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March 13, 2007 Project No. 0701003

Paul Coover
2545 NE Kevos Pond Drive
Poulsbo, Washington 9837059

Report of Soil and Slope Survey and Geotechnical Engineering Study
Proposed Single Family Residence
55 Beach Drive
Quilcene, Jefferson County, Washington
Parcel #701344049

This report presents the results of a soil and slope survey and geotechnical engineering study directed at evaluating potential landslide and erosion hazards at the referenced site as a basis for providing slope setback, foundation design and site drainage recommendations. The general scope of this study was developed during our previous work on the project in 2003 and 2004 and outlined in our proposal to you dated December 14, 2006. Written authorization to proceed with the study was received from you on January 5, 2007 with the fieldwork portion of the study being started on January 29, 2007.

To aid in expediting this project copies of this report have been sent to your contractor, Rob Thomas at Rob Thomas Construction.

Property Information

Property Owner: Paul Coover

Owner Mailing Address: 2545 Kevos Pond Drive
Poulsbo, Washington 98370

Owner Telephone: 360-394-1505

Site Address: 55 Beach Drive
Quilcene, Jefferson County, Washington

Parcel #701344049

Proposed Development

As shown on the attached Site Plan, Figure 2 of this report, under the proposed development plan a wood-framed, single-family residence is to be constructed approximately 75 feet back from the top of the steep

slopes at the west end of the property with an additional detached garage structure located in the central portion of the lot. Septic drainfields are to be located in the northeast portion of the property. The house will have a gross footprint on the order of 27 feet by 74 feet and the detached garage 32 feet by 16 feet. From discussions with Rob Thomas we understand that the residence may have a slab-on-grade or a framed floor or a combination of the two depending on the final building design and grades.

As shown on Figure 2, storm runoff from the driveway and garage is to be treated and dispersed in the area around the garage. Although conceptually storm water runoff from the house is to be directed into a dispersion field between the top of the bank and house, in our opinion, this location is not acceptable in that it could lead to a localized destabilization of the upper portion of the slope. Issues related to storm water runoff are discussed in a following section.

At the time of this report, the finished floor and yard elevations have not been finalized. However, it is understood that no existing slopes will be steepened with the proposed development. It is anticipated that the area around the structure will be landscaped in a more urban fashion and that following construction, all areas of disturbed and/or bare ground will be re-vegetated, landscaped or otherwise provided with erosion protection.

Methodology

Soil and slope conditions of the subject property were visually examined and evaluated using available slope exposures and shallow, hand excavated test pits both on the site and adjacent areas. Particular attention was directed to the western portion of the Dabob Cove development west of and down slope of the subject property. Extended subsurface data was obtained by the completion of one rotary exploratory boring, using truck-mounted drilling equipment provided by Holt Drilling of Tacoma, Washington. The boring was extended to a depth of 150.5 feet as shown on the attached soil log. Soils sampled in the boring were examined and logged by the engineering geologist. Standard Penetration Test (SPT) samplers were used to obtain soil samples for evaluation and determine N-values for the materials encountered. The N-value is evaluated using a SPT sampler driven 18 inches using a 140 pound hammer free-falling 30 inches. (Note: Hammer used was a drop hammer attached to a dry, new rope with two turns around a cathead.) The N-value is the number of blows required to drive the sampler the last foot. The N-value was used as an indication of the of the relative soil density. The N-values and soil strata encountered are shown on the attached boring log, Figure 3 of this report. The soil strata shown on the log were observed at a spot location. Actual subsoil conditions and thickness may vary between the boring location and as exposed in excavations or other

exposures. The approximate location of the boring is indicated on the attached Site Plan, Figure 2. Test Pit locations are shown on Figure 4 and a summary of test pit findings presented on Figure 5.

In addition to the observation of available soil exposures and reconnaissance of the area, the following readily available resources were reviewed.

Resources used:

1. "Geologic Map of The Olympic Peninsula, Washington", U.S.G.S, map I-994, 1978.
2. "Thickness of Unconsolidated Sediments, Puget Lowland, Washington", Washington State Department of Natural Resources, Division of Geology and Earth Resources, Geologic Map GM-12, 1974
3. "Geologic Framework for the Puget Sound Aquifer System, Washington and British Columbia", U.S.G.S Professional Paper 1424-C, 1999.
4. "Relative Slope Stability in East-Central Jefferson County, Washington", Washington State Department of Natural Resources, Division of Geology and Earth Resources, OFR 76-27, 1976.
5. "Compressibility of Earth Materials In East-Central Jefferson County, Washington", Washington State Department of Natural Resources, Division of Geology and Earth Resources, OFR 76-29, 1976.
6. "Mineral Resources in East-Central Jefferson County, Washington", Washington State Department of Natural Resources, Division of Geology and Earth Resources, OFR 76-28, 1976.
7. "Geologic Map of East-Central Jefferson County, Washington", Washington State Department of Natural Resources, Division of Geology and Earth Resources, OFR 76-26, 1976.
8. "Geology and Ground Water Resources of Eastern Jefferson County, Washington", Washington State Department of Ecology, Water Supply Bulletin 54, 1981.
9. "Geotechnical Report, Shoreline Bluff, Kennard Lot 2, Tax Parcel 701344049, Township 27N, Range 1W, Section 34, Jefferson County, Washington", prepared for Paul and Jan Coover by the Stratum Group, August 20, 2001.
10. "Soil Survey of Jefferson County Washington", United States Department of Agriculture, 1975.
11. USDA, Natural Resources Conservation Service, On Line Reports, "Washington State Soil Survey Reports"
12. Coastal Zone Atlas of Washington, Jefferson County volume.
13. U.S.G.S. 7.5 minute series topographic map "Quilcene, Washington Quadrangle"
14. Aerial Photographs
15. "Living with the Shore of Puget Sound and the Georgia Strait", Thomas A. Terich, Duke University Press, 1987.

16. On-line water well information available from the Washington state Department of Ecology web site.
17. On-line information available from the Jefferson County Department of Community Development web site.
18. "Engineering Geology in Washington" Volume I, Washington Division of Geology and Earth Resources, Bulletin 78, 1989.
19. Topographic map of project area titled "Dabob Cove Tracts, Toandas Peninsula, Sec 34, TWN27N, RNG1W, John Weaver Owner, Scale 1"=100'", Boundary determination by Roats Engineering, Topography by Walker & Associates. Drawing undated. Drawing located and provided by Rob Thomas, Rob Thomas Construction.

Distance and slope measurements referenced in this report were determined in the field using small, handheld equipment, i.e., Brunton compass, Suunto inclinometer, tape measure, and optical range finder. All measurements should be considered accurate to the degree implied by the method used.

Fieldwork, data acquisition and analysis for this study were undertaken between January 8 and March 7, 2007, with both dates being inclusive.

Site Surface and Subsurface Conditions

As shown on the attached drawings, the subject property is roughly rectangular in shape located on a north trending point. The easterly end of the property extends a short distance beyond Beach Drive and overlooks a steep walled ravine. The western end of the lot extends a short distance over the steep west facing slopes. Excluding the steep slopes at the east and west ends of the site, the site property slopes downward to the north at an average grade of 10% or less. The steep slopes at the east and west ends of the property have slope angles ranging from near 32 degrees to 40 degrees (slope grades of 62% to 84%) with short sections of steeper slope. Away from the site are substantial areas of slope having grades steeper than 100%. The ravine at the east end of the property appears to have been developed by a combination of water erosion, sloughing and smaller landsliding events. The steep slopes at the west end of the property comprise the central portion of the head scarp of a large landslide which extends from the subject property to Dabob Bay, some 1,300+/- feet to the west. The north-south width of the landslide area is on the order of 1,000+/- to 1,200+/- feet. Slope stability maps of the area indicate that the area between Dabob Bay and the site is considered an unstable recent slide area while the slopes into the ravine at the east end of the property are considered unstable. The major portion of the subject property, including the proposed building area, is indicated by the mapping to be considered stable. During our reconnaissance of the area, evidence of recent sloughing and sliding was

observed in the ravine at the east end of the property. Throughout the landslide area between the site and Dabob Bay there is substantial evidence of comparatively recent landslide events; which, although not of catastrophic size, are comprised of several hundred to several thousand cubic yards of material. However, at the western end of the property although there is evidence of ongoing sloughing and minor sliding from the steep slopes, there is no indication of recent or ongoing large earth movements or landsliding.

The driveway has been roughed in and graveled and the home and garage sites roughly cleared. Outside of these areas the property remains in a native condition, generally an open to moderately dense understory growth of mixed brush and shrubs below an open, mixed canopy of evergreen and deciduous trees.

As exposed in the boring, test pits and various exposures, below a foot+/- of forest duff and topsoil, the site is underlain by roughly three to four+ feet of silty, gravelly sand. This upper layer of material is glacial till, the upper portion of which has been loosened by weathering and root action. Underlying the glacial till are pre-glacial soils comprised primarily of interbedded to discontinuous layers of sand and gravelly sand with occasional layers of silty material and scattered layers of clay and silt. Based on exposures below the level of the site, it appears that the sands extend to the level of Dabob Bay and are generally similar to those encountered in the boring. Geologic maps of the area are in general agreement with the soil conditions observed in the site area and indicate that the upland areas (areas having an elevation similar to or greater than that of the site) are underlain by glacial till which in turn is underlain by pre-glacial materials-generally Pre-Vashon Stratified Sediments or Vashon Advance Outwash.

Mapping by the Soil Conservation Service (SCS) indicates that from Beach Drive westward to about the center of the property is underlain by Sinclair gravelly sandy loam, 0% to 15% slopes (SCS soil type SnC) with Hoypus gravelly sandy loam, 0% to 15% slopes (SCS soil type HuC) covering from the center of the property to the upper portion of the steep slopes at the west end of the site. The steep slopes are indicated to be underlain by soils of the Cassolary-Kitsap Complex, 30% to 50% slopes (SCS soil type CkE). The SCS indicates that the Hoypus soils are derived from glacial outwash on terraces with the Sinclair soils being derived from glacial till on glacial terraces. The SCS indicates that the Cassolary portion of the Cassolary-Kitsap Complex is derived from reworked glacial and marine sediments while the Kitsap portion is derived from glacial lake sediments.

