain detail is attached to this report as Plate 8. Footing drains placed behind backfilled walls should consist of 4-inch-diameter, perforated, smooth wall, rigid PVC pipe surrounded by at least 6 inches of 1-inch-minus, washed rock wrapped in a non-woven, geotextile filter fabric (Mirafi 140N, Supac 4NP, or similar material). At its highest point, a perforated pipe invert should be at least as low as the bottom of the footing, and it should be sloped for drainage. All roof and surface water drains must be kept separate from the foundation drain system. Some entities require that Schedule 40 PVC pipe be used beneath structures.

Groundwater was not observed during our fieldwork in the approximate area of the new office building. However, if seepage is encountered in an excavation, it should be drained from the site by directing it through drainage ditches, perforated pipe, or French drains, or by pumping it from sumps interconnected by shallow connector trenches at the bottom of the excavation.

Site excavations and final site slopes should be graded so that surface water is directed off the site and away from the top of the steep slopes. Water should not be allowed to stand in any area where foundations or slabs are to be constructed. Final site grading in areas adjacent to the buildings should slope away at least 2 percent, except where the area is paved. Surface drains should be provided where necessary to prevent ponding of water behind foundation or retaining walls.

GENERAL EARTHWORK AND STRUCTURAL FILL

All building and pavement areas should be stripped of surface vegetation, topsoil, existing fill, and other deleterious material (trash and debris.) The stripped or removed materials should not be mixed with any materials to be used as structural fill, but the soil portions of the stripped materials may be used in non-structural areas, such as landscape beds.

Structural fill is defined as any fill, including utility backfill, placed under, or close to, a building, behind permanent retaining or foundation walls, or in other areas where the underlying soil needs to support loads. All structural fill should be placed in horizontal lifts with a moisture content at, or near, the optimum moisture content of that material. The optimum moisture content is that moisture content that results in the greatest compacted dry density of the fill material. The moisture content of fill is very important and must be closely controlled during the filling and compaction process. The on-site soils are *generally* not suitable for reuse as wall backfill due to their variable silt content and difficulty in separating relatively silty recessional soils from relatively clean recessional soils. However, based on our explorations, there are areas within the site that have suitable, well drained gravelly soils below the ground surface. Thus, it would be necessary to remove the silty overburden soils to expose the sandy gravel/gravelly sand soils. The sandy gravel/gravelly sand "borrow" pit(s) would need to be filled with compacted structural fill if buildings or pavements will be placed near or over these pits.

The allowable thickness of the fill lift will depend on the material type selected, the compaction equipment used, and the number of passes made to compact the lift. The loose lift thickness should not exceed 12 inches. We recommend testing the fill as it is placed. If the fill is not sufficiently compacted, it should be recompacted before another lift is placed. This eliminates the need to remove the fill to achieve the required compaction. The following table presents recommended relative compactions for structural fill:

LOCATION OF FILL PLACEMENT	MINIMUM RELATIVE COMPACTION
Beneath slabs or walkways	95%
Filled slopes and behind retaining walls	90%
Beneath pavements	95% for upper 12 inches of subgrade; 90% below that level

Where: Minimum Relative Compaction is the ratio, expressed in percentages, of the compacted dry density to the maximum dry density, as determined in accordance with ASTM Test Designation D 1557-91 (Modified Proctor).

Use of On-Site Soil

If grading activities take place during wet weather, or when the surficial silty fill and on-site soils are wet, site preparation costs might be higher because of delays due to rain and the potential need to import granular fill. The on-site soils, specifically the existing fill and portions of the underlying recessional soils, contain significant silt fines and, therefore, are considered moisture sensitive. Grading operations will be more difficult during wet weather, or when the moisture content of these soils exceeds the optimum moisture content.

The moisture content of the silty, on-site soil materials must be at, or near, the optimum moisture content, as the soil cannot be consistently compacted to the required density when the moisture content is significantly greater than optimum amount. The moisture contents of the on-site soils were generally moist at the time of our explorations based on visual field estimation. The caving observed in some of our test pits suggests that some of the soils on this site at the time of our explorations were wet-of-optimum moisture.

The recessional soils on the site could be used as structural fill if grading operations are conducted during slightly wet-to-dry weather periods. However, during prolonged dry weather, it will be necessary to add water to achieve the optimum moisture content in the recessional soils.

