Geotechnical Report

1919 Berry Street

Olympia, WA

Prepared for
Barend Van Zanten

by
Geotechnical Testing Lab
Olympia, WA

August 2, 2003

Pacific Management Group
P.O. Box 7279
Olympia, WA 98507

Attn: Barend Van Zanten

Re: Geotechnical Report
Parcel 49300500300
1919 Berry St. NE
Olympia, WA 98506
N47°03.706' W122°53.634'

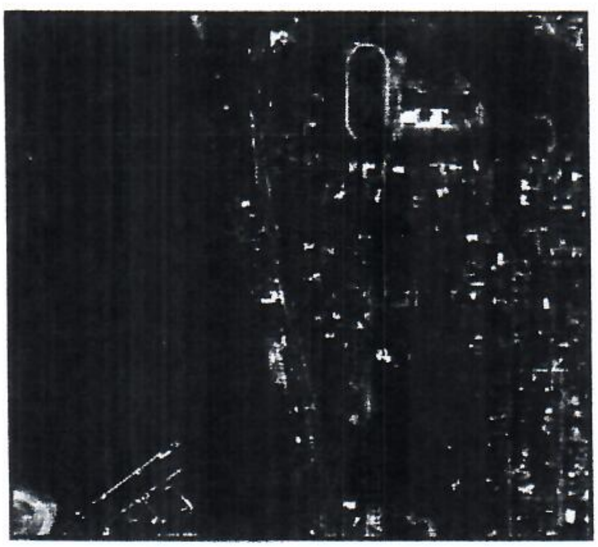
INTRODUCTION

This report summarizes the results of our geotechnical consulting services for the proposed single-family residence to be constructed on the above referenced site in Olympia, Washington. The location of the site is shown relative to the surrounding area on the Vicinity Plan, Figure 1.

Our understanding of the project is based on our discussions, review of the site, and our explorations. We understand that a new home is to be located on the above referenced lot. Stormwater runoff from the site, roof and hard surfaces, will be collected and directed to the west of the proposed home. The general layout of the site is shown on the Site Map, Figure 2.

We further understand that very little grading is required at the site to reach design grade. In general, grading will consist of the excavation of the foundation or footings. The proposed structure will be elevated on structural support members. Limited structural fill will be required.

City property offsite to the west has slopes that are greater than 40 percent. The City of Olympia therefore requires that a geotechnical report be prepared in accordance with the Critical Areas Ordinance.



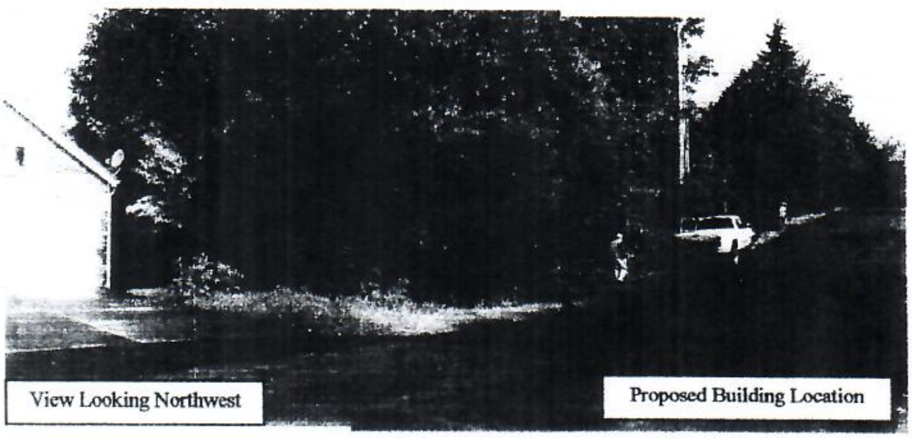
The purpose of our services is to evaluate the surface and subsurface conditions at the site as a basis for providing geotechnical recommendations and design criteria for the project and to satisfy the requirements of the City of Olympia Critical Areas Ordinance. Geotechnical Testing Lab is therefore providing geologic and hydrogeologic services for the project. Specifically, our scope of services for this project will include the following:

1. Review the available geologic, hydrogeologic and geotechnical data for the site area.
2. Conduct a geologic reconnaissance of the site area.
3. Explore the shallow subsurface conditions at the site by using available data.
4. Evaluate the landslide and erosion hazards at the site per The City of Olympia Critical Areas Ordinance.
5. Provide geotechnical recommendations for site grading, including site preparation, sub-grade preparation, fill placement criteria (including hillside grading), temporary and permanent cut and fill slopes, drainage and erosion control measures.
6. Provide recommendations and design criteria for design of conventional subgrade/retaining walls, including backfill and drainage requirements, lateral design loads, and lateral resistance values.
7. Provide recommendations and design criteria for the structural foundation and floor slab support, including allowable bearing capacity, sub-grade modulus, lateral resistance values and estimates of settlement.

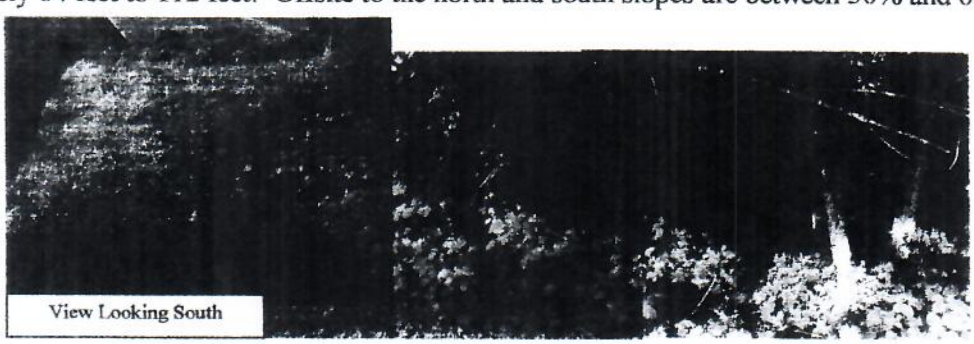
SITE CONDITIONS

Surface Conditions

The proposed building site is located off Berry Street in The City of Olympia, Washington. The immediate site is situated in an area of moderate development. An existing home is located on the lot to the south; a vacant lot is uphill to the north. The proposed layout of the site is shown on the Site Plan, Figure 2.



