Kala Point Owners' Association
1760 Kala Point Drive
Port Townsend WA 98368
360-385-0814

LANDAU ASSOCIATES

September 1, 2010

Cedarview Group
c/o Mr. Hal Glantz
133 Cedarview Drive
Port Townsend, Washington 98368

Attn: Mr. Hal Glantz

RE: GEOLOGIC RECONNAISSANCE LETTER REPORT
KALA POINT BLUFF (NORTHERN SECTOR)
PORT TOWNSEND, WASHINGTON

Dear Mr. Glantz:

This letter report summarizes observations made during our August 18, 2010 geologic slope reconnaissance along the northern sector of the Kala Point Bluff (Tax Parcel Nos. 965000347, 965000371, and 965800016). The purpose of our services was to complete a reconnaissance of this coastal bluff located northeast of the ten lots comprising a portion of Kala Point development, to evaluate the geologic impact of cutting seven select trees near the crest. Our services were provided in accordance with the scope of services contained in our August 12, 2010 proposal. Written authorization to proceed was received from you on August 17, 2010.

This report has been prepared based on our discussions with the Cedarview Group, information obtained during our site visits, research of existing information, our familiarity with geologic conditions within the vicinity of the site, and our experience on similar and nearby projects. The general project location is shown on the Vicinity Map (Figure 1).

BACKGROUND

Kala Point, a gated residential community, is located about 2¼ miles south of Port Townsend on a coastal bluff facing east toward Marrowstone and Indian Island in Jefferson County, Washington. The bluff within Kala Point has been divided into three sectors by the Bluff Management Advisory Committee (BMAC) as elected by the Kala Point Owners Association (KPOA). The 1,200-ft-long northern sector of the bluff parallels Kala Heights Drive and is bordered at the crest by ten residential lots (Figures 2 and 3). We understand that Cedarview Group's objective is to preserve and maintain a water view by cutting seven select trees near the crest, while preserving and maintaining the stability of the slope. Our geotechnical observations and opinions regarding this action are contained within this report.

Based on a previous topographic survey (Twelker 1981), the bluff rises steeply upward from a beach about 180 vertical feet to a relatively level upland area with an overall average slope of about 40 to 45 degrees (84 to 100 percent gradient). Near 20- to 30-ft high vertical slopes exist along the toe. Individual residences are set back a distance ranging from approximately 45 to 165 ft from the crest of the bluff. The upland area between the houses and the edge of the slope is generally landscaped with lawns and ornamental shrubs. Scattered tall conifers are located along and below the edge of the bluff. The bluff is generally heavily vegetated with fir, hemlock, madrona, willows, and alders. The nearly vertical lower portion of the slope is partially bare.

A review of available historical aerial photographs taken in 1994, 2001, and 2006 (WDOE 2010) shows the general bluff area heavily vegetated with no readily visible signs of erosion and/or landsliding with the exception of slope toe erosion (Figure 4). This erosion is typical of Puget Sound coastal bluff areas that develop as a result of continued wave attack, which results in oversteepening of the lower portion of the slope. Undercutting by wave attack and surficial landsliding are the primary mechanisms that contribute to ongoing slope regression.

The geology in the project area has been mapped (Schasse and Slaughter 2005) as a sequence, from youngest to oldest, of beach deposits along the base of the steep slope, Vashon recessional deposits and glacial till (hardpan) exposed on the upland area, and Vashon advance outwash deposits exposed in the upper and mid portions of the slope. The mapped geology is generally consistent with conditions observed during our geologic reconnaissance. We concur, however, with a previous report (Shannon & Wilson, Inc. 2006) that the soil exposed within about 20 ft above the beach appears to be an older Pleistocene deposit that pre-dates the Vashon advance outwash. We also observed this deposit to consist of hard, gray clay/silt, which is likely sediment deposited in lakes in front of advancing glacial ice (glacial lacustrine deposits). According to Jefferson County Code, Kala Point is designated as a landslide hazard area that is a subset of a geologically hazardous area and governed by their Critical Areas Ordinance. At the time this report was prepared, available LiDAR coverage (Light Distance And Ranging, also known as Airborne Laser Swath Mapping or ALSM) taken in 2000 was available. LiDAR is a relatively new technology that employs an airborne scanning laser rangefinder to produce accurate topographic surveys. This data (Figure 3) indicates an existing convergent-shaped, landslide feature extending about 300 ft along the northern boundary from house #260 south towards house #210. Historical aerial photographs taken in 2001 (WDOE 2010) show this area as heavily vegetated with no evidence of exposed soils that could indicate past or recent landsliding.

According to a recent water well record search (WDOE 2010), the closest wells are located about ¼ mile west of the bluff. These two wells were installed in the late 1970s and construction notes indicate that subsurface conditions consist of about 20 ft of glacial till overlying clean sand to a depth of about 110

to 130 ft before encountering moist clay soils. Static groundwater information was noted on the water well record at a depth of about 140 ft. Based on our site reconnaissance visits and review of available water well records, the shallow subsurface conditions are consistent with the previously described regional geologic mapping.