Please note that the surficial site soils are moderately moisture sensitive, thus are somewhat susceptible to softening and "pumping" from construction equipment, or even foot traffic, when the moisture content is greater than the optimum moisture content. As discussed in the ***General*** section, it will be beneficial to protect subgrades with a layer of imported rock to limit disturbance from traffic.

Structural fill that will be placed in wet weather should consist of a coarse, granular soil with a silt or clay content of no more than 5 percent. The percentage of particles passing the No. 200 sieve should be measured from that portion of soil passing the three-quarter-inch sieve.

LIMITATIONS

The analyses, conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the test pits are representative of subsurface conditions on the site. If the subsurface conditions encountered during construction are significantly different from those observed in our explorations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unanticipated soil conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking soil samples from test pits. Based on our observation of the soils in the test pits excavated at this site, we fully anticipate that the subsurface conditions at this site will vary substantially between exploration locations. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

This report has been prepared for the exclusive use of the Strider Group, LLC, and its representatives for specific application to this project and site. Our recommendations and conclusions are based on observed site materials, visual soil classification, and laboratory testing. Our conclusions and recommendations are professional opinions derived in accordance with current standards of practice within the scope of our services and within budget and time constraints. No warranty is expressed or implied. 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. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

In addition to reviewing the final plans, Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our explorations, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services only when requested by you or your representatives. We can only document site work that we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

The following plates are attached to complete this report:

Plate 1	Vicinity Map
Plate 2	Site Exploration Plan
Plates 3 - 7	Test Pit Logs
Plate 8	Typical Foundation Drain
Appendix	Soil Laboratory Test Results

We appreciate the opportunity to be of service on this project. If you have any questions, or if we may be of further service, please do not hesitate to contact us.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

Gary Beckham, P.G., P.E.G.
Senior Engineering Geologist

JAMES HOUSTON STRANGE JR
STATE OF WASHINGTON
36094
REGISTERED
PROFESSIONAL ENGINEER

12/13/06

EXPIRES 01-31-08
James H. Strange, P.E.
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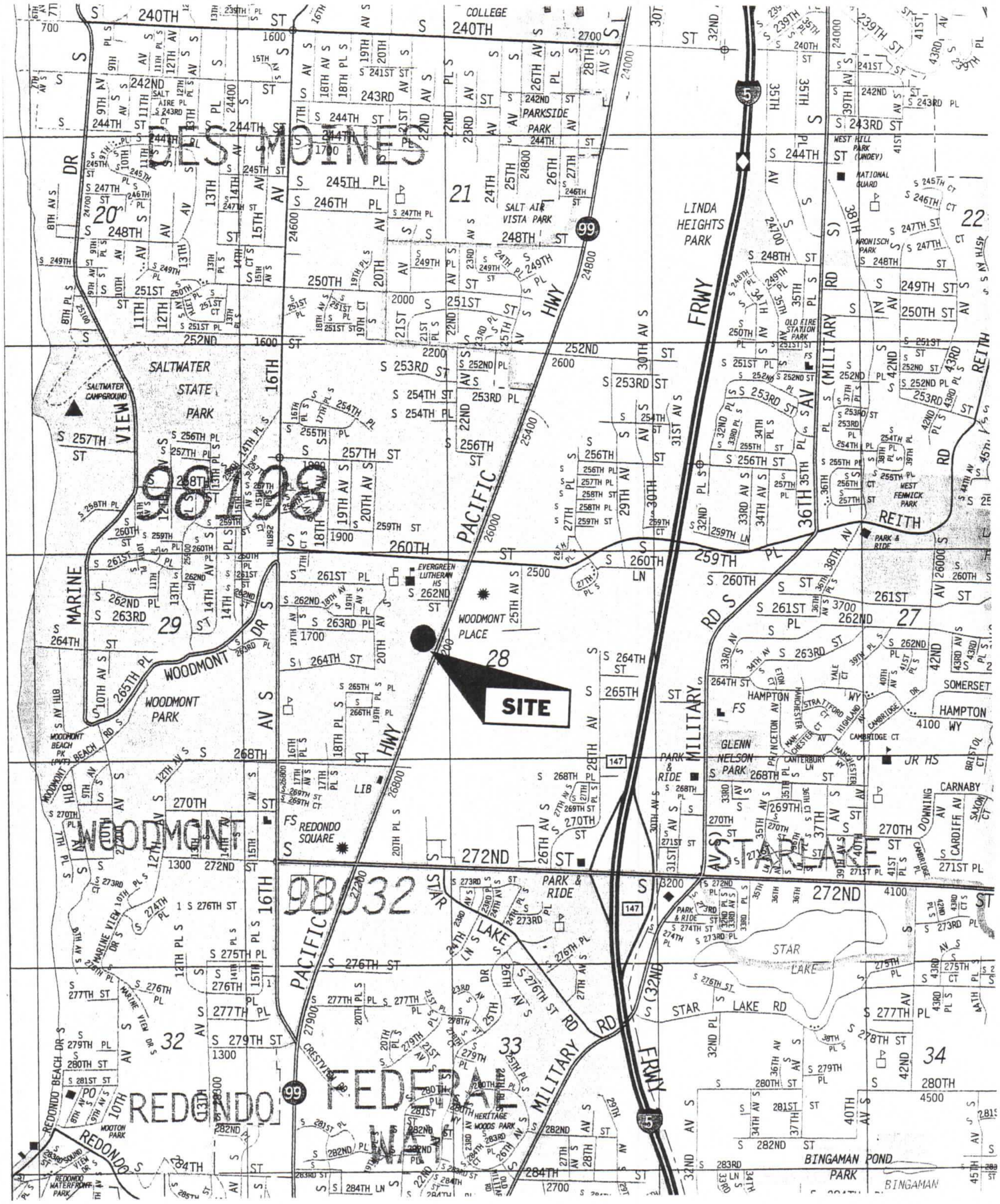