We conducted a reconnaissance of the site area and drilled eight holes to refusal. Elevations in the site area range from approximately 84 feet to 112 feet. Offsite to the north and south slopes are between 30% and 60%.



We observed no evidence of major erosion onsite. No surficial sloughing or soil movement was observed on the steeper portions of the site. No evidence of deep-seated slope instability was observed in the site area at the time of our site visit. A stormwater drainage channel, fed from two culverts, is located at the proposed building location.

Eastern Slope Fill Material for Berry Street

The site is vegetated predominately with a moderate to dense understory of vine maple, salal, young alder trees, maple, blackberry, ferns, skunk cabbage, and Scot's broom. No evidence of surface water flow outside of dedicated channels was observed in the site area at the time of our reconnaissance. The general topography of the site area indicates that the site drains toward the west.

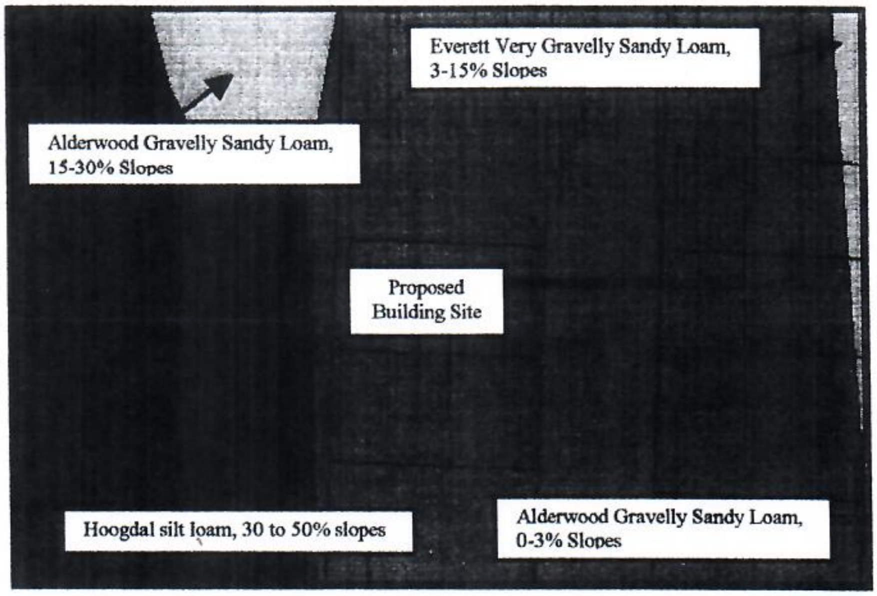
Site Geology

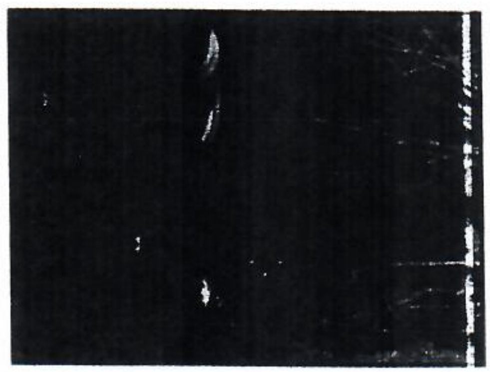
The site is generally situated within an upland area of glacial till deposits. The existing topography, as well as the surficial and shallow subsurface soils of the area, are the result of the most recent Vashon stade of the Fraser glaciation that occurred between about 10,000 and 12,000 years ago, and weathering and erosion that has occurred since. A description of the surficial soils is included in the "Site Soils" section of this report. In general, Vashon glacial till underlay the site.

Site Soils

The Soil Survey of Thurston County, Washington, USDA Soil Conservation Service (1990) has mapped the site soils as an Alderwood gravelly sandy loam, 0-3% slopes (1), at the proposed building area. The survey reads, "This moderately deep, moderately well drained soil is on glacial till planes. It formed in ablation till overlaying basal till. The depth to hardpan ranges from 20 to 40 inches. Permeability is moderately rapid above the hardpan in the Alderwood soil and very slow in the pan. Available water capacity is low. A perched seasonal high water table is at a depth or 18 to 36 inches from November to March. Runoff is slow, and the hazard of water erosion is slight. Because the rooting depth is restricted by the hardpan, trees are subject to occasional wind throw. If this unit is used for home sites, the main limitation is the seasonal wetness. The soil can support large loads. A drainage system should be installed on sites for buildings with basements or crawl spaces. Hydrologic group C."

Hoogdal silt loam, 30-50% slopes (44), is located to the west of the proposed building location. The survey reads, "This moderately deep, moderately well drained soil is on terrace escarpments. It formed in loess and glaciolacustrine sediment. Permeability is very slow in the Hoogdal soil. Available water capacity is high. A perched seasonal high water table fluctuates between depths of 18 to 24 inches from December to March. Runoff is medium, and the hazard of water erosion is moderate. Establishing a plant cover on steep slopes that have been cut or filled reduces the hazard of erosion. Hydrologic group C." The following figure from the Thurston County Geodata website represents the site geology.

