Geological/Geotechnical Report - Whisper Ridge Oceanside, Oregon

Prepared for:
Robert F. Trost

September 28, 2005
1120-00

Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

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Introduction and Limitations

In accordance with our contract, we are providing geologic and geotechnical information required by the Tillamook County Planning Department for constructing a 20-acre subdivision in a Geologic Hazard Zone as defined by Tillamook County Land Use Ordinance 4.070.

This work was performed for the exclusive use of Robert F. Trost and his agents and consultants for specific application to this project and site. We performed this work in accordance with generally accepted professional practices in the same or similar localities, related to the nature of the work accomplished, at the time the services were performed. No other warranty, express or implied, is made.

Site Description and Background

Ash Creek Associates, Inc., understands that Robert F. Trost is requesting a preliminary geologic and geotechnical assessment for the subject property, located east of the 3 Capes Scenic Highway between the Capes development and Oceanside, Oregon (Figure 1). The property is being assessed for the suitability of developing a 20-acre subdivision in two phases (Figure 2). The streets are not yet named, but the development is divided into two phases, with Phase 1 located in the western one-third of the site and Phase 2 in the eastern two-thirds. The preliminary 24-lot layout for Phase 1 has been completed and Phase 2 will be done at a later date.

The property has been designated on the Tax Maps as Partition Plats 2000-52, 2000-55, and 2004-29 (Figure 3). The overall site is a slightly irregular rectangular shape with the longer axis in a north-south direction. The land surface consists of a north-south tending ridge near the east property line and for the most part slopes moderately downward toward the west and southwest. The northeast corner slopes toward the north and northwest with a north-trending swale originating about 150 feet south of the northern property line. The site relief varies approximately 220 feet, with the low point at approximate elevation (El.) 265 above Mean Sea Level (MSL) at the southwest corner, and the high point at approximate El. 486 at the top of the knoll near the northeastern corner.

A series of existing gravel roads and sand trails allow fairly easy access to much of the site. For the most part, they follow the approximate layout shown on Figure 2. An existing gravel road begins across Hillsdale Street from Huckleberry Lane and winds up the hill eastward following the Phase 1-Phase 2 boundary to the north property line, then terminating at the north-south intersection near the northeastern property corner. A north-south sandy trail begins at the curve in Hillsdale Street about 200 feet north of Central, continues through the roundabout in the west-central part of the site, and terminates at the north property line. Another sandy trail extends northward from Manzanita Street and follows the Phase 1-Phase 2 boundary to the roundabout in the west-central part of the site where it terminates.

The nearby shore front areas from Cape Lookout to Cape Meares have long been plagued by slope movement, and during the El Nino and La Nina events of the early 1980s and late1990s, severe erosion and

property damage occurred nearby. Unstable slopes in the bedrock have been recorded to the south and west at the Capes and (proposed) Spindrift developments, and to the north above Oceanside and Cape Mears. The unstable areas are limited to the beach front and movement only seems to occur during cyclic extreme erosion events. This property does not have beach front exposure and erosion and landsliding from direct wave attack is not a factor. Any unstable slopes on the site would most likely be of a localized nature and would potentially be man-caused.

Our scope of work involved performing a library research and geologic reconnaissance of the site and surrounding area, including traversing a representative quantity of the slopes on foot and noting relevant surface features, and reviewing nearby geologic and geotechnical reports in our files and at the offices of the Tillamook County Department of Community Development.