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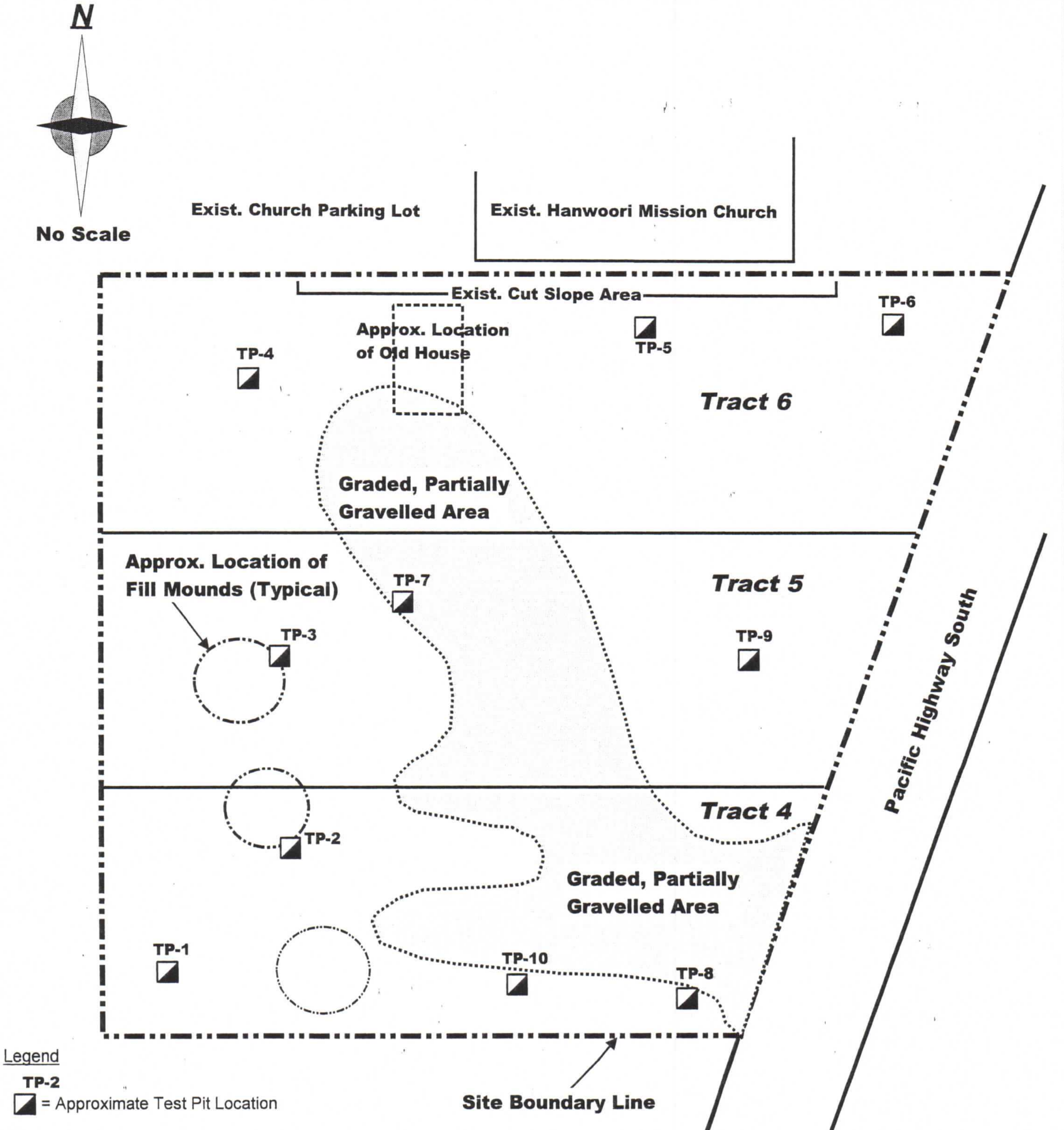
VICINITY MAP