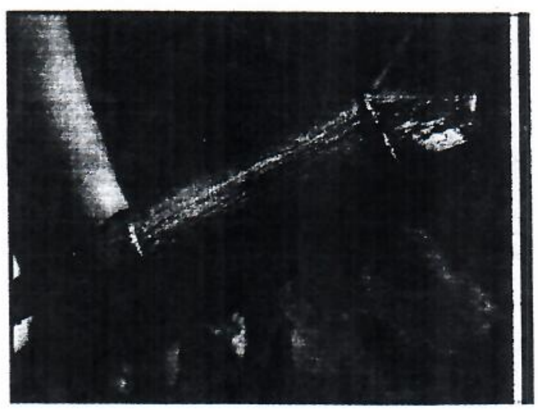




Subsurface Explorations

Subsurface conditions at the site were evaluated by hand drilling eight test holes to refusal. Alluvial deposits (organic sandy silt) were found to a depth of 18 inches. Groundwater was unearthed between 4 and 18 inches. Glacial till (sandy gravel) below 24 inches bears blow counts (N) greater than 50. A blow count over 50 is considered refusal.

SUBSURFACE CONDITIONS



In general, the undisturbed portion of the site is underlain by a gravelly sandy loam soil over glacial till. Groundwater seepage was not observed at the site. Stormwater from off site was found flowing in a 24-inch deep channel. Based on the nature of the near surface soils, alluvial deposits over undisturbed glacial till, seasonally perched groundwater conditions should be expected during periods of extended wet weather.

Slope Stability

Since slopes of 40 percent or greater with 10 feet or more of vertical relief occur on or near the site, the City of Olympia requires that a geologic hazards report be completed per the Critical Areas Ordinance.

Using a nuclear densiometer, the compaction was found to be 97% for the compacted road fill along Berry Street. In general, the underlying and undisturbed native soils consist of gravels with variable amounts of sand and silt. These soil components are in a dense to very dense condition except where they have been disturbed by weathering activity. Evidence of deep-seated landslide activity was not observed at the site at the time of our site visit.

Weathering, erosion, and the resulting sloughing and shallow landsliding are natural processes that can affect steep slope areas. Instability of this nature is typically confined to the upper weathered or disturbed zone, which has been disturbed and has a lower strength. No evidence of local surficial erosion, raveling and sloughing was observed in the site area at the time of our site visit.

Significant weathering typically occurs in the upper 2 to 3 feet and is the result of oxidation, root penetration, wet/dry cycles, and freeze/thaw cycles. Erosion in steep slope areas such as this can be reduced through proper design and construction of the storm water system.

Erosion control recommendations for the sloping areas are provided in the "Erosion Control" sections of this report. Proper planning, design and construction techniques will reduce the risk of surficial erosion or movement in these areas.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on the results of our site reconnaissance and our experience in the area, it is our opinion that the site is suitable for the construction of the proposed single-family residence.

The slopes located west of the building portion of the site area and the adjacent property are stable relative to deep-seated instability and will not be affected by the proposed home. Proper drainage control measures will reduce or eliminate the potential for erosion in this area, and improve slope stability.

Conventional construction equipment may be utilized for work at the site. Conventional isolated footings may be utilized at the site for support of the structure if anchored in the undisturbed glacial till. We do recommend that roof and footing drains be installed for the home. A vapor barrier is recommended for all slab-on-grades (garage). Infiltration of the stormwater is not possible at the site.


View Looking West

Pertinent conclusions and geotechnical recommendations regarding the design and construction of erosion control methods are presented below.

Landslide – Erosion Hazard Areas

Classification

The City of Olympia Critical Areas Ordinance (17.15.200) defines landslide hazard areas as "those areas which are potentially subject to risk of mass movement due to a combination of geologic, topographic, and hydrologic factors. The following areas are considered to be subject to landslide hazards:

A. Any area with a combination of:
   1) Slopes fifteen percent (15%) or steeper, and
   2) Impermeable subsurface material (typically silt and clay), frequently interbedded with granular soils (predominantly sand and gravel), and

3) Springs or seeping groundwater during the wet season (November to February).

B. Steep slopes of forty percent (40%) or greater.

C. Any areas located on a landslide feature which has shown movement during the past 10,000 years or which is underlain by mass wastage debris from that period of time.

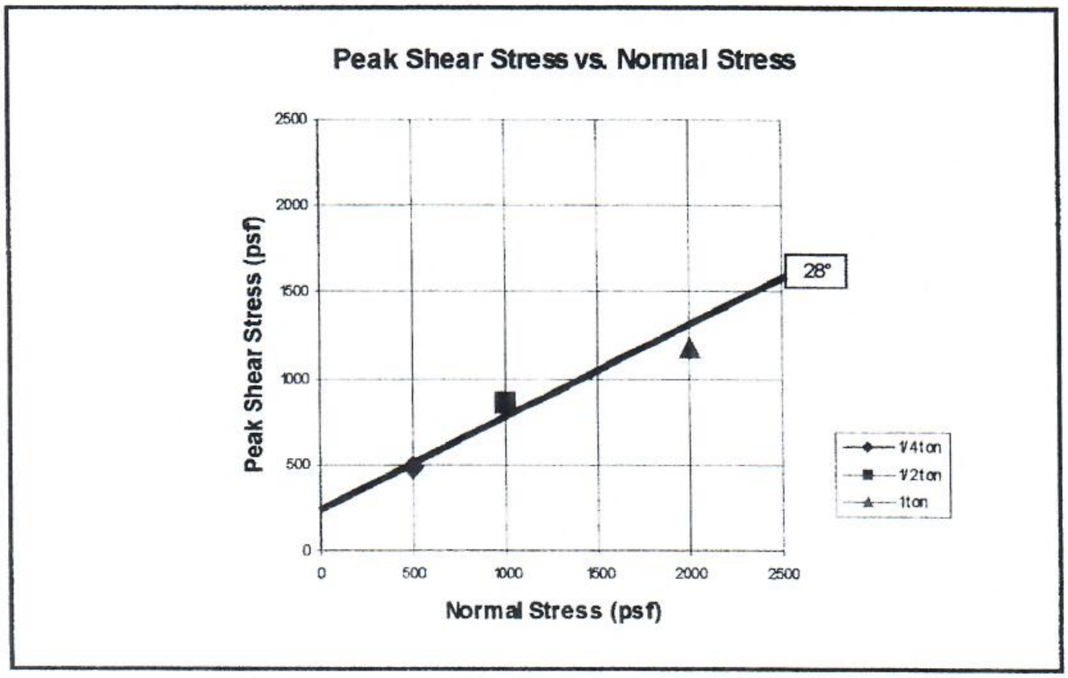
D. Any area potentially unstable as a result of undercutting by wave action and is identified as "Unstable" or of "Intermediate Stability" on the maps of the Coastal Zone Atlas of Washington, Volume 8, Thurston County (1980), as amended. (Refer to Figures 6 and 7.)"