Based on the soils exposed on and around the property, it is our opinion that the site soil conditions are generally consistent with those shown on the geologic and soil maps of the area, although Kitsap type soils

were not identified during our fieldwork. It is suspected that any differences between the mapped and observed soil conditions are a result of mapping scale, availability of exposures, depositional conditions and intended map usage.

No springs or seeps were observed on the property and the site appears to generally be well drained. Ground water was present in the boring at a depth of 50.5 feet (in open, uncased hole following flushing of drilling fluid). This may represent water perched on the underlying clay layer at a depth of about 55.2 feet. During our reconnaissance of the area additional areas of outwatering were observed at approximate elevations of 300+/-, 250+/-, 180+/- to 200+/-, and 80+/- to 100+/- feet.

Conclusions

Based on our observations, reconnaissance, analysis and review of the materials noted above, it is our opinion that:

- The native subsurface soil conditions are generally suitable for the type of development proposed.
- The slope on which the site is located is cored by soils in a dense to very dense condition.
- As presently proposed, the construction of a new residence on the site will not affect the slope stability on the subject or adjoining properties.
- Due to the geologic conditions, height and slope steepness, the west facing slopes are potentially subject to periodic landsliding and continuing raveling and sloughing. Larger soil movements may be triggered as a result of ground saturation, down slope grading or undercutting or other similar activities resulting in the removal of slope support.
- The slopes at the west end of the property meet the county criteria for identification as a landslide hazard area.
- Stability analysis of the overall west facing slopes, for existing conditions, indicates a factor of safety of 1.56 in the static condition and 1.11 in the dynamic condition (0.15g), as shown on the attached figures at the end of this report. Additional discussions of the slope stability are presented in subsequent sections.
- With regard to slope setback considerations, it is our opinion that a minimum top of slope setback of 70 feet for the residence and similar critical structures should be maintained. A minimum top of slope setback for light weight, non-critical structures such as storage buildings, decks or gazebos, etc., of 40 feet may be used. NOTE: Although the existing topographic maps may be used for conceptual siting of structures, we recommend that actual siting be accomplished in the field with setback measurements being made from the top of slope flagged and identified during our fieldwork.

- Due to the potential for charging the near slope face ground water table of the steep slope which could result in slope failure and/or increased slope erosion, we recommend that the storm water dispersion field for the house NOT be located as shown on Figure 2. We recommend that all storm water infiltration systems be located east of the residence.
- We recommend that a native vegetation buffer having a minimum width of 30 feet be maintained along the top of the west facing slopes.

Although the site has technical considerations related to the proximity of the slopes, ground water considerations and slope stability, based on our fieldwork and analysis, it is our opinion that with adequate design and construction considerations successful development of the site can be accomplished generally as proposed. It must be recognized that the off-site slope instabilities must be tolerated both because of their shear magnitude and as they do not lie on properties under control of this property owner. Specific site development recommendations are provided in the following sections of this report.

Slope Stability Evaluation

Slope stability modeling was performed using the commercially available computer program "SLIDE", version 5.028. Subsurface conditions were developed from the geologic explorations conducted for this evaluation. Material properties used in the analyses were selected from experience and published values in the geologic and geotechnical literature for geologic units in the Puget Sound lowland area. Various scenarios were evaluated to assist in understanding the behavior of the slope. Parameters were varied to develop failure configurations that approximated the available geomorphic configuration of the slope. Results of the numerical modeling suggested that there would be a reduction in safety factor that would approach a failure condition when there was a substantial rise in ground water levels or there was a large earthquake event with peak ground accelerations of those estimated by the USGS (United States Geological Survey) for the 5% PE (probability of exceedence) in 50 years event. Our presented results indicate a one-half peak ground acceleration for the 10% PE in 50 years which is the criteria commonly used in slope stability modeling. These conditions are, in our opinion, the likely factors that have most likely led to the formation of the existing landform. Based on these analyses, we evaluated the location of the failure surfaces and provided setback criteria that would provide a margin if the events were to occur.

Seismic Concerns

Although the property is located in the seismically active Puget Sound region, it is reported to have received no readily observable damage resulting from the magnitude 6.8 earthquake of February 28, 2001. In the event

of an earthquake of adequate magnitude and/or duration, some soil movement is possible if other conditions are right. However, the potential for soil movement on this property is no greater than that for properties elsewhere with similar soil conditions. Also, it is expected that all work and designs will be completed in accordance with current IBC seismic requirements, or potentially more stringent future requirements.

Recommendations

As previously noted, the following recommendations are provided to aid with the satisfactory completion of the project. These recommendations should be incorporated into the site design, planning and construction as appropriate.

Site Preparation and Grading

All pavement, fill and/or building areas should be stripped of all sod, organic soil, existing fill and debris. In most areas, a stripping depth of about one to two feet should be anticipated. However, deeper excavations will be required to remove large tree root-balls, boulders or pockets of unsuitable soils. Stripped soils, contaminated with organics or debris, should be wasted off site or used in landscape areas.

Following stripping of the site, and prior to the placement of any fill, the exposed subgrade should be proof rolled and compacted to a firm, unyielding condition using vibratory equipment of appropriate size and type. (Note: Due to slope considerations fills used for landscaping or general leveling between the vegetation buffer and the 70 foot top of slope setback line should be of limited extent and no greater than one foot in thickness. Where fills of greater extent are proposed, the grading plan should be reviewed and all proposed work specifically approved by the project geotechnical engineer.) Compaction of the stripped subgrade should be continued until field density tests show that a minimum compaction of 95% of the maximum dry density, as determined by ASTM method D-1557, has been achieved in all fill, building, driveway, and parking areas, or we indicate that in our opinion a firm unyielding subgrade has been created. Any soft or weaving areas disclosed during proof rolling should be excavated and replaced with compacted structural fill. Areas, which are to be filled to bring the building or pavement grades up to the desired elevation, should be filled with compacted granular material free from roots, trash or other deleterious materials. It is our opinion that due to the high silt content of the near surface site soils and the finer grained materials observed in the area, native soils should not be used as fill in wet weather due to their moisture sensitivity. To the degree possible, we recommend that all site grading and preparation be undertaken and completed during dry weather. If grading in building or pavement areas is necessary during wet weather, and time does not permit allowing the soils to dry sufficiently, we recommend that all excavated soil be removed from the site or set aside in covered

stockpiles, and that materials used as structural fill (fill placed on slopes or under buildings or pavements) consist of free draining gravelly sand having a maximum size of 1-1/2 inches and with not more than 5.0% fines, material passing a U.S. No. 200 sieve. All imported fill material should conform to the above recommendation regardless of the weather.

All structural fill (fill below buildings, roadways or parking areas, or fill placed on slopes) should be placed on a firm, properly prepared subgrade. Fill materials should be placed in layers approximately 8 inches in thickness, conditioned to a moisture content suitable for compaction, and compacted to 95% of the maximum dry density as determined by ASTM D-1557.

It is recommended that permanent cut slopes not exceed 2H:1V (50%). Fill slopes should not be steeper than 2H:1V (50%) for fill placed in accordance with the requirements of Appendix J of the International Building Code (2003 edition) or 3 to 4H:1V (33% to 25%) for uncontrolled fills of moderate quality material. In areas where steeper slopes are required, retaining structures should be provided. In areas where fills are to be made on slopes steeper than 5H:1V the subgrade should be benched and prepared in accordance with IBC (2003) requirements prior to fill placement. Benches should be cut at a maximum vertical height of 18 inches.

It should be anticipated that, if steeply cut, portions of the site soils may be subject to caving, and sloughing will occur as the soils are exposed to drying. All temporary cuts and excavations should be sloped or shored in accordance with local, state and federal requirements.

Surface and Ground Water

Only minor storm water related problems are anticipated if site grading and preparation are undertaken during the normally drier portions of the year. If site work is undertaken during wet weather it should be expected that the silty and finer-grained site soils will become over-saturated and unworkable. If the site work is undertaken during wet weather, the contractor should be fully prepared to deal with soil and water problems normally encountered in these materials during wet weather work, including the filtering of runoff, as needed to prevent the siltation of down slope areas. To aid in minimizing potential erosion, it is recommended that the building site not be stripped and left without erosion protection for an extended period of time prior to the actual start of construction and/or landscaping. Silt fencing and other erosion control devices and measures, including piped conveyance, may be required to control water runoff and sediment transport off the site.

Although during our fieldwork no ground water was observed at the elevation of the proposed construction, it should be anticipated that perched water flows or water flows developed during periods of wet weather may occur at random depths in sandier zones or atop siltier layers. In that we are unable to predict where or when this might occur we recommend that any development of seeps or flows be treated as a construction/maintenance problem.

To preclude the possible build-up of ground water or storm runoff in the soils adjacent to the structure, it is recommended that a four-inch diameter, perforated, rigid pipe be placed, perforations down, around the outside of the building foundation at the footing subgrade elevation. All of the drainage system should be bedded in a drainage sand and gravel and designed to carry any accumulated water away from the structure to an appropriate discharge area. Roof drainage should not be connected to the footing drains but may use the same outfall piping, if connected well away from the building such that roof water will not backup into the footing drains.

All runoff from roofs, driveways, and hard surfaced areas should be intercepted, collected and disposed of away from the structure and slopes, and discharged where the water will not effect down grade (slope) structures, walls, or properties. All piping for the drainage system should be rigid and smooth walled. Corrugated, ADS-type piping should not be used. If infiltration/dispersion systems are employed we recommend that they be located as far from the building and steep slopes as possible.

Structure Siting and Foundation Design

We recommend that all foundations be designed to bear on the medium dense to very dense native soils or structural fill placed and compacted as previously described. Continuous footings should not be less than 16 inches wide and isolated footings should not be less than 20 inches in their smallest dimension, regardless of the resulting bearing pressure. Additional foundation sizing and design considerations should be in accordance with International Building Code requirements, as modified by local codes and regulations, in effect at the time of construction.

All footings on gentle slopes (<15%) should bottom a minimum of 18 inches below the lowest adjacent exterior grade and 12 inches below the lowest interior grade. Footings on slopes steeper than 15% should be designed to bear a minimum of three feet below the finished exterior surface soil grade and be at least eight feet horizontally back of the finished soil face of the slope.