Proposed Car Dealership
26429, 26475 and 26505 Pacific Hwy. South
Des Moines, Washington

Job No:	Date:		Plate:
06417	Dec. 2006	No Scale	1



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EXPLORATION SITE PLAN

Proposed Car Dealership
26429, 26475 and 26505 Pacific Hwy. South
Des Moines, Washington

Job No:	Date:		Plate:
06417	Dec. 2006	No Scale	2

TEST PIT 1

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				Leaves and forest duff over 8" dark brown, silty SAND topsoil
			SM	Tan brown, silty SAND with gravel and roots, wet, loose (***Recessional deposit***)
5			SM SW	Interlayered orange brown, silty SAND, fine- to medium-grained, and SAND, fine- to coarse-grained, with gravel and cobbles, moist, loose - becomes medium-dense
10			SM	Gray, silty SAND, fine- to medium-grained, medium-dense, with several 1" - 6" layers of clean sand, wet, medium-dense
			SM	Gray, silty SAND, fine- to medium-grained, with gravel and cobbles, wet, medium-dense
15				

*** Test Pit terminated at 13 feet on December 5, 2006.**
*** No groundwater seepage observed during excavation.**
*** Slight caving observed from 8 to 11 feet during excavation.**

TEST PIT 2

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Dark brown gray, silty SAND, fine- to medium-grained, with gravel, wood debris, tires, rebar, plastic bottles, and cans, wet, very loose (***Fill***)
5		▼		- becomes orange brown, silty SAND, fine- to medium-grained, with gravel, very wet, loose Gray, silty SAND, fine- to medium-grained, with wood and bark - large madrona tree limbs at 7.5' - 8.5'
			SM/OL	Dark black brown, silty SAND and organic SILT (Relict topsoil)
10			SM	Orange brown, silty SAND, fine- to medium-grained, with gravel, very moist, loose (***Recessional deposit***) - becomes interlayered with gray SAND, fine- to medium-grained, with silt, moist, medium-dense at 11'
15				

*** Test Pit terminated at 13 feet on December 5, 2006.**
*** Very slight groundwater seepage observed at 4 feet in fill during excavation.**
*** Slight caving of fill observed from 6.5 feet to 9.5 feet during excavation.**

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TEST PIT LOG

26429 - 26475 - 26505 Pac. Hwy. So.
Des Moines, Washington

Job	Date:	Logged by:	Plate:
06417	Dec. 2006	GDB	3

TEST PIT 3

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
0–5			FILL	Dark brown, orange brown, and brown, silty SAND with gravel and roots, very moist, loose (***Fill***)
5–11		▼ (9.5)	SM	Orange, silty SAND, fine- to medium-grained, with gravel and cobbles, very moist, loose (***Recessional deposit***) - grades to mostly silty, sandy GRAVEL with coarse sand and considerable cobbles, medium-dense at 6.5'

Depth scale: 5, 10, 15

*** Test Pit terminated at 11 feet on December 5, 2006.**

*** Moderate to strong groundwater flow observed at 9.5 feet during excavation.**

*** Caving observed from 9.5 feet to 11.0 feet during excavation.**

TEST PIT 4

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Forest duff over 6" topsoil
			FILL	Brown, silty SAND with gravel and roots, wet, loose (***Fill***)
			SM/SP	Interlayered orange brown, silty SAND, fine- to medium-grained, and gray brown SAND with silt, gravel, and occasional cobbles, wet, medium-dense (***Recessional deposit***)
5		▼	GP	Black gray, sandy, fine GRAVEL with coarse sand and occasional coarse gravel, saturated, medium-dense
			SM/SP-SM	Interlayered gray and gray brown SAND with silt and silty SAND, fine- to medium-grained, with fine gravel, wet, medium-dense