The adjacent slopes exceed 40 percent, the stability is intermediate, and an impermeable subsurface material exists Therefore, areas on the site qualify as landslide hazard areas.

The soils at the site are mapped as Alderwood gravelly sandy loam in the building portion of the site. The Alderwood soils are described as having a slight erosion hazard, based on the present slope inclination. The Hoogdal soils are described as having a moderate erosion hazard, based on the present slope inclination. These soils do not meet the technical criteria of an erosion hazard.

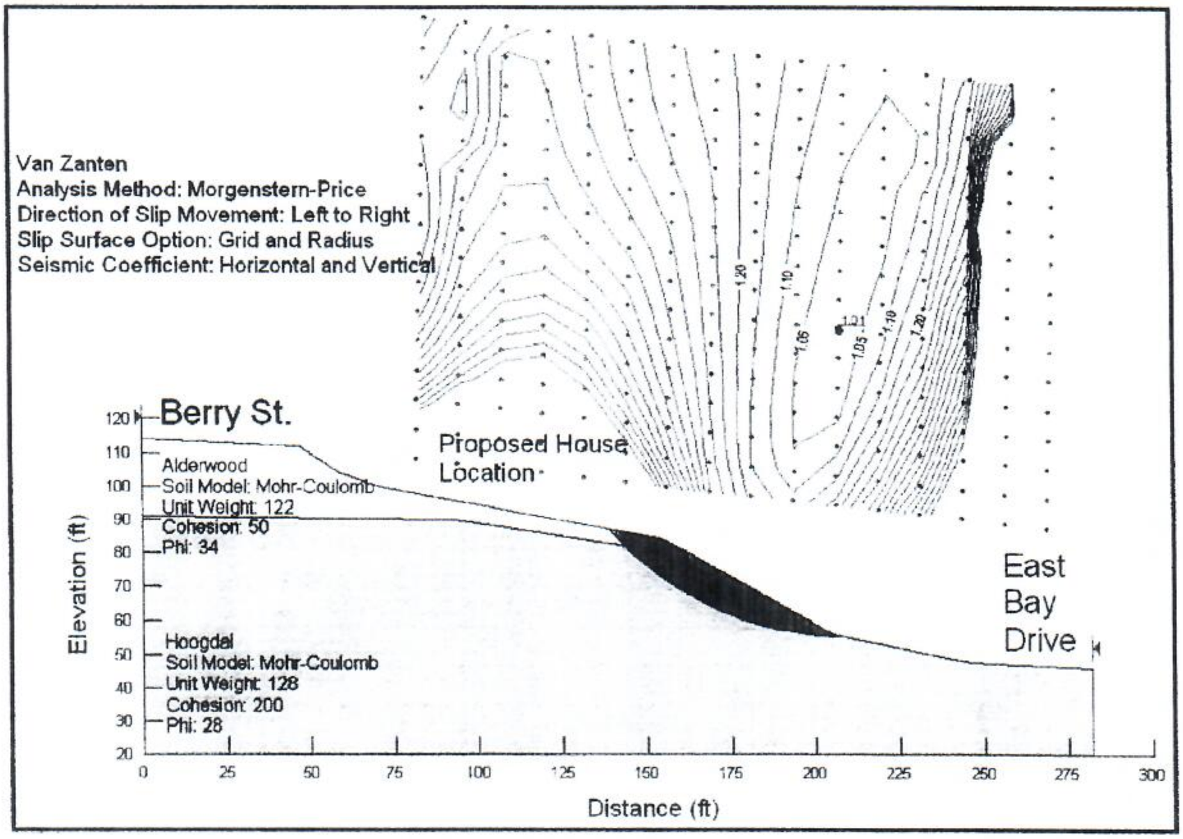
Slope Stability

Based on our field observations, explorations and our experience with the soil types encountered on the property, we conclude that although portions of the slopes on the lot exceed 100 percent, they are generally stable relative to deep-seated failure in their present configuration. The following figure represents a shear angle for the Hoogdal silt loam.



As previously discussed, weathering, erosion, and the resultant surficial sloughing and landsliding are natural processes that affect slope areas. Significant weathering typically occurs in the upper 2 to 3 feet, the result of oxidation, root penetration, wet and dry cycles and freeze and thaw cycles. These processes can be managed and the risk reduced through proper construction of the residence, including the stormwater system. Erosion control recommendations in the slope and buffer areas are provided in the "Building Setback" and "Erosion Control" sections of this report.

Slope stability was modeled using the GEO-SLOPE/W program (version 5.13) in both static and dynamic conditions ($c_a = 0.3$). Factors of safety were determined using Bishop's, Janbu, and the Morgenstern-Price methods. The site was modeled using two layers, shown in the following figure. The Alderwood soil was determined to have a unit weight of 122 pcf, cohesion of 100 psf, and a shear angle (ϕ) of 34°. A unit weight of 128 pcf, cohesion of 150 psf, and a shear angle (ϕ) of 28° were used for the Hoogdal soil. The deep Hoogdal soil layer is representative of a worse case scenario for a confining layer with a lower shear angle. Under static conditions, the slopes remained stable to deep-seated and shallow failure. Under dynamic loading, the 4906 computations demonstrated that the slope is not susceptible to surficial raveling; large deep-seated failure was not demonstrated by our model. See the following figure of a surficial failure with a minimum F.S. of 1.01 under dynamic conditions.