It is recommended that all foundation excavations be inspected prior to placing concrete, to verify that the bearing surface has been properly cleaned, prepared and soil conditions are as anticipated. All foundation subgrade areas should be recompacted following excavation. Bearing surfaces should be firm and free of sloughed or water-softened soil. Standing water should not be allowed to accumulate in the foundation excavations.

For spread footing foundations designed and constructed as outlined above, an allowable soil bearing pressure of 2,000 PSF may be used for foundations bearing on the medium dense to dense insitu soils or properly placed and compacted structural fill. For foundations bearing on the dense to very dense insitu soils, an allowable soil bearing pressure of 4,000 PSF may be used.

We estimate that total settlement for foundations designed and constructed as outlined above will be an inch or less, with differential settlement between similarly loaded foundations potentially approaching the total settlement. It is anticipated that most settlements will occur as the foundations are loaded. Failure to properly place structural fill or prepare the subgrade areas may increase settlement resulting from loading and/or shaking resulting from an earthquake.

Cast-In-Place Retaining and Subsurface Walls

The following earth pressures and design values are provided for cast-in-place retaining and subsurface walls up to 10 feet in height. We recommend that all foundations be designed as outlined above and bear on the medium dense to dense native soils or structural fill placed and compacted as previously described.

Retaining and subsurface walls should be designed for an active equivalent fluid pressure of 35 pcf, if the top of the wall is allowed to deflect, assuming a horizontal ground surface behind the wall. If the top of the wall is restrained, an equivalent fluid pressure of 55 pcf is recommended. Active or at rest pressures will need to be increased for sloping ground or surcharge loads (such as vehicle traffic) behind the wall. Earthquake loadings are also expected to increase the lateral pressures indicated above. The increases for most basement walls have historically been expected to be within limits that are generally compensated for with a reduced safety factor (Seed, H. B. & Whitman, R. V., Design of Earth Retaining Structures for Dynamic Loads, 1970 Specialty Conference on Lateral Stresses in the Ground and Design of Earth Retaining Structures, American Society of Civil Engineers, 1970). However, the increases in lateral loadings from earthquake forces are expected to provide a slightly increased component of the lateral pressures to be taken into consideration in the structural design of buried walls. Seed and Whitman discuss a procedure for determination of lateral

loading following an approach suggested by Mononobe and Okabe. As input to the Mononobe-Okabe evaluation, a friction angle of 34 degrees for the backfill soils was used along with a horizontal and vertical earthquake acceleration of 0.2g (half of the 0.4g peak ground acceleration for the 5% probability of exceedance in 50 years, as suggested by the USGS). Based on this input and some assumptions on wall friction, an earthquake loading surcharge of 18 pcf (equivalent fluid pressure), for unrestrained walls, and 35 pcf, for braced walls is recommended. This loading is additive to the static "active" and "at-rest" pressures indicated above. The application of this loading depends on the wall type chosen. The earthquake surcharge loading should be applied as an inverted triangular loading with the resultant pressure from the surcharge applied at the upper third point of the wall for cantilevered (unbraced walls) and as a rectangular loading with the resultant pressure from the surcharge applied at the mid point of the wall for braced walls.

Resistance to sliding could be developed by a combination of passive pressure and base friction. A base friction coefficient of 0.5 is considered appropriate for the expected dense site foundation support soils. An ultimate passive equivalent fluid earth pressure for retaining structures, considering a horizontal ground surface, of 350 pcf is available to develop additional resistance to lateral pressures. Passive pressures should be ignored or appropriately reduced in areas where the ground slopes downward on the resisting side of the wall within 4 times the wall footing embedment depth. Appropriate safety factors should be applied to the recommended base friction and ultimate passive pressure values.

The above-recommended pressures do not include the effects of hydrostatic pressure on the wall as they assume a drained condition exists. The maintenance of a dewatered/drained condition behind all retaining structures is required for the above values to be valid. The following drain system and backfill requirements are recommended.

A longitudinal subdrain with a minimum diameter of 4 inches should be constructed at the base of the footing elevation behind the walls. This drain should be constructed of a 4-inch diameter perforated pipe laid perforations down, bedded in an eighteen-inch envelope of free-draining sand and gravel. This system should be sloped to drain and the water disposed of in the storm drainage system. Clean-outs should be provided at bends and convenient intervals, so that the drainage system can be maintained in a well-functioning condition. Flexible plastic piping (such as corrugated ADS-type piping) should not be used behind the wall.

All wall backfill over the gravel envelope should consist of clean, free-draining, well-graded sand and gravel containing less than 2.0% fines (material passing a U.S. No. 200 sieve). This material should extend out from

the rear wall face a minimum of eighteen inches. The free-draining backfill should be placed to the surface in paved areas or to within eighteen inches of the surface in non-paved areas. In non-paved areas, the final eighteen inches of backfill should consist of topsoil or native materials firmly tamped into place. Backfill should be compacted as recommended above for fills.

Slabs-on-Grade

Slab-on-grade floors may be supported on properly placed and compacted structural fill or on the medium dense to very dense insitu native soils following preparation as outlined above. A capillary break/drainage layer consisting of six inches of pea gravel, or clean crushed rock should be placed below the floor slab. The capillary break material should contain less than 1.0% material passing a U.S. No. 200 sieve and less than 4.0% material passing a U.S. No. 10 sieve. A visqueen vapor barrier having a minimum thickness of 6-mils should be placed between the capillary break and the floor slab. We understand that a sand cushion between the vapor barrier and the base of the slab may improve the curing of the slab concrete. If a sand cushion is placed between the capillary break material or the vapor barrier and the slab, it should not contain free moisture when the slab is constructed. Excess moisture in the cushion could cause impervious floor coverings to bubble.

Construction Considerations

As a preliminary guideline for temporary cuts less than 10 feet in height, we recommend temporary slopes be made no steeper than 1H:1V for the dense soils and no steeper than 1 1/2H:1V in medium dense soils or structural fill placed and compacted as outlined above. For temporary cut slopes in existing fill, topsoil, or loose materials or over 10 feet in height we recommend temporary slopes no steeper than 1 ½ H:1V for the full height of the cut. Temporary slopes or excavations should be benched and/or shored as required by safety regulations in effect at the time of construction. These temporary slope recommendations are for native soils and fill materials; flatter slopes may be required in wet weather or if soil conditions other than those previously described are encountered. The contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulations; e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations. Such regulations are strictly enforced and, if not followed, the owner, the contractor, or the earthwork or utility subcontractors could be liable for substantial penalties. The contractor should be made responsible for the stability of all excavations and slopes during construction because he is continually on site and can observe the stability of the exposed soils. In addition, the contractor should be

prepared to shore any unstable slope area and provide shoring as required by local, state, or federal laws or codes. The provision of shoring design recommendations is beyond the authorized scope of this report. In no case should excavated soils be placed on the slope or stockpiled within 20 feet of the top of any existing or excavated slope, rockery or retaining structure. Failure to comply with these guidelines may lead to destabilization of the slope.

In a disturbed condition the site soils may be eroded by channelized water or sheet flow storm runoff. Therefore, it is recommended that all site preparation and excavation work be completed during the normally drier portion of the year. During periods of heavy rainfall, ditching should be used to divert water away from stripped areas and visqueen should be used to cover the slopes and soil stockpiles to aid in preventing excessive surface erosion. This covering also aids in preventing infiltration of water into the unprotected soils. All disturbed soil areas and slopes should be replanted with fast-growing, deep-rooted grass, shrubs and other ground cover as soon after final grading as possible. If the vegetation is not fully established prior to the on set of wet weather, the slopes should be covered with visqueen to aid in preventing excessive erosion and water infiltration.

It should be anticipated that there could be a number of additional site development or construction problems, particularly if the earthwork has not been completed and the site properly protected at the onset of wet weather. It is recommended that a qualified representative of the architect or engineer make periodic inspections of all excavations and slopes to provide early recognition of concerns and recommendations.

Report Limitations

This report has been prepared for the exclusive use of Paul Coover and his agents for use in developing the referenced project. The conclusions and recommendations in this report are based on my visual observations, interpretation of site conditions as they presently exist, and the expectation that the exploratory efforts adequately define the subsurface conditions throughout the site. The soil conditions described in this report and the conclusions and recommendations contained in this report are provided for this specific site only and should not be expanded for use on adjacent sites or properties without additional exploration and review of those sites by this firm. The results of this study are intended for the use of the original client only. Use of this report in whole or part by third parties will require a written agreement be in place between the consultant and the third-party.

NOTE: Although we have reviewed subsurface conditions as part of this study, we have not conducted analytical laboratory testing of any samples obtained, have not evaluated the site for the potential presence of contaminated soil, and have not evaluated or addressed ground water conditions or concerns except as noted in this report.

The owner and the contractor should make themselves aware of and become familiar with applicable local, state, and federal safety regulations, including current O.S.H.A. safety standards. Construction site safety generally is the sole responsibility of the contractor. The contractor shall also be solely responsible for the means, method, techniques, sequences, and operations of construction operations. The firm, Allen L. Hart Engineering Geologist (including consultants and subcontractors) is providing the preceding information and recommendations solely as a service to Paul Coover. Under no circumstances should the provision of this information or recommendations be construed to mean that the firm Allen L. Hart Engineering Geologist (including consultants and subcontractors) is assuming responsibility for construction site safety or the contractor's activities; such responsibility is not implied and should not be inferred.

Within the limitations of scope, schedule, and budget for this work, it is warranted that the work has been done in accordance with generally accepted practices followed in this area at the time this is report was made. No other warranty, expressed or implied is made.

Should you have any questions or if I may be of additional assistance, please call our office at (253) 752-8963.