Geology

The entire site is located upon soils that have been classified by past geologic mapping (DOGAMI Bulletin 74, 1972 and others) as stable sand dunes. The surrounding geologic units consist of Miocene-aged (5.3 to 23.8 million years ago [mya]) volcanic rocks along the northern boundary of the site, Miocene-aged marine sedimentary rocks along the eastern boundary of the site, and Pleistocene-aged (10,000 to 1.8 mya) elevated Marine Terrace Deposits slightly south of the site (Figure 3). The volcanic rocks are primarily breccias and flows with interspersed submarine pillow lavas; the Astoria Formation consists of marine sedimentary sandstone and mudstone materials scraped off the ocean floor by sea-floor spreading; and the terrace deposits consist of unconsolidated to partially cemented sands and gravels derived from beach and near-shore deposition. The Astoria Formation is thought to dip seaward at 10 to 12 degrees, but no exposures are located nearby to verify the actual inclination. Both the volcanic rocks and the Astoria Formation are mapped as having landslide topography at or near the ground surface, but not having observed active landsliding in the area. The nearby Terrace Deposits rest directly on the Astoria Formation and do not show indications of historical ground movement. Based upon the past geologic mapping and observed near-surface conditions, the sand dunes rest upon the eroded surface of one or more of these materials and do not show evidence of historical movement.

As part of our library research we reviewed historical USGS topographic maps and photos (1939 through 1999). The review indicates that historically slopes in the immediate area west of this site have persistently maintained the present configuration.

In addition to topographic maps, aerial photos, and existing geotechnical reports, we relied upon information contained in:

Allan, J.C. and Priest, G.R., 2001. Evaluation of Coastal Erosion Hazard Zones Along Dune & Bluff Backed Shorelines in Tillamook Co., Oregon. DOGAMI OFR 0-01-03.

Hofmeister, Jon, 2000. Slope Failures in OR – GIS Inventory for Three 1996/1997 Storm Events. DOGAMI SP-34.

Jacoby, G. C., D. E. Bunker, and B. E. Benson, 1997. Tree-ring Evidence for an A.D. 1700 Cascadia Earthquake in Washington and Northern Oregon. Geology, v. 25, no. 11, p. 999-1002.

Redfern, Roger, 1994. Preliminary Geologic Assessment of Ocean Pines, Oceanside area, Tillamook County, Oregon.

Satake, K., K. Shimazaki, Y. Tsuji, and K. Ueda, 1996. Time and Size of a Giant Earthquake in Cascadia Inferred from Japanese Tsunami Records of January 1700. Nature, v. 379, p. 246-249.

Schlicker, H.G., et al., 1972. Environmental Geology of the Coastal Region of Tillamook and Clatsop Counties, Oregon. DOGAMI Bulletin 74.

Taylor, G. G., 1998. Impacts of the El Nino Southern Oscillation of the Pacific Northwest. Oregon Geology, v. 60, No. 3, p. 51-56.

Reconnaissance

During our reconnaissance, we observed soil creep on the steeper portions of the site, but did not observe active landsliding. The soil creep was generally observed on slopes over steepened by road cutting, or previous, logging operations. Slopes steeper than approximately 2 Horizontal to 1 Vertical (2H:1V) are prone to soil creep, but the occurrence is typically confined to the upper 2 to 3 feet and can be controlled by flattening the slopes or embedding foundations.

Typically, if the dune sands are located away from direct wind or wave erosion, and are involved in slope movement beyond normal soil creep, the causes are usually tied to cutting or fill placement, human and animal activity, and removal of native slope vegetation. If a slope has been undercut or over steepened, the sand seeks a stable angle of repose of about 32 degrees, and to achieve it, the ground above the cut begins raveling and sloughing until a level of marginal stability is achieved (a slope at 32 degrees is considered fragile and highly susceptible to further movement). Once started, this is a slow process that can take many years to complete.

Surface conditions observed during our reconnaissance consist primarily of shore pine, brush, and grasses covering virtually the entire site. In many areas, stumps, branches, and slash are present beneath the brushy areas. Although no recent slope clearing was evident, the site has been completely logged at least once during the past. The effects of clear cutting on slope stability are primarily the loss of tree root structure and accelerated movement on over steepened slopes. Ground disturbance during the cutting process also lends to instability. Tree root structure provides some level of surface stability (i.e., within 5 to 8 feet of the ground surface) as well as strength to soil mantling the site slopes.