Building Setback

A 50-foot building setback from landslide hazard areas is required unless evaluated and reduced by an engineering geologist, a licensed professional engineer, or an Administrative action (OCC 14.10.415). Based on our geotechnical evaluation of the site and our experience in the area, we recommend a building setback of 15 feet from the western slope area of 40 percent or greater. The building setback is to be measured from the bottom of the footing to the face of the slope, in accordance with the Unified Building Code. Clearing and grading may not be allowed within the setback area, other than landscaping for lawn or gardening, because the slope stability or erosion hazard will be adversely impacted.

No changes in slope stability are expected on the site as a result of the proposed single-family residence. Grading may occur in the central portion of the site based on appropriate engineering recommendations. Grading in the building portion of the site should be conducted in accordance with geotechnical recommendations provided herein

As previously discussed, weathering, erosion and the resultant surficial sloughing and shallow landsliding are natural processes that affect slope areas. No surficial raveling or sloughing from the past was observed in the sloping portions of the site. To manage and reduce the potential for these natural processes, we recommend the following:

1. No drainage of concentrated surface water or significant sheet flow onto the slope area. Drainage shall be collected into the existing stormwater channel.
2. No filling in excess of two feet unless retained by retaining walls or constructed as an engineered fill.
3. No filling within the buffer or setback zone unless retained by retaining walls or constructed as an engineered fill and approved by a landscape architect.

Seismic – Liquefaction Hazard

According to the Seismic Zone Map of the United States contained in Figure 16-2 of the 1997 Uniform Building Code, the project site is located within Seismic Risk Zone 3.

Based on the subsurface conditions observed at the site, we interpret the site conditions to correspond to a seismic Soil Profile Type Sc, for Very Dense Soil, as defined by Table 16-J (UBC). This is based on the range of SPT (Standard Penetration Test) blow counts and/or probing with a ½-inch diameter steel probe rod. The shallow soil conditions were assumed to be representative for the site conditions beyond the depths explored.

The near-surface soils are generally in a dense condition; the soil is of a fine and uniform grain size. Shaking of the already dense soil is not apt to produce a denser configuration and subsequently excess pore water pressures are not likely to be produced. Based on our review of the subsurface conditions, we conclude that the site soils are not susceptible to liquefaction.

Erosion Control

No erosion is expected onsite or offsite provided that the measures provided below are followed. A registered landscape architect should be consulted to create a re-vegetation plan for the City property to the west. Removal of onsite natural vegetation shall be minimized and limited to trimming and landscaping consistent with home gardening or as proscribed by a landscape architect. Temporary and permanent erosion control measures shall be installed and maintained during construction or as soon as practical thereafter to limit the additional influx of water to exposed areas.

It is our opinion that the potential erosion hazard of the site is not a limiting factor for the proposed construction. Temporary and permanent erosion control measures should be installed and maintained during construction or as soon as practical thereafter to limit the additional influx of sediment to exposed water areas.

Erosion control measures should include, but not be limited to, berms and swales with ground cover/protection or silt fencing in exposed areas. Graded areas should be shaped to avoid concentrations of runoff onto cut or fill slopes, natural slopes or other erosion-sensitive areas. A typical silt fence diagram is included in this report.

EARTHWORK

Site Preparation

All areas to be excavated should be cleared of deleterious matter including any existing structures, foundations, abandoned utility lines, debris and vegetation.

Based on our observations, we estimate that stripping on the order of 8 to 12 inches will be necessary to remove the root zone and surficial soils containing organics. Areas with deeper, unsuitable organics should be expected in the vicinity of depressions or heavy vegetation. Stripping depths of up to 1.5 feet may occur in these areas. These materials may be stockpiled and later used for erosion control and landscaping. Materials that cannot be used for landscaping or erosion control should be removed from the project site.

Where placement of fill material is required, the exposed subgrade areas should be compacted to a firm and unyielding surface prior to its placement. Excavations for stump removal in the building area should be backfilled with structural fill compacted to the density requirements described in the "Structural Fill" section of this report. If structural fill is needed, we recommend that a member of our staff evaluate the exposed subgrade conditions after removal of vegetation and topsoil stripping is completed.

Any soft, loose or otherwise unsuitable areas delineated during foundation preparation or probing should be compacted, if practical, or over-excavated and replaced with suitable fill, based on the recommendations of our report.

Fill Material

All fill material should be placed as structural fill. The structural fill should be placed in horizontal lifts of appropriate thickness to allow adequate and uniform compaction of each lift. Fill should be compacted to at least 90 percent of MDD (maximum dry density as determined in accordance with ASTM D-698) to within 2 feet of subgrade and 95 percent MDD in the upper 2 feet.

The appropriate lift thickness will depend on the fill characteristics and compaction equipment used. We recommend that the appropriate lift thickness be evaluated by our field representative during construction.

The suitability of material for use as structural fill will depend on the gradation and moisture content of the soil. As the amount of fines (material passing No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult to achieve. During wet weather, we recommend use of well-graded sand and gravel with less than 10 percent (by weight) passing the No. 200 sieve based on that fraction passing the ¾-inch sieve. If prolonged dry weather prevails during the earthwork and foundation installation phase of construction, a somewhat higher (up to 12 percent) fines content will be acceptable.

Material placed for structural fill should be free of debris, organic matter, trash and cobbles greater than 6 inches in diameter. The moisture content of the fill material should be adjusted as necessary for proper compaction.

Suitability of On-Site Soils as Fill

On-site Alderwood and Hoogdal soils should not be used as structural fill. In general, the native soils (gravelly sandy loam) encountered on the site have greater than 10 percent fines (material passing the US No. 200 Sieve) and are not suitable for use as structural fill.

Cut and Fill Slopes

All job site safety issues and precautions are the responsibility of the contractor providing services and/or work. The following cut/fill slope guidelines are provided for planning purposes.