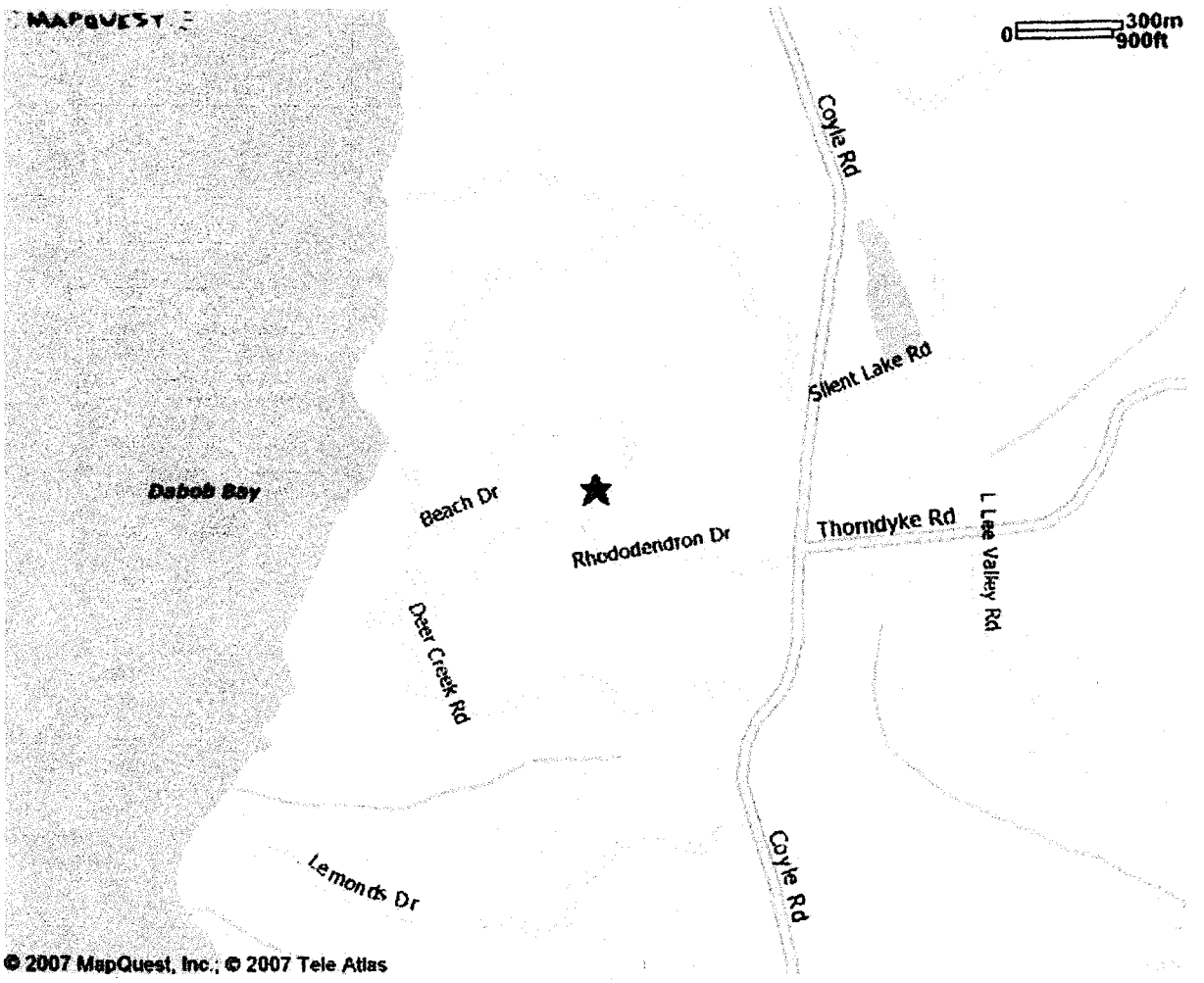
Sincerely,

Allen L. Hart, CPG, RG/CEG
Licensed Engineering Geologist

State of Washington
Engineering Geologist
542
Licensed Geologist
3/13/07
ALLEN L. HART

JOHN KEITH CROSS
STATE OF WASHINGTON
18444
REGISTERED
PROFESSIONAL ENGINEER
3/13/07
EXPIRES 10/9/07

J. Keith Cross, P.E., Geotechnical Engineering Consultant to the firm Allen L. Hart Engineering Geologist

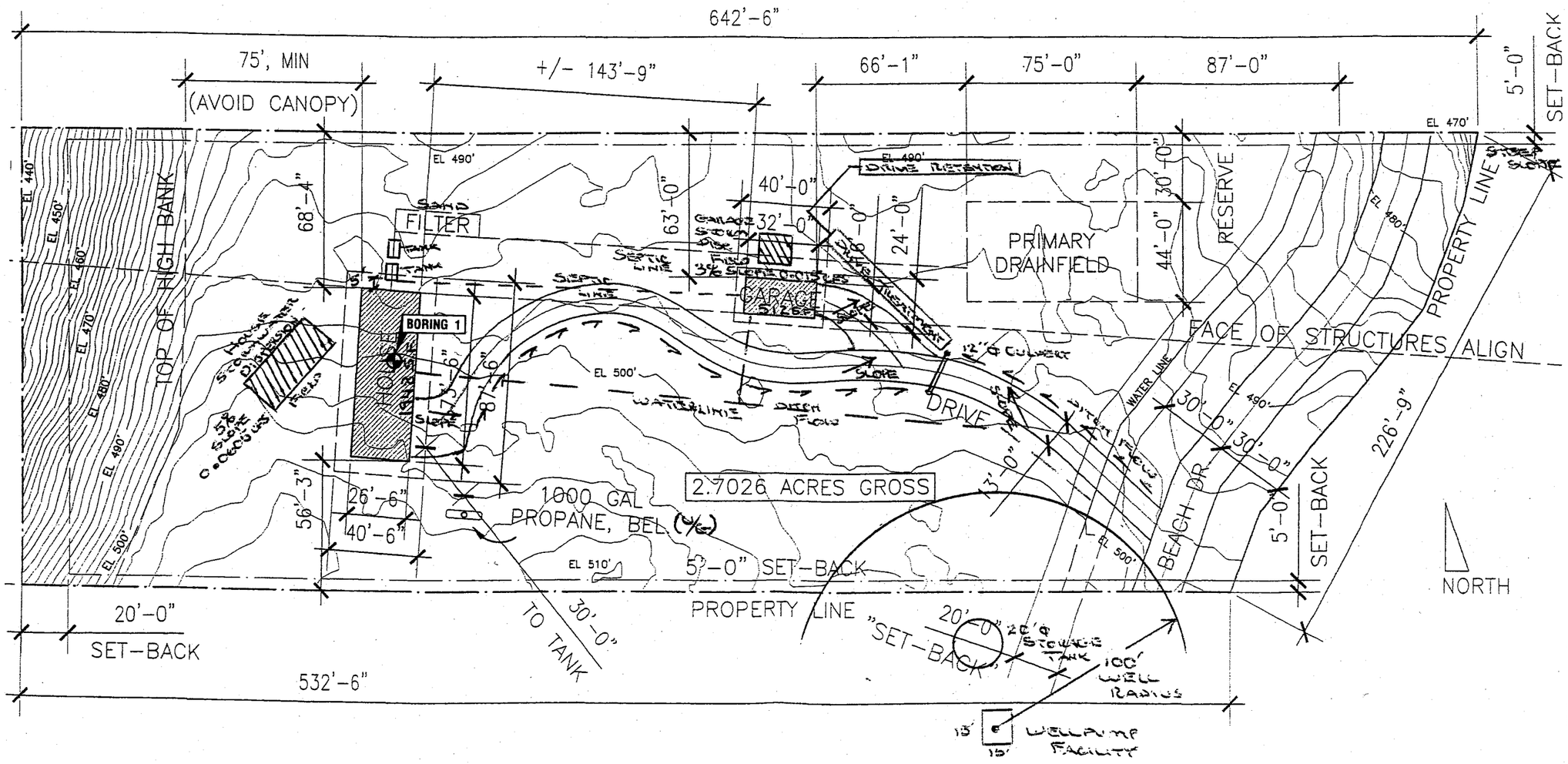


Allen L. Hart Engineering Geologist **1720 North Oakes** **Tacoma, WA 98406** **253-752-8963**	**FIGURE 1- VICINITY MAP** **Location: 55 Beach Drive, Quilcene, Jefferson County, Washington** **Job No. : 0701003** **Client: Paul Coover** **Date: 3/6/2007**

ALLEN L. HART ENGINEERING GEOLOGIST
1720 North Oakes, Tacoma, Washington 98406
253-752-8963

FIGURE 2
SITE PLAN
Client: Paul Coover
Project Number: 0701003

Drawing provided by Rob Thomas Construction. Scale as shown.



SOIL AND BORING COMPLETION LOG

ALLEN L. HART ENGINEERING GEOLOGIST

BORING NUMBER : 1
FIGURE 3
SHEET 1 of 7

PROJECT : Coover Residence
PROJECT NUMBER: 0701003
DRILLING CONTRACTOR : Holt Drilling
START : 2/5/2007
FINISH : 2/6/2007
LOGGER : ALH

CLIENT: Paul Coover
LOCATION : 55 Beach Drive, Quilcene, WA
DRILLING METHOD: Mud Rotary
HAMMER WT (lb)/DROP (in): 140/30
GROUND SURFACE ELEVATION : 490+/-
WATER LEVEL AND DATE (ft bgs) : See comments

DEPTH (ft bgs)	WATER LEVEL	SAMPLE NUMBER	SAMPLE RECOVERY	SAMPLE SPT 6"-6"-6"	SAMPLE N-VALUE	SAMPLE SYMBOL	USCS	SAMPLE DESCRIPTION	COMMENTS
1							SM	**Silty gravelly SAND** Brown to tan, loose to medium dense, silty gravelly SAND, moist to very moist.	
2							SM		
3									
4								**Silty gravelly SAND** Gray, medium dense to dense, silty gravelly SAND, moist. (Glacial till)	
5									
6		1	1.5	18,25,23	48		SP	**Fine to medium SAND** Gray, medium dense to dense, fine to medium SAND, moist to very moist.	
7									
8									
9									Drill action shows gravel below 9 feet.
10								**Gravelly fine to coarse SAND** Gray, medium dense to dense becoming very dense, gravelly fine to coarse SAND, very moist to wet.	
11		2	1.5	29,27,26	53		SP		
12									
13									
14									
15									
16		3	1	26,32	58		SP		
17									
18									
19									
20									
21		4	1.5	20,25,31	56		SP		
22									
23									
24									
25									Drill action shows more gravels.