Depth scale: 5, 10, 15

*** Test Pit terminated at 10 feet on December 5, 2006.**

*** Moderate to strong groundwater flow observed in gravel at 5 feet to 9 feet during excavation.**

*** Caving observed from 5 feet to 9 feet during excavation.**

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TEST PIT LOG

26429 - 26475 - 26505 Pac. Hwy. So.
Des Moines, Washington

Job	Date:	Logged by:	Plate:
06417	Dec. 2006	GB	4

TEST PIT 5

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			SM	Gray brown, silty SAND, fine- to medium-grained, with roots, wet, very loose (***Recessional deposit***)
			SP	Gray SAND, fine-grained, with occasional medium-grained sand, moist, loose
5, 10			SP/SM	Orange mottled gray and brown SAND with silt, fine- to medium-grained, moist, loose - grades to medium-dense at 4' - 1' thick gravelly sand layer at 6' - 7' - gravel in sand below 7'

*** Test Pit terminated at 11 feet on December 5, 2006.**
*** No groundwater observed during excavation.**
*** No caving observed during excavation.**

TEST PIT 6

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				Dark black brown, sandy, organic SILT topsoil with roots
			ML	Tan brown, fine, sandy SILT, wet, soft (***Recessional deposit***) - becomes medium-stiff at 3'
			ML	Mottled tan orange brown, fine, sandy SILT, wet, medium-stiff, poorly laminated
5, 10			SM	Mottled orange brown, silty SAND, fine- to medium-grained, with occasional gravel, moist, loose to medium-dense - grades to mostly fine, silty SAND at about 8'

*** Test Pit terminated at 10 feet on December 5, 2006.**
*** No groundwater observed during excavation.**
*** No caving observed during excavation.**

TEST PIT 7

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
0–4			SW/GW	Interlayered gray brown, gravelly SAND, fine- to coarse-grained, and sandy GRAVEL with cobbles, moist, loose (***Recessional deposit***)
4				- becomes medium-dense at 4'

Depth scale: 5, 10, 15

* **Test Pit terminated at 11 feet on December 5, 2006.**
* **No groundwater seepage observed during excavation.**
* **Caving observed from the surface to 4 feet during excavation.**
* **Gravel layer dips 30 - 40 degrees down to the north.**

TEST PIT 8

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Brown, silty SAND with roots, gravel, plastic pipe, and wire, wet, loose (***Fill***)
			SW	Black brown, gravelly SAND, fine- to coarse-grained, moist, loose (***Recessional deposit***)
				- becomes mostly sandy gravel, medium-dense
			SP	Gray brown SAND, fine- to medium-grained, with occasional gravel, moist, medium-dense

Depth scale: 5, 10, 15

* **Test Pit terminated at 11 feet on December 5, 2006.**
* **No groundwater seepage observed during excavation.**
* **Caving observed from 1 foot to 4 feet during excavation.**

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TEST PIT LOG

26429 - 26475 - 26505 Pac. Hwy. So.
Des Moines, Washington

Job	Date:	Logged by:	Plate:
06417	Dec. 2006	GDB	6

TEST PIT 9

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			FILL	Brown, silty SAND with gravel, cobbles, and roots, moist, loose (***Fill***)
			SP	Brown gray SAND, fine- to medium-grained, moist, loose (***Recessional deposit***) - becomes medium-dense at 3'
5			GM	Tan brown, silty, fine sandy GRAVEL, moist, medium-dense
			SP	Interlayered gray SAND with gravel, moist, medium-dense
10				
15				

* **Test Pit terminated at 10 feet on December 5, 2006.**
* **No groundwater seepage observed during excavation.**
* **No caving observed during excavation.**
* **Gravel layer at 6 feet to 7.5 feet dips 30 degrees down to the north.**

TEST PIT 10

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
				Brown, silty SAND with gravel and roots, wet, loose (***Fill***)
			SM	Mottled orange brown, silty SAND, fine- to medium-grained, with gravel, moist, loose (***Recessional deposit***)
5			SP/SM	Interlayered tan gray, silty SAND and brown SAND with silt and gravel, fine- to medium-grained, wet, medium-dense
10				
15				