Temporary cut slopes will likely be necessary during grading operations. As a general guide, temporary slopes of 1.5 to 1 (horizontal to vertical) or flatter may be used for temporary cuts in the upper 3 to 4 feet of the glacially consolidated soils that are weathered to a loose/medium dense condition. Temporary slopes of 1 to 1 or flatter may be used in the unweathered dense to very dense sands and gravels.

These guidelines assume that all surface loads are kept at a minimum distance of at least one half the depth of the cut away from the top of the slope and that significant seepage is not present on the slope face. Flatter cut slopes will be necessary where significant raveling or seepage occurs.

Subsurface drainage may be required if seepage areas are discovered. Surface drainage should be directed away from all slope faces. Some minor raveling may occur with time. All slopes should be seeded, covered with straw or plastic as soon as practical to facilitate the development of a protective vegetative cover, or otherwise protected.

Foundation Support

Where foundation elements are located near slopes of 15 percent or more, the footings should be located a minimum of 2 times the footing width from the slope face (horizontally), and founded in medium dense or denser native soils or properly prepared structural fill.

We recommend a minimum width of 3 feet for isolated footings and at least 24 inches for continuous wall footings. Footings founded as described above can be designed using an allowable soils bearing capacity of 2,000 psf (pounds per square foot) for combined dead and long-term live loads in areas of medium dense to dense soils.

The weight of the footing and any overlying backfill may be neglected. The allowable bearing value may be increased by one-third for transient loads such as those induced by seismic events or wind loads.

Lateral loads may be resisted by friction on the bases of footings and floor slabs and as passive pressure on the sides of footings. We recommend that an allowable coefficient of friction of 0.40 be used to calculate friction between the concrete and the underlying soil. Passive pressure may be determined using an allowable equivalent fluid density of 300 pcf (pounds per cubic foot).

We estimate that settlements of footings designed and constructed as recommended will be less than 1 inch for the anticipated load conditions, with differential settlements between comparably loaded footings of ½ inch or less.

Most of the settlements should occur essentially as loads are being applied. However, disturbance of the foundation subgrade during construction could result in larger settlements than predicted.

Floor Slab Support

Slabs-on-grade should be supported on structural fill prepared as described in the "Structural Fill" section of this report. We recommend that floor slabs be directly underlain by a minimum 6-inch thickness of coarse sand and/or gravel containing less than 5 percent fines (by weight). The drainage material should be placed in one lift and compacted to an unyielding condition.

A synthetic vapor barrier should be used for the control of moisture migration through the slab, in particular where adhesives are used to anchor carpet or tile to the slab. A thin layer of sand may be placed over the vapor barrier and immediately below the slab to protect the liner during steel and/or concrete placement. The lack of a vapor barrier could result in wet spots on the slab, particularly in storage areas.

GEOTECHNICAL TESTING LABORATORY

Retaining Wall

Retaining walls may be utilized on the sloping portion of the site to retain fill material or below grade walls.

The lateral pressures acting on the subgrade and retaining walls will depend upon the nature and density of the soil behind the wall. It is also dependent upon the presence or absence of hydrostatic pressure. If the adjacent exterior wall space is backfilled with clean granular, well-drained soil (washed rock), the design active pressure may be taken as 35 pcf (equivalent fluid density). This design value assumes a level backslope and drained conditions as described below.

Retaining walls located on or near the toe of a slope that extends up behind the wall should be designed for a lateral pressure, which includes the surcharge effects of the steep slope in proximity to the wall. Although not expected at this site, the following data is provided for planning purposes.

For an irregular or composite slope, the equivalent slope angle may be determined by extending a line upward from the toe of the wall at an angle of 1 to 1 (Horizontal to Vertical) to a point where the line intersects the ground surface. The surcharge effects may be modeled by increasing the equivalent fluid pressure for flat ground by the percentage given in the following table:

Slope Inclination: Equivalent Fluid Pressure

Slope Angle	Percent Increase	Equivalent Fluid Pressure
Horizontal	0%	35 pcf
3H:1V	25%	44 pcf
2H:1V	50%	53 pcf
1H:1V	75%	61 pcf

If the walls are greater than 8 feet in height, exclusive of the footing, additional design considerations should be applied.

Positive drainage, which controls the development of hydrostatic pressure, can be accomplished by placing a zone of coarse sand and gravel behind the walls. The granular drainage material should contain less than 5 percent fines. The drainage zone should extend horizontally at least 18 inches from the back of the wall. The drainage zone should also extend from the base of the wall to within 1 foot of the top of the wall. The drainage zone should be compacted to approximately 90 percent of the MDD. Over compaction should be avoided as this can lead to excessive lateral pressures.

A perforated PVC pipe with a minimum diameter of 4 inches should be placed in the drainage zone along the base of the wall to direct accumulated water to an appropriate discharge location.

We recommend that a non-woven geotextile filter fabric be placed between the drainage material and the remaining wall backfill to reduce silt migration into the drainage zone. The infiltration of silt into the drainage zone can, with time, reduce the permeability of the granular material. The filter fabric should be placed in such a way that it fully separates the drainage material and the backfill, and should be extended over the top of the drainage zone.

Lateral loads may be resisted by friction on the bases of footings and as passive pressure on the sides of footings and the buried portion of the wall. We recommend that an allowable coefficient of friction of 0.40 be used to calculate friction between the concrete and the underlying soil.

Site Drainage

All ground surfaces, pavements, and sidewalks should be sloped away from the residences and associated structures. Surface water runoff should be controlled by a system of curbs, berms, drainage swales, and directed to the existing storm drainage channel.

We recommend that conventional roof drains be installed for the home and garage. Collected water shall be conveyed to the existing storm drainage channel.

LIMITATIONS

We have prepared this report for use by Barend Van Zanten and members of his design team, for use in the design of a portion of this project.