SOIL AND BORING COMPLETION LOG

ALLEN L. HART ENGINEERING GEOLOGIST

BORING NUMBER : 1
FIGURE 3
SHEET 2 of 7

PROJECT : Coover Residence
PROJECT NUMBER: 0701003
DRILLING CONTRACTOR : Holt Drilling
START : 2/5/2007
FINISH : 2/6/2007
LOGGER : ALH

CLIENT: Paul Coover
LOCATION : 55 Beach Drive, Quilcene, WA
DRILLING METHOD: Mud Rotary
HAMMER WT (lb)/DROP (in): 140/30
GROUND SURFACE ELEVATION : 490+/-
WATER LEVEL AND DATE (ft bgs) : See comments

DEPTH (ft bgs)	WATER LEVEL	SAMPLE NUMBER	RECOVERY	SPT 6"-6"-6"	N-VALUE	SYMBOL	USCS	SAMPLE DESCRIPTION	COMMENTS
26		5	1	33,50	83		SP		
27									
28								Sandy GRAVEL Gray, very dense, sandy GRAVEL to gravelly SAND, moist to very moist.	Drill action shows lenses/layers of gravelly material to 38 ft.
29									
30			.5	56			GP		
31									
32									
33									
34									
35			.5	53			GP		
36									
37									
38								Fine SAND with silt Gray, very dense, fine SAND with silt and silty zones, moist to very moist.	
39									
40									
41		8	1.5	30,45,50	95		SP		
42									
43									
44									
45									
46		9	1.5	30,36,47	83		SP		
47									
48									
49									
50			4	150/5					Rock in sampler at S-10

SOIL AND BORING COMPLETION LOG

ALLEN L. HART ENGINEERING GEOLOGIST

BORING NUMBER : 1
FIGURE 3
SHEET 3 of 7

PROJECT : Coover Residence
PROJECT NUMBER: 0701003
DRILLING CONTRACTOR : Holt Drilling
START : 2/5/2007
FINISH : 2/6/2007
LOGGER : ALH

CLIENT: Paul Coover
LOCATION : 55 Beach Drive, Quilcene, WA
DRILLING METHOD: Mud Rotary
HAMMER WT (lb)/DROP (in): 140/30
GROUND SURFACE ELEVATION : 490+/-
WATER LEVEL AND DATE (ft bgs) : See comments

DEPTH (ft bgs)	WATER LEVEL	SAMPLE NUMBER	SAMPLE RECOVERY	SPT 6"-6"-6"	N-VALUE	SYMBOL	USCS	SAMPLE DESCRIPTION	COMMENTS
51	▼						GP	**Sandy GRAVEL** Gray, very dense, sandy GRAVEL to gravelly SAND, moist to very moist.	Indicated water level in open, uncased hole after flushing of drilling fluid.
52									
53									
54									
55									
56		11	1.5	20,25,37	62		CL	**CLAY** Tan, very hard, CLAY, moist.	
57									
58									
59									
60			.5	66			SP	**Fine SAND** Gray, very dense, fine SAND, moist to very moist.	
61									
62									
63									
64									
65									
66		13	1.4	30,49,50/4	99		SP	**Fine to medium SAND** Gray with scattered tan zones, very dense, fine to medium SAND with silty zones and scattered gravels and gravelly zones, very moist.	3ft diameter boulder with gravels/cobbles below.
67									
68									
69									
70									
71		14	1	34,57	91		SP	**Fine to medium SAND** Gray, very dense, fine to medium SAND, moist to very moist.	
72									Smooth, firm drilling. No gravelly zones and mimimal gravel in cuttings.
73									
74									
75									

SOIL AND BORING COMPLETION LOG

ALLEN L. HART ENGINEERING GEOLOGIST

BORING NUMBER : 1
FIGURE 3
SHEET 4 of 7

PROJECT : Coover Residence
PROJECT NUMBER: 0701003
DRILLING CONTRACTOR : Holt Drilling
START : 2/5/2007
FINISH : 2/6/2007
LOGGER : ALH

CLIENT: Paul Coover
LOCATION : 55 Beach Drive, Quilcene, WA
DRILLING METHOD: Mud Rotary
HAMMER WT (lb)/DROP (in): 140/30
GROUND SURFACE ELEVATION : 490+/-
WATER LEVEL AND DATE (ft bgs) : See comments

DEPTH (ft bgs)	WATER LEVEL	SAMPLE NUMBER	RECOVERY	SPT 6"-6"-6"	N-VALUE	SYMBOL	USCS	SAMPLE DESCRIPTION	COMMENTS
76		15	1.5	40,50,50	100		SP		
77									
78									
79									
80									
81		16	1.5	47,41,58	99		SP		
82									
83									
84									
85			.5	60			SP		
86									
87									
88									
89									Slightly silty to silty material in cutting return.
90									
91		18	1.5	31,30,35	65		SP		
92									
93									
94									
95									Smooth, firm drilling
96		19	1.5	41,40,47	87		SP		
97									
98									
99									
100									

SOIL AND BORING COMPLETION LOG

ALLEN L. HART ENGINEERING GEOLOGIST

BORING NUMBER : 1
FIGURE 3
SHEET 5 of 7

PROJECT : Coover Residence
PROJECT NUMBER: 0701003
DRILLING CONTRACTOR : Holt Drilling
START : 2/5/2007
FINISH : 2/6/2007
LOGGER : ALH

CLIENT: Paul Coover
LOCATION : 55 Beach Drive, Quilcene, WA
DRILLING METHOD: Mud Rotary
HAMMER WT (lb)/DROP (in): 140/30
GROUND SURFACE ELEVATION : 490+/-
WATER LEVEL AND DATE (ft bgs) : See comments

DEPTH (ft bgs)	WATER LEVEL	SAMPLE NUMBER	RECOVERY	SPT 6"-6"-6"	N-VALUE	SYMBOL	USCS	SAMPLE DESCRIPTION	COMMENTS
101		20	1	52,50	102		SP		
102									
103									
104									
105									
106		21	1.5	44,58,50/4	108		SP		
107									
108									
109									
110			.5	59			SP		Drilling continues firm but smooth.
111									
112									
113									
114									
115			.5	60			SP		
116									
117									
118									
119									
120			.5	51			SP		
121									
122									
123									
124									
125									

SOIL AND BORING COMPLETION LOG

ALLEN L. HART ENGINEERING GEOLOGIST

BORING NUMBER : 1
FIGURE 3
SHEET 6 of 7

PROJECT : Coover Residence
PROJECT NUMBER: 0701003
DRILLING CONTRACTOR : Holt Drilling
START : 2/5/2007
FINISH : 2/6/2007
LOGGER : ALH

CLIENT: Paul Coover
LOCATION : 55 Beach Drive, Quilcene, WA
DRILLING METHOD: Mud Rotary
HAMMER WT (lb)/DROP (in): 140/30
GROUND SURFACE ELEVATION : 490+/-
WATER LEVEL AND DATE (ft bgs) : See comments

DEPTH (ft bgs)	WATER LEVEL	SAMPLE NUMBER	SAMPLE RECOVERY	SPT 6"-6"-6"	N-VALUE	SYMBOL	USCS	SAMPLE DESCRIPTION	COMMENTS
126		25	1	50,63	113		SP		Drilling continues firm but smooth.
127									
128									
129									
130			.5	54			SP		
131									
132									
133									
134									
135			.5	64			SP		
136									
137									Drill action indicates occasional scattered gravel below 137 feet.
138									
139									
140			.5	57			SP		
141									
142									
143									
144									
145			.5	50			SP		
146									
147									
148									
149									
150			.5	54			SP		

SOIL AND BORING COMPLETION LOG

ALLEN L. HART ENGINEERING GEOLOGIST

BORING NUMBER : 1
FIGURE 3
SHEET 7 of 7

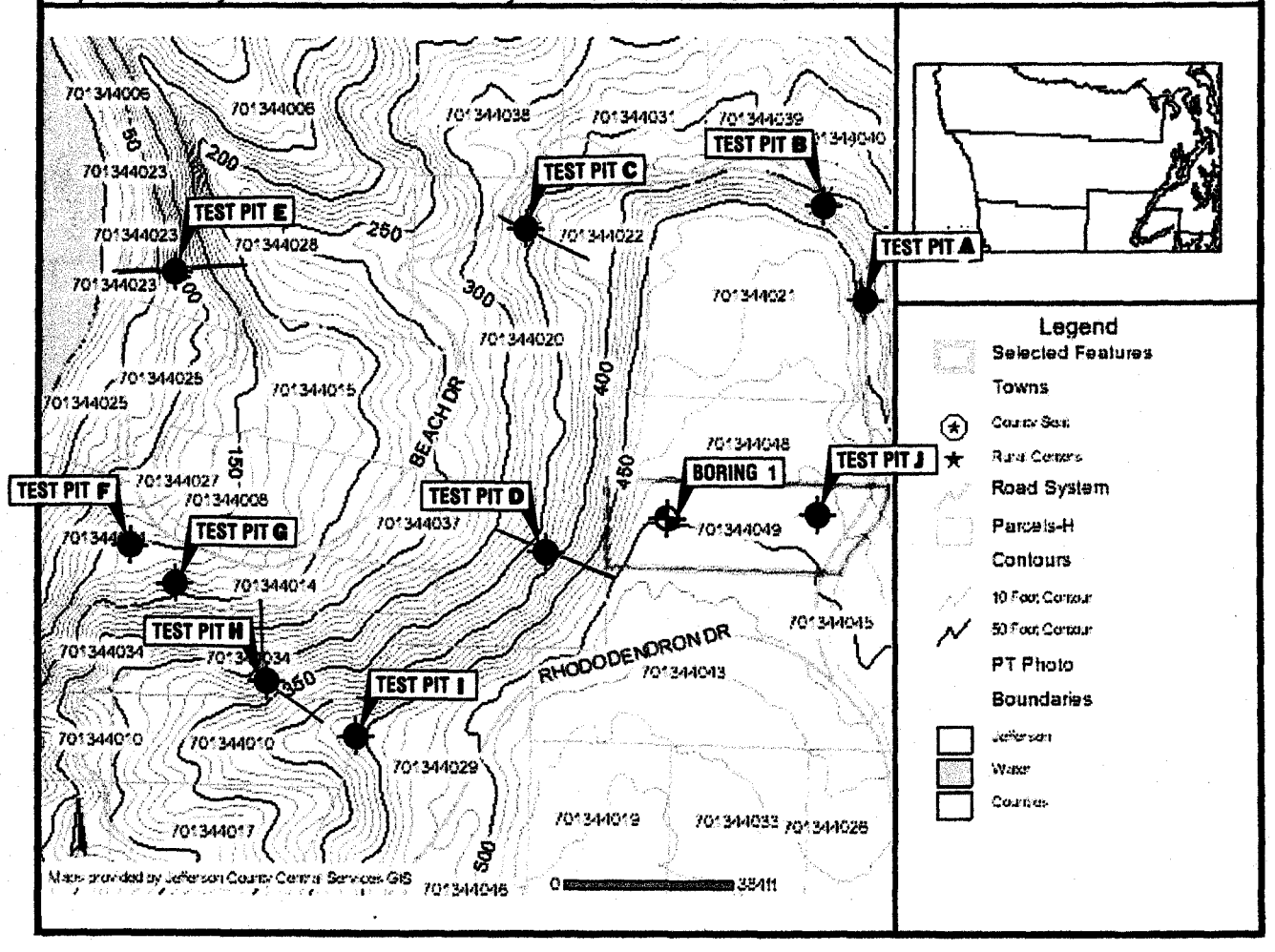
PROJECT : Coover Residence
PROJECT NUMBER: 0701003
DRILLING CONTRACTOR : Holt Drilling
START : 2/5/2007
FINISH : 2/6/2007
LOGGER : ALH