* **Test Pit terminated at 10 feet on December 5, 2006.**
* **No groundwater seepage observed during excavation.**
* **No caving observed during excavation.**

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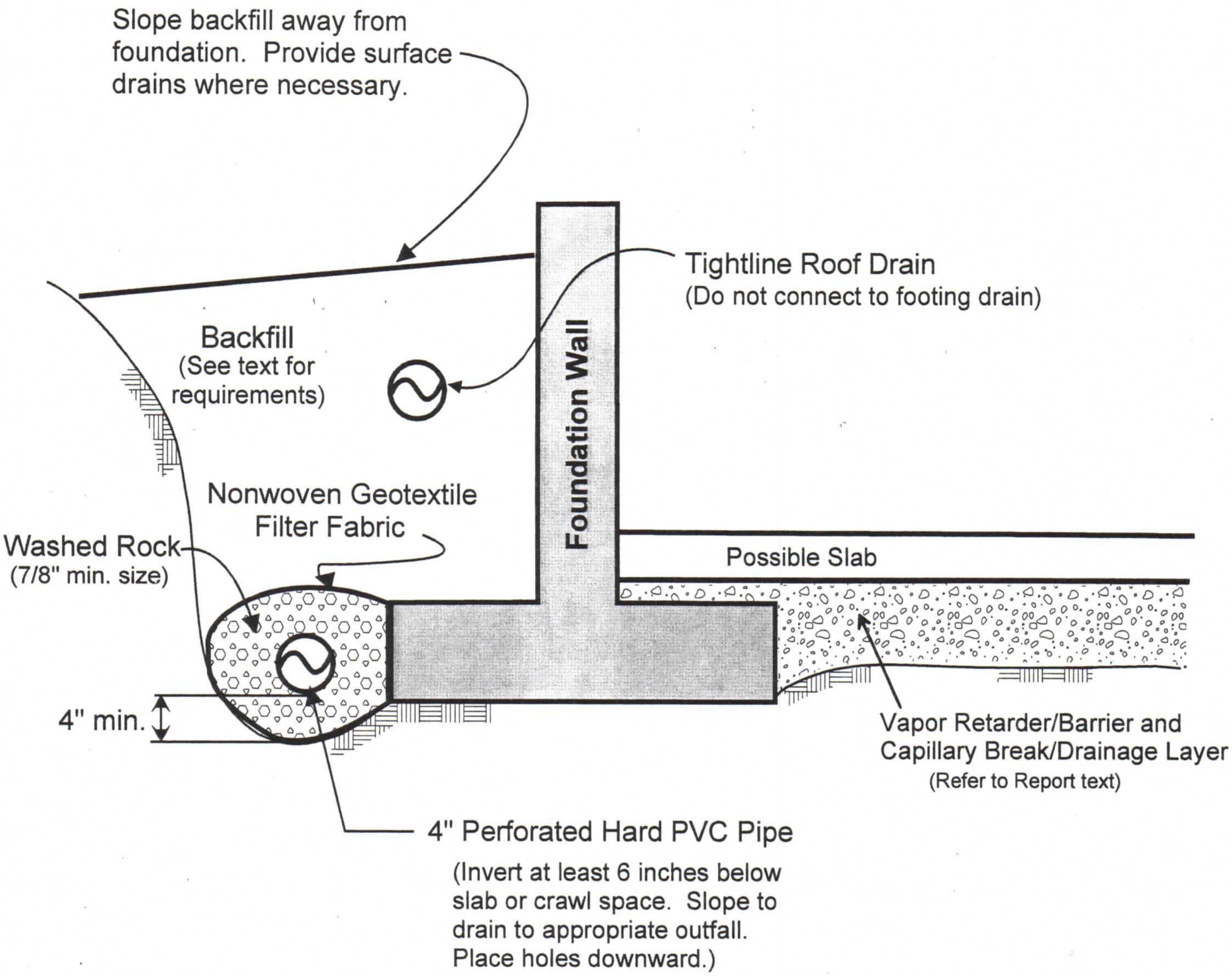
TEST PIT LOG

26429 - 26475 - 26505 Pac. Hwy. So.
Des Moines, Washington

Job	Date:	Logged by:	Plate:
06417	Dec. 2006	GDB	7



NOTES:

(1) In crawl spaces, provide an outlet drain to prevent buildup of water that bypasses the perimeter footing drains.