The data used in preparing this report, and this report, should be provided to prospective contractors for their bidding or estimating purposes only. Our report, conclusions and interpretations are based on data from others and our site reconnaissance, and should not be construed as a warranty of the subsurface conditions.

Variations in subsurface conditions are possible and may also occur with time. A contingency for unanticipated conditions should be included in the budget and schedule. Sufficient consultation should be made with our firm during construction to confirm that the conditions encountered are consistent with those indicated by the recommendations and for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork and foundation installation activities comply with contract plans.

If our analysis and recommendations are followed, we do not anticipate any on site or off site impact from the construction. It is our conclusion that potential landslide hazards from the landslide area can be overcome so as not to cause harm to property, public health and safety, or the environment.

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

If there are any changes in the loads, grades, locations, configurations or type of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as appropriate.

Respectfully submitted,
GEOTECHNICAL TESTING LABORATORY
Harold Parks

Harold Parks,
Engineering Geologist

Exp. 1/31/04

GEOTECHNICAL TESTING LABORATORY

Boring Log

TP-1

Depth	Description
0" - 12"	Duff, water
12" - 48"	Silt, water, 36 blows/foot @ 24"
48" - 96"	Gravelly Sand, Wet
	Total Depth = 96"

TP-2

Depth	Description
0" - 4"	Duff, water at 4"
4" - 42"	Silty Sand, 20 blows/foot @ 24"
	Total Depth = 42"

TP-3

Depth	Description
0" - 8"	Duff
8" - 36"	Sandy Gravel
	Total Depth = 36"

TP-4

Depth	Description
0" - 8"	Duff
8" - 20"	Silt
20" - 36"	Gravelly Sand
	Total Depth = 36"

TP-5

Depth	Description
0" - 12"	Duff
12" - 36"	Sandy Gravel
	Total Depth = 36"

TP-6

Depth	Description
0" - 12"	Duff
12" - 36"	Sandy Gravel
	Total Depth = 36"

TP-7

Depth	Description
0" - 6"	Duff
6" - 24"	Gravelly Sand, Water at 18"
24" - 36"	Gravel with Sand
	Total Depth = 36"

TP-8

Depth	Description
0" - 6"	Duff
6" - 24"	Sandy Gravel
24" - 36"	Sandy Gravel
	Total Depth = 36"