CLIENT: Paul Coover
LOCATION : 55 Beach Drive, Quilcene, WA
DRILLING METHOD: Mud Rotary
HAMMER WT (lb)/DROP (in): 140/30
GROUND SURFACE ELEVATION : 490+/-
WATER LEVEL AND DATE (ft bgs) : See comments

DEPTH (ft bgs)	WATER LEVEL	SAMPLE					SAMPLE DESCRIPTION		COMMENTS
		NUMBER	RECOVERY	SPT 6"-6"-6"	N-VALUE	SYMBOL	USCS		
151									Boring terminated at 150.5 feet.
152									
153									
154									
155									
156									
157									
158									
159									
160									
161									
162									
163									
164									
165									
166									
167									
168									
169									
170									
171									
172									
173									
174									
175									

ArcIMS HTML Viewer Map

FOR INFORMATIONAL PURPOSES ONLY-Jefferson County does not attest to the accuracy of the data contained herein and makes no warranty with respect to its correctness or validity. Data contained in this map is limited by the method and accuracy of its collection. Mon Feb 26 14:16:29 2007



Test pit locations should be considered approximate. Map scale as indicated. Map source: Jefferson County web site.

Allen L. Hart Engineering Geologist
1720 North Oakes, Tacoma, Washington 98406
253-752-8963

FIGURE 4-TEST PIT LOCATIONS
Location: 55 Beach Drive, Quilcene, Jefferson County, Washington
Job No. : 0701003
Client: Paul Coover
Date: 3/6/2007

SUMMARY OF TEST PITS

Test Pit A

Location: Road cut
Material: Silty, gravelly SAND (glacial till) over fine SAND ranging from some silt to silty.

Test Pit B

Location: Road cut
Material: Silty fine SAND over fractured CLAY.

Test Pit C

Location: Slope exposure
Material: SAND with minor to some silt.

Test Pit D

Location: Slope exposure and hand pits
Material: SAND with minor to some silt and silty zones. Clay layer at about elevation450+/-.

Test Pit E

Location: Cliff and slope exposure
Material: Massive to bedded SAND with random, discontinuous appearing layers of gravelly SAND. Silt content variable, sand generally appears clean to minor silt while gravelly zones appear some silt to silty.

Test Pit F

Location: Graded cut bench
Material: Silty SAND and SAND.

Test Pit G

Location: Slide block, slope exposure, hand pits and colluvium
Material: Silty fine SAND with fractured, broken chunks and blocks of SILT and CLAY.

Test Pit H

Location: Slope exposure and hand pits
Material: SAND with minor to some silt and silty zones.

Test Pit I

Location: Slope exposure and hand pits
Material: Silty fine SAND and fractured CLAY.

Test Pit J

Location: Septic soil log pits
Material: Silty, gravelly SAND (glacial till).

FIGURE 5

SUMMARY OF TEST PITS

Test Pit A

Location: Road cut
Material: Silty, gravelly SAND (glacial till) over fine SAND ranging from some silt to silty.

Test Pit B

Location: Road cut
Material: Silty fine SAND over fractured CLAY.

Test Pit C

Location: Slope exposure
Material: SAND with minor to some silt.

Test Pit D

Location: Slope exposure and hand pits
Material: SAND with minor to some silt and silty zones. Clay layer at about elevation450+/-.

Test Pit E

Location: Cliff and slope exposure
Material: Massive to bedded SAND with random, discontinuous appearing layers of gravelly SAND. Silt content variable, sand generally appears clean to minor silt while gravelly zones appear some silt to silty.

Test Pit F

Location: Graded cut bench
Material: Silty SAND and SAND.

Test Pit G

Location: Slide block, slope exposure, hand pits and colluvium
Material: Silty fine SAND with fractured, broken chunks and blocks of SILT and CLAY.

Test Pit H

Location: Slope exposure and hand pits
Material: SAND with minor to some silt and silty zones.

Test Pit I

Location: Slope exposure and hand pits
Material: Silty fine SAND and fractured CLAY.

Test Pit J

Location: Septic soil log pits
Material: Silty, gravelly SAND (glacial till).

FIGURE 5

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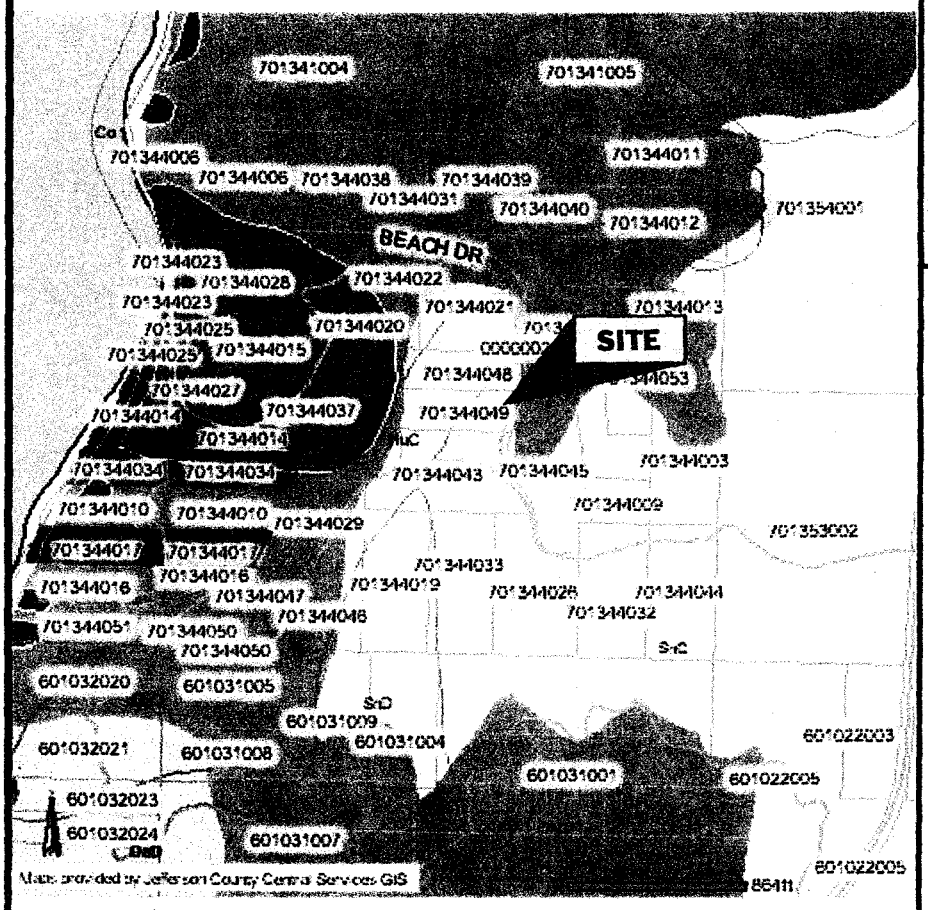

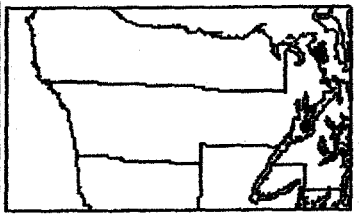

Legend

- Parcels-H
- Road System
- Towns
- County Seat
- Rural Centers
- Soils-H
- Landslide Hazard
- Slides
- High
- Moderate
- Slight
- outlines_mid
- Jefferson
- Water
- Counties

Allen L. Hart Engineering Geologist **1720 North Oakes** **Tacoma, WA 98406** **253-752-8963**	**Jefferson County Landslide Hazard Map** **Location: 55 Beach Drive, Quilcene, Jefferson County, Washington** **Job No. : 0701003** **Client: Paul Coover** **Date: 3/6/2007**
	FIGURE 6