(2) Refer to report text for additional drainage, waterproofing, and slab considerations.

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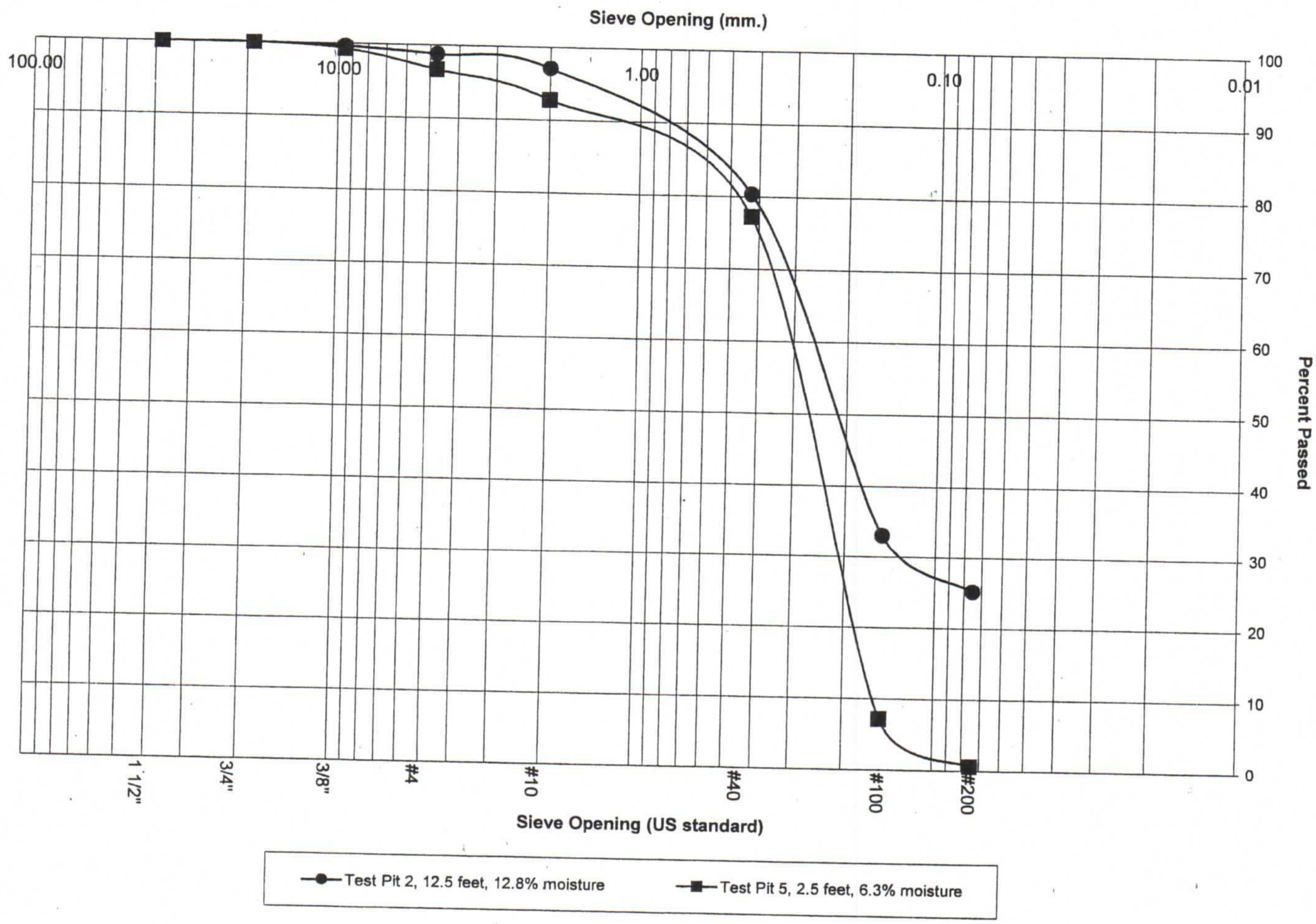
FOOTING DRAIN DETAIL

Proposed Car Dealership
26429, 26475 and 26505 Pacific Hwy. South
Des Moines, Washington