During our reconnaissance, we did not see evidence that running water (surface flow) has caused any significant erosion on the property. Historically, due to the high permeability of the dune sands, water tends to infiltrate downward rather than run off, and surface erosion by water has not been an issue.

Geologic Hazards

Landsliding

As noted previously, active landsliding in the immediate area has historically been confined to oceanfront properties underlain by near shore landslide blocks, or near shore properties in areas of aggressive shoreline retreat. Examples of these areas have been widely documented at the Capes development and in the proposed Spindrift development.

The ancient rocks and soils underlying the dune sands have been mapped as having landslide topography but the landsliding may be several hundred or several thousand years old. If the landsliding were tied to subduction earthquakes, the dunes would show disturbance related to deep-seated ground movement.

In our opinion, this property does not exhibit recent landslide movement, and we do not consider it to be an issue with respect to development.

Mudflows

Based upon the soil types and our observations, mudflow events are not likely to occur on this site.

Brallier Peat Soils

Based upon the soil types and our observations, Brallier Peat soils do not occur on this site.

Earthquakes

Abundant, recently acquired evidence indicates a series of geologically recent serious earthquakes related to the Cascadia Subduction Zone (CSZ) has occurred along the coastline of the Pacific Northwest. Evidence suggests as many as 13 major earthquakes or more have occurred in about the last 7,700 years. These earthquakes were accompanied by widespread subsidence of a few inches to a few feet. Massive waves (tsunamis, also incorrectly termed "tidal waves") appear to have been associated with many of these earthquakes. The most devastating in recent history just occurred in Malaysia at the end of December 2004. The extent of damage to terrace and dune backed bluffs has not yet been evaluated, but is likely to be significant.

In addition, settlement, liquefaction, and landsliding of some earth materials are believed to have been commonly associated with these seismic events. Saturated sandy soils underlying the site may be susceptible to liquefaction.

These earthquakes would likely have a magnitude 8.0 to 9.0 and are believed to have an average recurrence interval of about 250 to 650 years, with a mean near 450 years (Priest et al., 1997). Evidence suggests the last major earthquake probably occurred approximately 300 years ago (Jacoby et al., 1997; Satake et al., 1996). Risks associated with these major earthquakes should be considered in light of the low probability of one occurring in any given year and the high consequences resulting from such an occurrence.

Other earthquakes related to shallow crustal movements or earthquakes related to the Juan de Fuca plate have the potential to generate magnitude 6.0 to 7.5 earthquakes. The recurrence interval for these types of earthquakes is difficult to determine from present data, but estimates of 150 years have been given in the literature.

Most of the Tillamook County area, including the subject property, lies in an area subject to possible tsunami hazards as the result of large-scale disturbance of the sea floor resulting from a possible "Great Subduction Zone Earthquake" on the CSZ (Priest, 1995). This property is far enough from the beach and high enough in elevation that it would not be subject to tsunami runup.

Overall, considering the age of the sand dunes and nearby geologic formations, they have been subjected to dozens of CSZ events, and unless otherwise greatly disturbed, they have reached a relatively stable equilibrium.

Tillamook County Standards

In responding to the Tillamook County requirements, we will address the items in the order that they appear in the ordinance:
Section 4.070(7) (Development Standards).

a) **Development Density.** The property is zoned for Single Family Residential and under Phase 1, 24 Lots are being proposed. Lot size does not contribute to Geologic Hazards.

b) **Locations for Structures and Roads.** The location of the structures will conform to normal lot line setback standards. Lot outlines and proposed road locations are shown on Figure 2 of this Geologic Hazard Report. As best they can, the roads follow existing contours to avoid excessive cutting.