ArcIMS HTML Viewer Map

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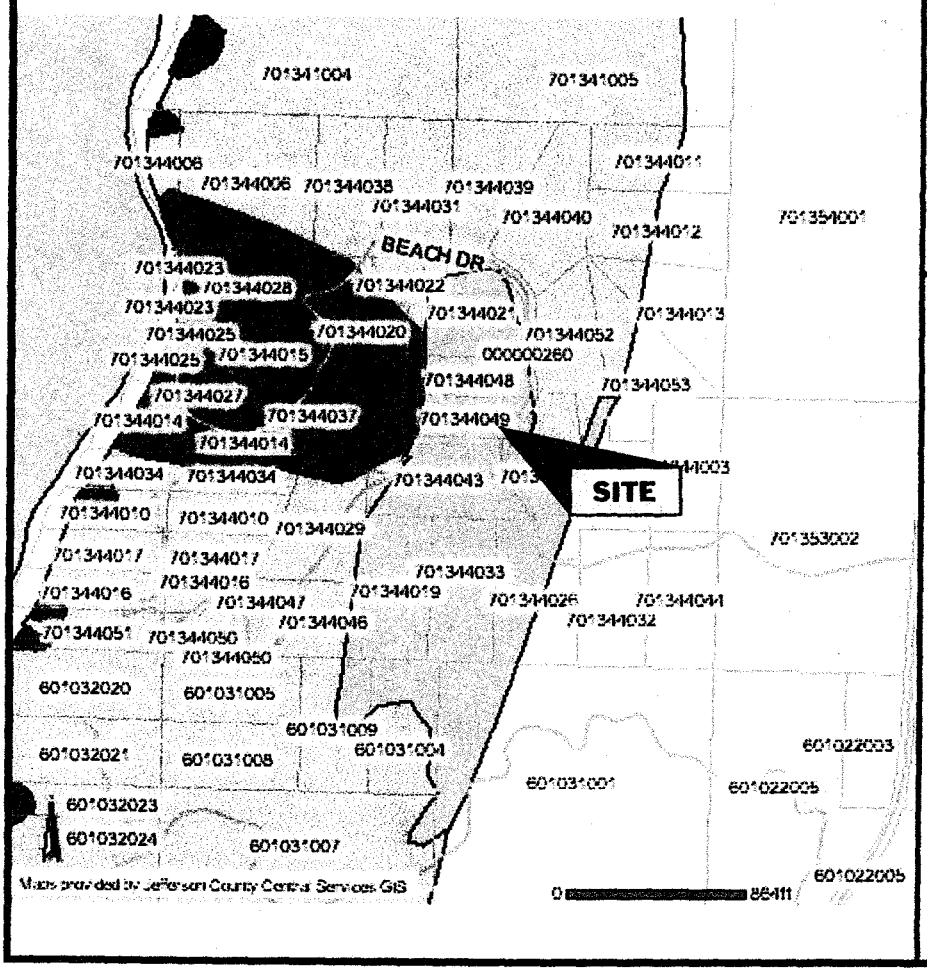

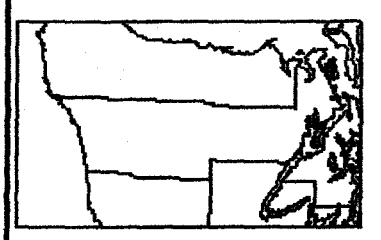

Legend

Parcels-H
Road System
Towns
County Seat
Rural Centers
Shoreline Slope Stability
Stable
Intermediate
Unstable
Unstable Recent Landslide
Unstable Old Landslide
Modified
outlines_mid
Jefferson
Water
Counties

Allen L. Hart Engineering Geologist **1720 North Oakes** **Tacoma, WA 98406** **253-752-8963**	**Jefferson County Shoreline Slope Stability Map** **Location: 55 Beach Drive, Quilcene, Jefferson County, Washington** **Job No. : 0701003** **Client: Paul Coover** **Date: 3/6/2007**
	FIGURE 7

ArcIMS HTML Viewer Map

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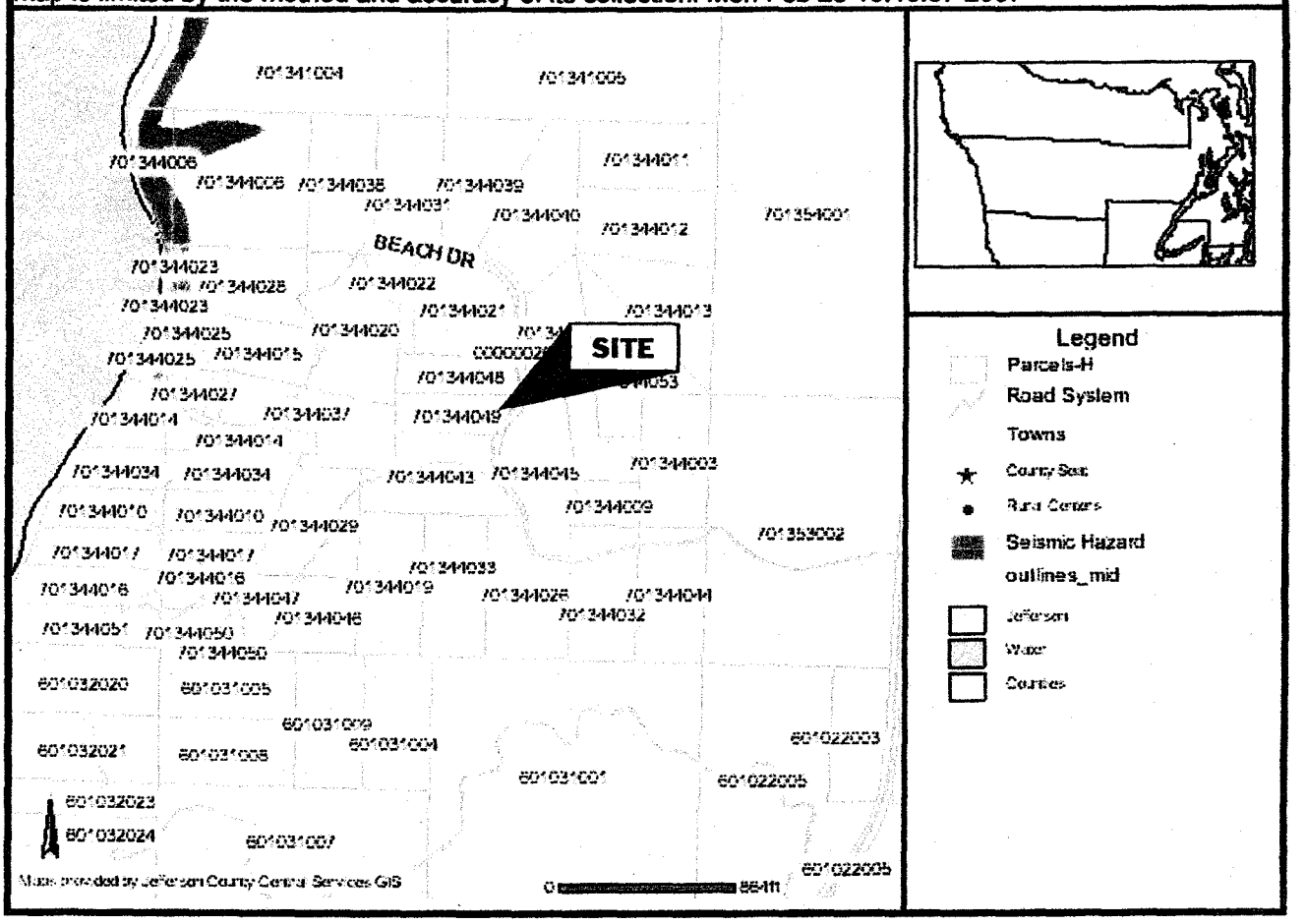
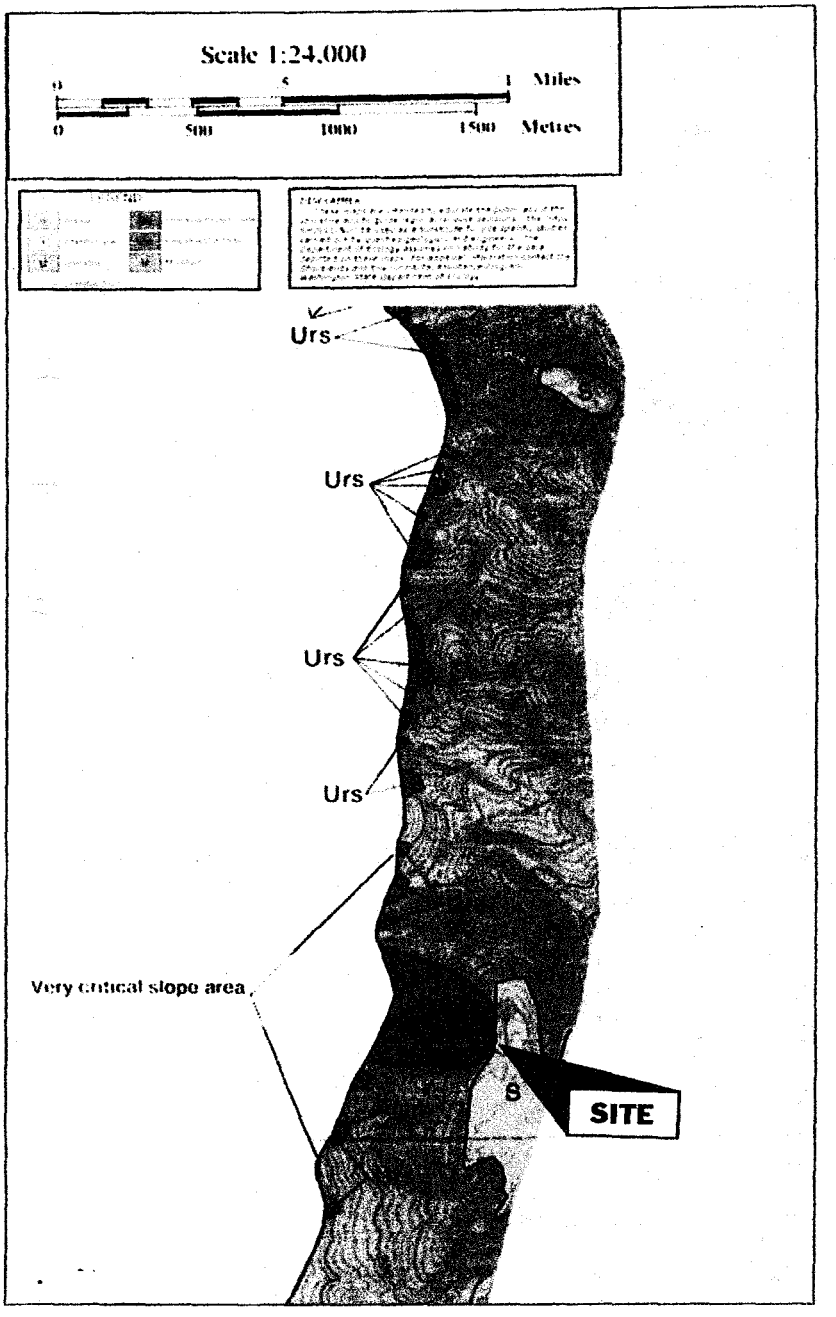