Job	Date:	Scale:	Plate:
06417	Dec. 2006	Not to Scale	8

APPENDIX

Soil Laboratory Test Results



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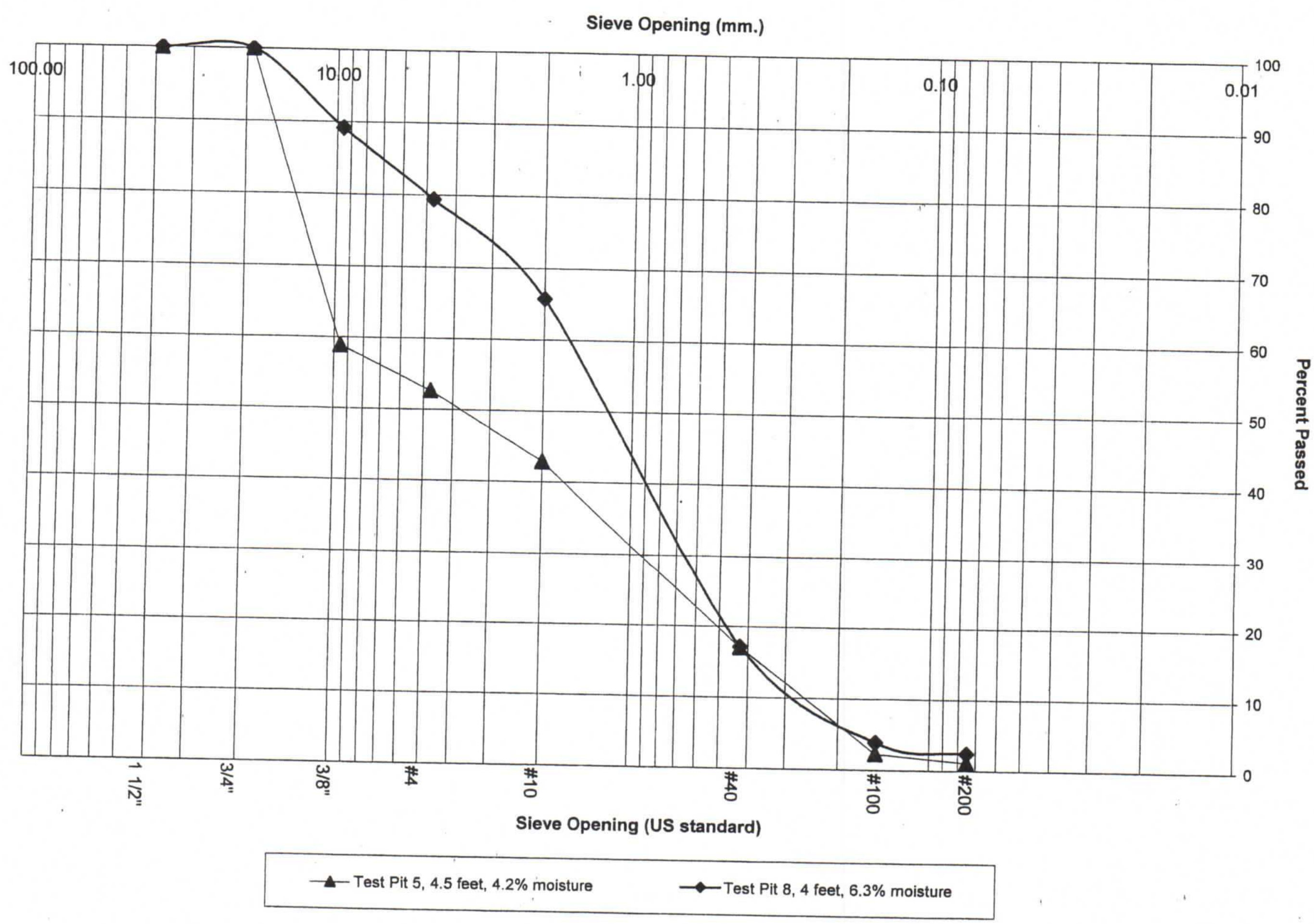
GRAIN SIZE ANALYSIS

Proposed Car Dealership
26429, 26475, and 26505 Pacific Hwy. South
Des Moines, Washington

Job	*Date:*	*Scale:*	*Plate:*
06417	Dec. 2006	Not to Scale	A



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GRAIN SIZE ANALYSIS

Proposed Car Dealership
26429, 26475, and 26505 Pacific Hwy. South
Des Moines, Washington

Job	Date:	Scale:	Plate:
06417	Dec. 2006	Not to Scale	B