c) **Land Grading Practices.** The only land grading anticipated will be road construction and building pad excavation. To our knowledge, no significant cuts or structural fills are proposed for the site, but should they occur, additional recommendations would include: soil compaction beneath

structures should be 95% of the maximum dry density in accordance with ASTM D-1557; cut and fill slopes should not exceed 2H:1V; retaining structures should be designed for slopes steeper than 2H:1V; no soil should be permanently stockpiled on existing slopes that exceed 4H:1V.

d) **Vegetation Removal and Re-Vegetation Practices.** Although the dunes are relatively stable, they are still subject to wind and water erosion if denuded and left uncovered. We recommend that any areas with bare sand exposed by topsoil removal be immediately re-vegetated or protected from erosion by a layer of gravel, sod, or other confinement.

e) **Foundation Design.** No building design is currently available, but we are assuming that construction will be in keeping with adjacent neighborhoods to the south and west. On slopes steeper than 3H:1V, the type and location of the structures should be reviewed on a case-by-case basis by Ash Creek Associates. Structures on 3H:1V slopes, or flatter, can utilize conventional foundations without special preparation or considerations.

f) **Road Design.** The roads are being designed by LDC Design Group of Tillamook, Oregon. No special considerations are needed outside standard grading practices. If permanent cut or fill slopes exceed 2H:1V, they should be evaluated and retaining structures should be installed.

g) **Management of Storm Water Runoff During and After Construction.** Based upon our observations, our experience in the area, and borings in the nearby areas, it appears that 40 to 65 feet of highly permeable dune/beach sands underlie the site. Water from rainfall, roofs, driveways, and roadways in the nearby area infiltrates the sands and dissipates into the subsurface. The critical condition is to not discharge water directly onto the slope faces. The water generated by roof and driveway drainage on this project should be routed into drywell systems, allowing the water to dissipate into the subsurface sands rather than being concentrated on the slopes.

In addition to the requirements outlined above, we are addressing the summary findings and conclusions of Section 4.070(8), as follows:

a) **The type of use proposed and the adverse effects it might have on adjacent areas.** The proposed use of the property is for construction of single-family dwellings. The dwellings will be in keeping with construction practices on adjacent properties and will have no adverse effects on adjacent areas.

b) **Hazards to life, public and private property, and the natural environment which may be caused by the proposed use.** The development will be consistent with the adjacent land use and will pose no hazards to life, property, or the natural environment.