10011 Blomberg St. SW, Olympia, WA 98512
Phone #: (360) 754-4612 Fax #: (360) 754-4848

GEOTECHNICAL TESTING LABORATORY

VICINITY MAP

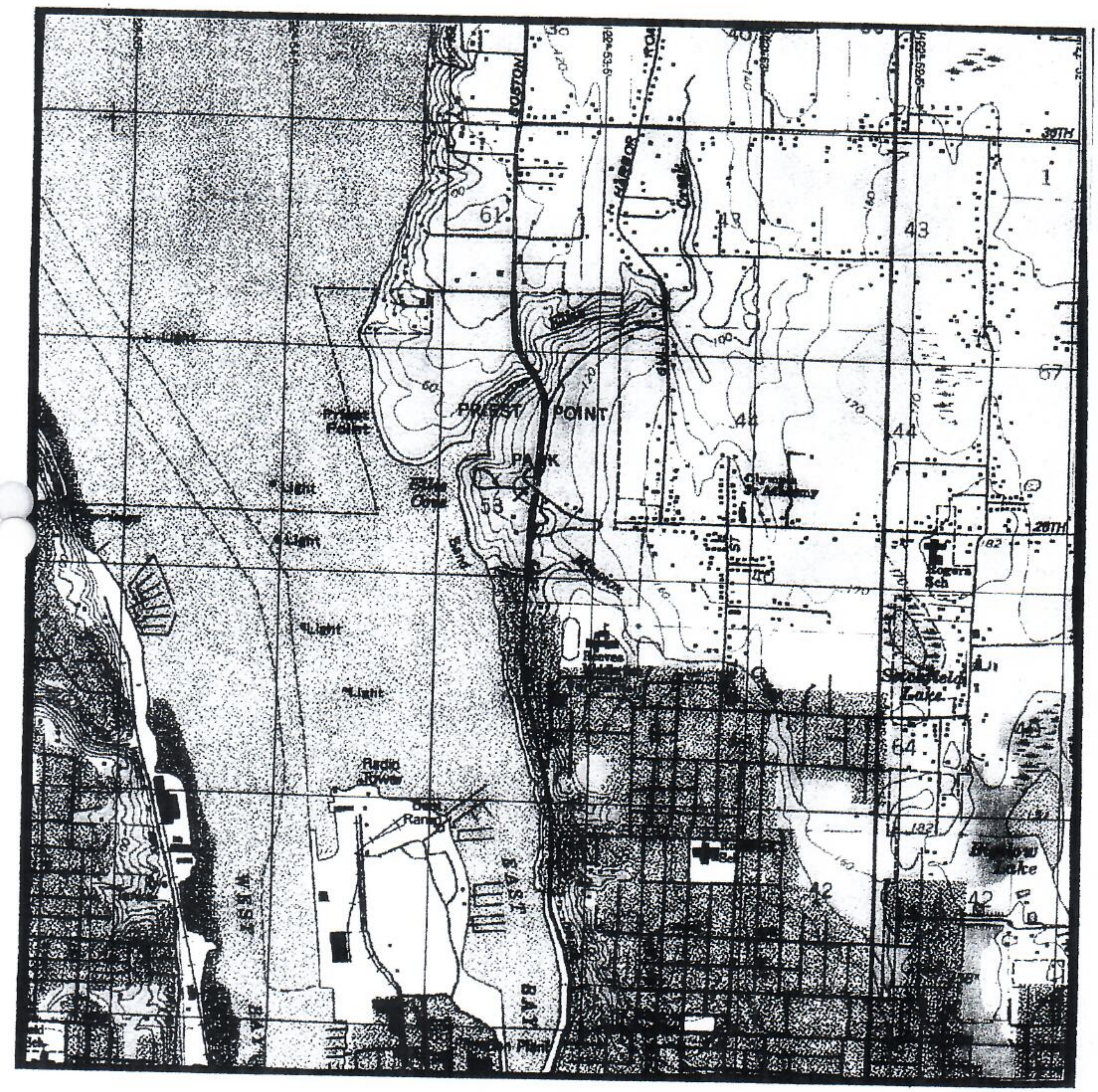
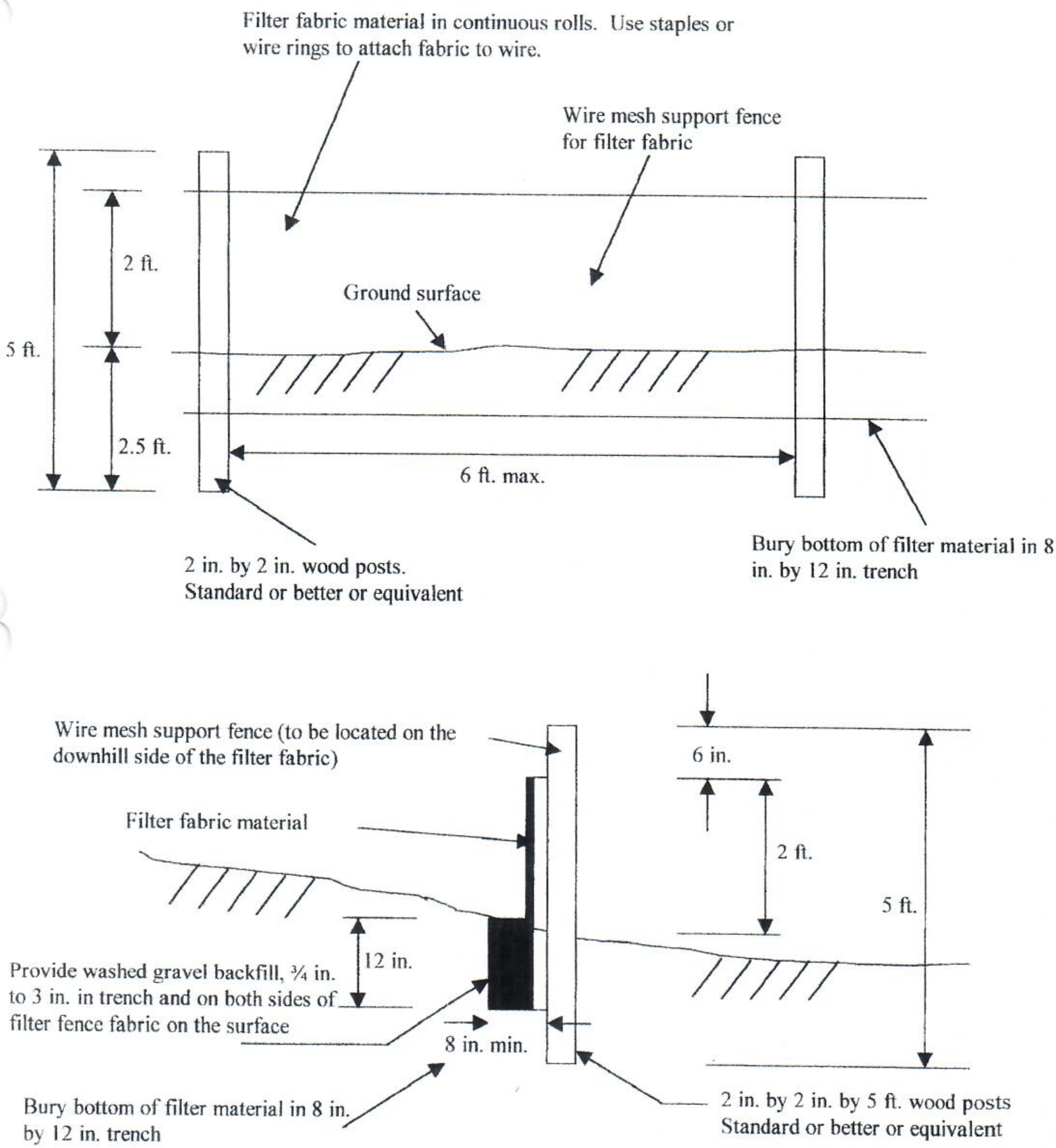


Figure 1

10011 Blomberg Street SW, Olympia, WA 98512
Phone #: (360) 754-4612 Fax #: (360) 754-4848



SILT FENCE DETAIL
Not to scale

GEOTECHNICAL TESTING LABORATORY

Geotechnical General Notes

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split-spoon.
Q_u: Unconfined compressive strength, tons/ft^2
Q_p: Penetrometer value, unconfined compressive strength, lbs/ft^2
V: Vane value, ultimate shearing strength, lbs/ft^2
M: Water content, %
LL: Liquid limit, %
PI: Plasticity index, %
D: Natural dry density, lbs/ft^3
WT: Apparent groundwater level at time noted after completion.

DRILLING AND SAMPLING SYMBOLS

SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
AU: Auger Sample.
GB: Grab Sample.
DB: Diamond Bit.
CB: Carbide Bit.
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Terms (Non-Cohesive Soils)	Standard Penetration Resistance
Very Loose	0 - 2
Loose	2 - 4
Slightly Compact	4 - 8
Medium Dense	8 - 16
Dense	16 - 26
Very Dense	Over 26

Terms (Cohesive Soils)	Q_u - (tons/ft^2)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm (Medium)	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in. +	**Coarse Sand**	5 mm - 0.6 mm	**Silts**	0.074 mm - 0.005 mm
Cobbles	8 in. - 3 in.	**Medium Sand**	0.6 mm - 0.2 mm	**Clays**	0.005 mm & Smaller
Gravel	3 in. - 5 mm	**Fine Sand**	0.2 mm - 0.074 mm		

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