Allen L. Hart Engineering Geologist
1720 North Oakes
Tacoma, WA 98406
253-752-8963

Jefferson County Seismic Hazard Map
Location: 55 Beach Drive, Quilcene, Jefferson County, Washington
Job No. : 0701003
Client: Paul Coover
Date: 3/6/2007

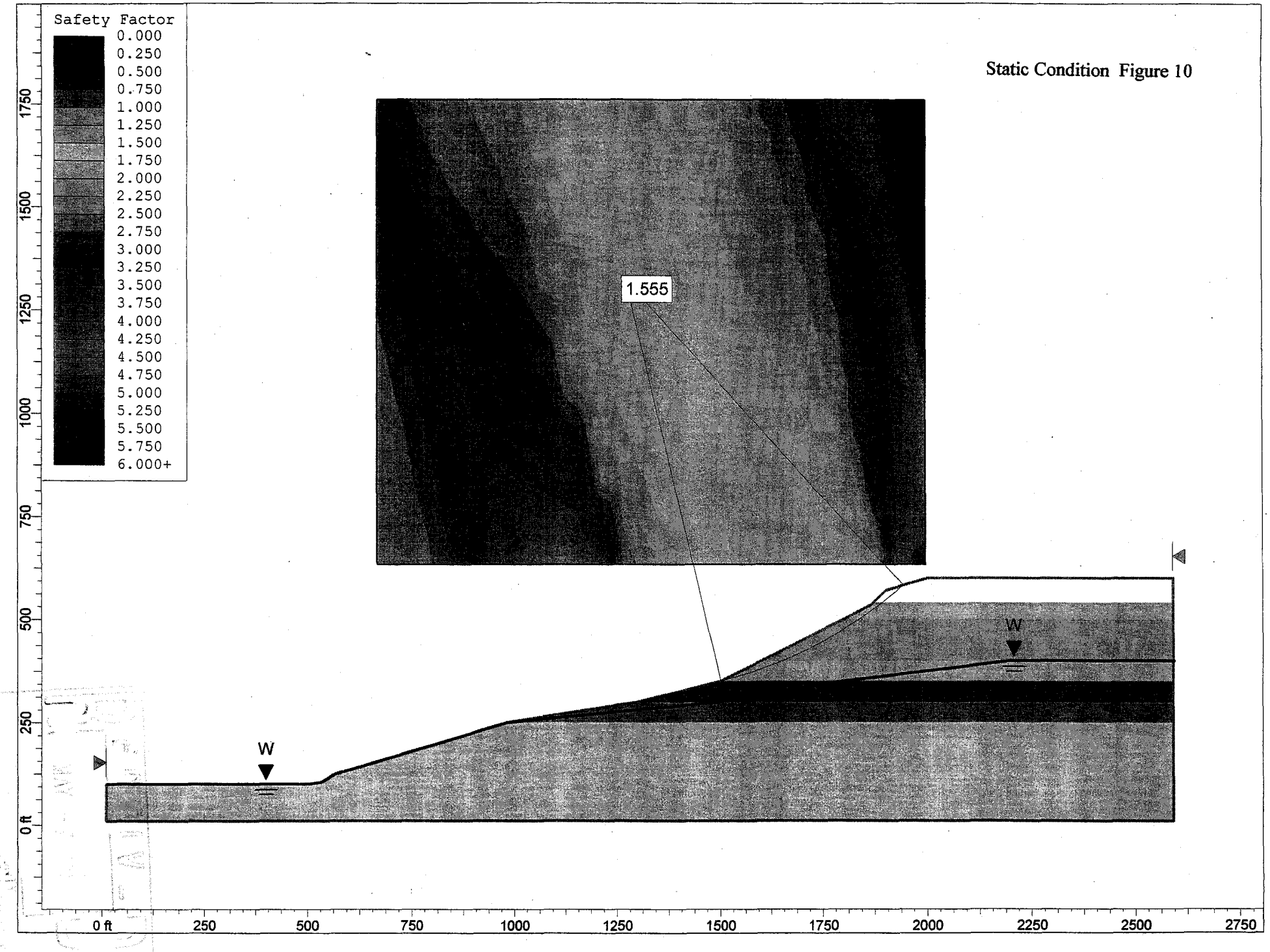
FIGURE 8



Portion of Washington State Coastal Zone Atlas, Jefferson County volume

ALLEN L. HART ENGINEERING GEOLOGIST **1720 North Oakes, Tacoma, Washington 98406** **253-752-8963**	**SLOPE STABILITY MAP** **Location: 55 Beach Drive, Quilcene, Jefferson County, Washington** **Job No. : 0701003** **Client: Paul Coover** **Date: 3/6/2007**
	Figure 9

Static Condition Figure 10



Slide Analysis Information

Document Name

File Name: ALH Dabob Cove 3

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Drift
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 200 psf
Friction Angle: 42 degrees
Water Surface: Water Table
Custom Hu value: 1

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Figure 11

Material: Clayey SILT
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 500 psf
Friction Angle: 25 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 1
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 150 psf
Friction Angle: 40 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 2
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 50 psf
Friction Angle: 38 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 4
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 10 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 5
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 10 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 6
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 10 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 7
Strength Type: Mohr-Coulomb

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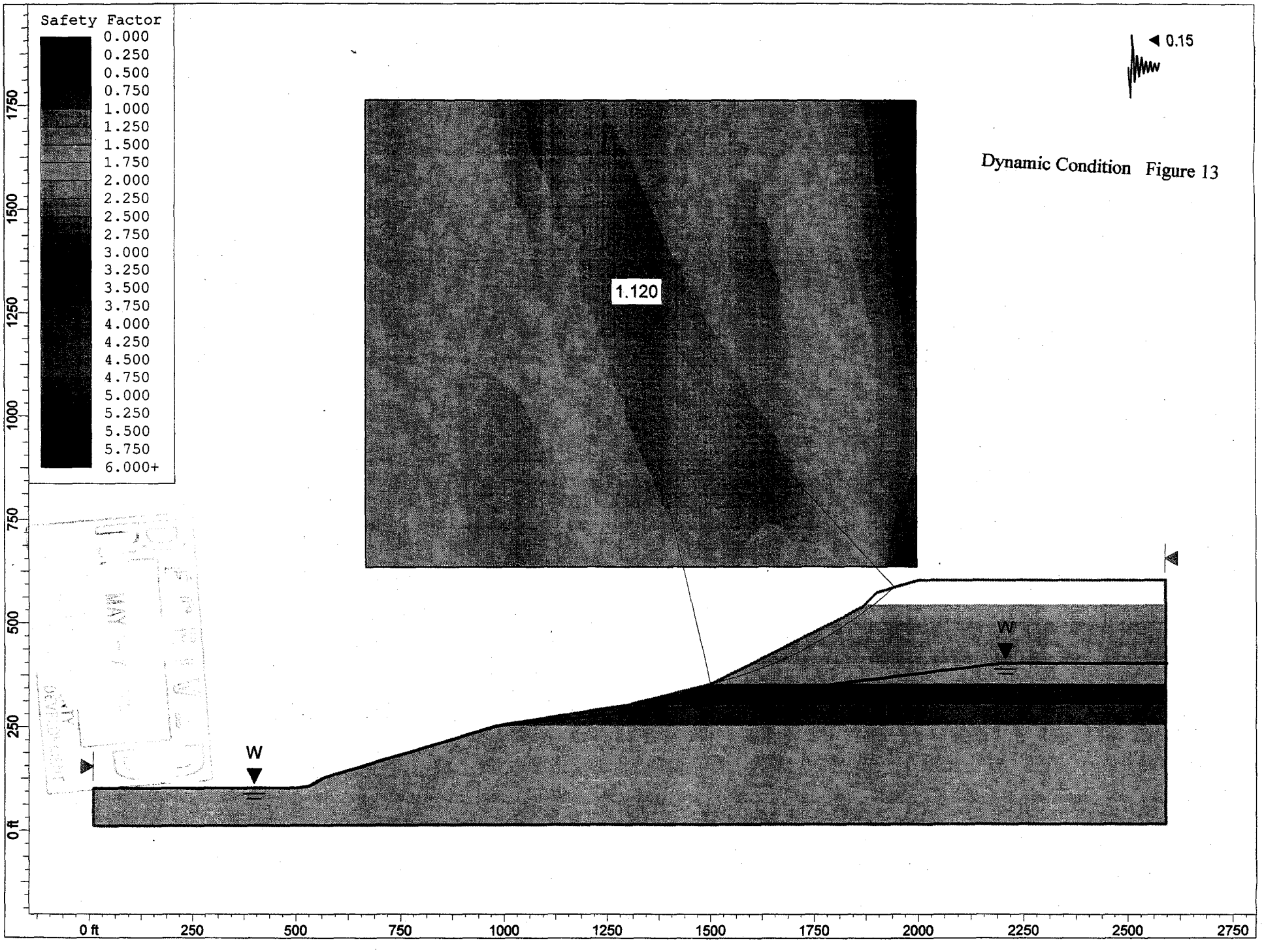
MAY -7

Figure 12



Dynamic Condition Figure 13

Slide Analysis Information

Document Name

File Name: ALH Dabob Cove 3

Project Settings

Project Title: SLIDE - An Interactive Slope Stability Program
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Loading

Seismic Load Coefficient (Horizontal): 0.15

Material Properties

Material: Drift
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3

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Figure 14

Cohesion: 200 psf
Friction Angle: 42 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Clayey SILT
Strength Type: Mohr-Coulomb
Unit Weight: 130 lb/ft3
Cohesion: 500 psf
Friction Angle: 25 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 1
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 150 psf
Friction Angle: 40 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 2
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 50 psf
Friction Angle: 38 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 4
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 10 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 5
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 10 psf
Friction Angle: 33 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: Sand 6
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 10 psf
Friction Angle: 32 degrees
Water Surface: Water Table
Custom Hu value: 1

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Figure 15