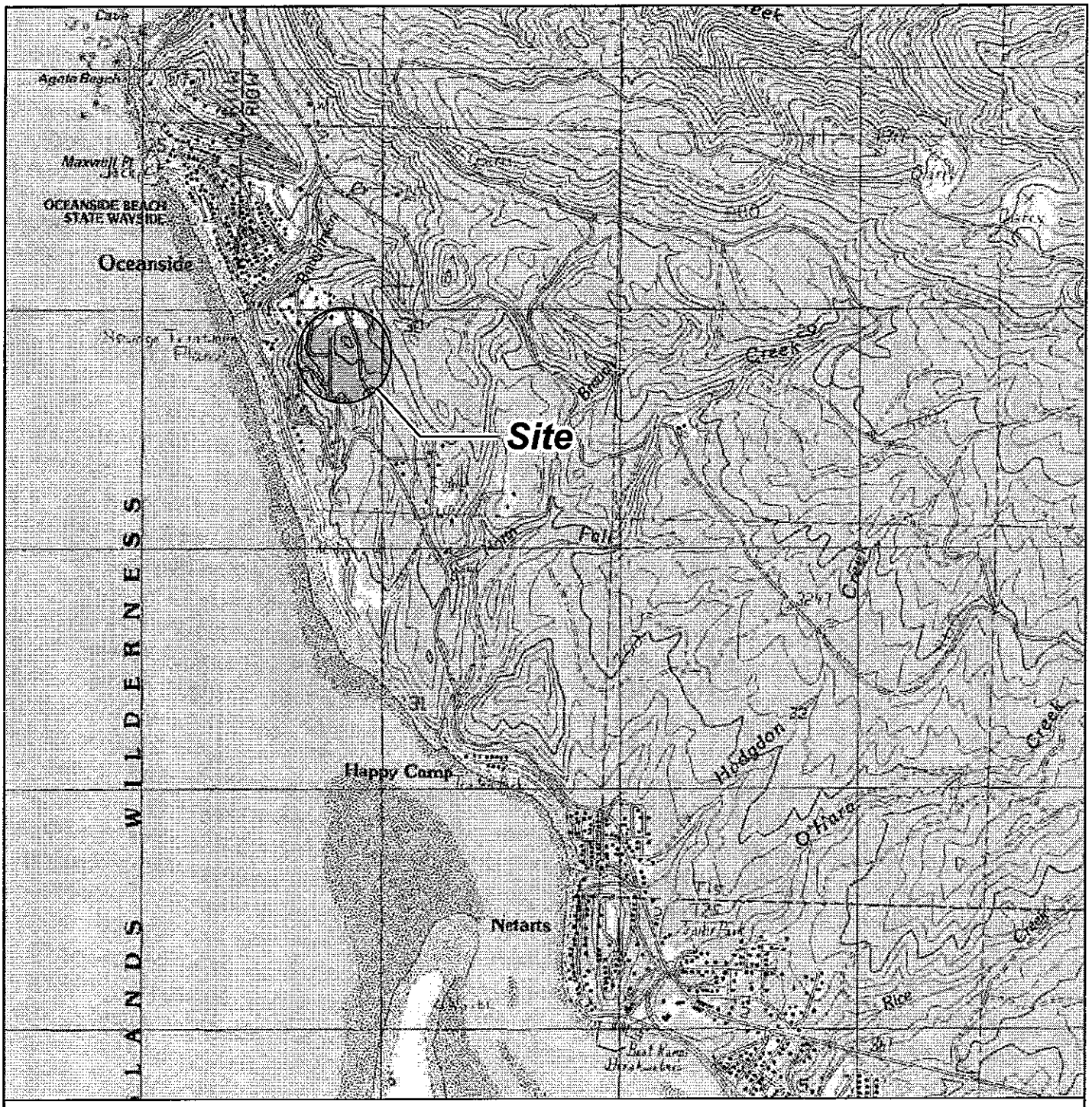
c) **Methods for protecting the surrounding area from any adverse effects of the development.** The erosion and storm water control plans are being designed by LDC Design Group. Storm water will not be allowed to flow onto adjacent properties and construction will be consistent with that on adjacent developments.

d) **Temporary and permanent stabilization programs and the planned maintenance of new and existing vegetation.** The existing vegetation on the slopes outside the road and building areas will not be disturbed by the development. Existing vegetative cover in open areas and non-structural areas will be left in place. Upon completion of the development, all bare ground should be protected against erosion by planting or gravel cover.

e) **The proposed development is adequately protected from any reasonably foreseeable hazards including, but not limited to GEOLOGIC HAZARDS, wind erosion, undercutting, ocean flooding, and storm waves.** The maintenance of existing vegetation and protection of areas disturbed during site development will prevent wind erosion; the development is at least 1/4 mile from the nearest ocean shore line, so long term undercutting by wave activity is not a problem. The development is located high enough in elevation (El. 265+) that ocean flooding and storm waves are not an issue.

f) **The proposed development is designed to minimize adverse environmental effects.** The development does not involve the use of hazardous materials and does not encroach upon unstable slopes or wetland areas. No adverse environmental effects are expected.

We hope that this letter meets your needs at this time. If you have any questions or need further clarification of these issues, please contact us at your convenience.



Base map prepared from USGS 7.5-minute quadrangles as provided by Topozone.

0 2000 4000

Scale in Feet

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Site Location Map

Trost Property
20 Acre Development
Oceanside, Oregon

Ash Creek Associates, Inc. Environmental and Geotechnical Consultants	Project Number 1120-00	Figure 1
	September 2005	