EXISTING CONDITIONS

On August 18 and 27, 2010, an engineering geologist from our firm completed a reconnaissance of the subject slope. The purpose of the reconnaissance was to document the existing conditions on the slope and evaluate the likely impact, if any, of cutting seven selected trees. Each tree has been designated a number by the BMAC; namely N43 through N49 (Figures 4 through 11) and measurements of tree diameters were taken using the standard forestry method of Diameter at Breast Height (DBH). Photographs taken of the select trees during the field reconnaissance are shown on Figures 6 through 9 and 10. The following summarizes conditions observed during the geologic reconnaissance.

At the time of our site reconnaissance visits, we did not observe any evidence of severe erosion, active landsliding, or other significant recent instability within or immediately adjacent to the select trees, with the exception of N43. Such evidence would include irregular topography, bare soil scarps, groups of toppled trees, backward leaning trees, and/or springs and groundwater seepage on the slope. Given the highly erosive nature of these upper sandy soils (Vashon advance outwash deposits), most trees on the slope exhibit a downslope curvature (or "pistol-butt"). Tree trunks with this characteristic are indicative of surficial soil creep, which is a natural process of slow, surficial, downslope soil migration. We did observe several groundwater seepage and flows at the contact between the permeable sandy soils (Vashon advance outwash deposits) and the lower 20 ft clays (glacial lacustrine deposits). These wet areas are highlighted by the growth of Arctic Sweet Coltsfoot (*Petasites frigidus var. palmatus*), a hydrophilic native plant.

Tree N43

This tree is located along the edge of the northern sector boundary with Old Fort Townsend State Park, directly below house #260, at about 80 ft (Elevation 110 ft) below the slope crest. This straight-trunked tree (approximately 24-inch DBH), is located within an evenly sloped portion of the slope. It is protected to the north by a forest of mature deciduous trees and surrounded by a light understory of brush. The south side of N43 and across the slope for about 100 ft is predominately vegetated with 6- to 12-inch DBH alders that were severely limbed and topped earlier this year (Figure 5). This tree limbing/topping zone extends from the crest of slope downslope about 100 ft (Elevation 80 ft). The alders in this area generally lean downslope at angles ranging from about 20 to 25 degrees. This leaning characteristic is typical for alders growing on slopes.

Alders dominate this area and are typically the first species to colonize rapidly in a disturbed area. Alders are prolific but short-lived (about 80-100 years). The slope surface within this zone is hummocky, loose under-foot, and reclined at an angle of about 40 degrees. A near vertical, 10-ft high scarp feature was observed to extend along the crest for a distance of at least 100 ft. The understory within this open area consists of sword-fern and light brush. Debris from the recent tree cuttings remains on slope. No groundwater was observed; however, two corrugated, 12-inch diameter drainage pipes were observed extending from the crest to unknown discharge points downslope (Figure 3). It appears that this area, located adjacent to and south of N43 appears to have experienced landslide activities in the past, (pre-2000 based on LiDAR imagery - see Figure 3). The age of the feature is unknown and it cannot be seen in a review of available aerial photographs. The likely effect of this recent tree cutting activity will be to accelerate the downslope movement of loose soils. It appears that previously eroded soils from this feature have migrated downslope, partially accumulating mid-slope behind a large stand of mature alders, before sloughing onto the beach below. Occasionally, soil debris is transported through this stand onto an open and bare scarp that extends to the beach below. This is the only toe area along the northern sector that slide debris obscures the vertical glacial lacustrine clay along the toe which indicates that wave action has not yet removed the slide mass and as such indicates recent slide activity.

Trees N44/N45

These fir trees are located within 15 ft of one another, about 20 ft (Elevation 160 ft) below the slope crest of house #210. These relatively straight-trunked trees, (24-inch DBH) are located within an evenly sloped area, interspersed between a group of 12- to 15-inch DBH cedars and a heavy understory of brush (Figure 7). Adjacent to N45 (located downslope of N44) is a fir tree stump cut some time in the past. No active springs or seeps, or indications of recent slope instability were observed in the general area.

Tree N46

This fir tree is located about 20 ft (Elevation 160 ft) below the slope crest of house #210. This 24-inch DBH tree exhibits a strong downslope curvature, extending about 6 to 8 ft from the trunk before straightening upward (Figure 8). This tree is located adjacent to and north of a group of 12- to 18-inch DBH cedar trees. The trunks of the cedar trees are only slightly curved. The general area is evenly sloped with a moderate understory of brush. No active springs or seeps, or indications of recent instability were observed in the general area. No groundwater was observed; however, one corrugated, 12-inch diameter drainage pipe was observed extending from the crest to an unknown discharge point

downslope. Visual signs of surface water erosion stemming from the crest has cleared the natural forest duff in the area above N46 limiting the amount of potential understory re-growth.

Tree N47

This fir tree is located about 25 ft (Elevation 145 ft) below the slope crest of house #194. This 24-inch DBH tree exhibits a slight downslope curvature at its base (Figure 9). This tree is located adjacent to a previously cut 60-inch DBH cedar tree. The general area is evenly sloped with a moderate understory of brush with an open canopy area. One group of 6- to 10-inch DBH big leaf maple trees are located about 20 ft to the north. No trees exist below N47 with the exception of an 18- to 24-inch DBH fir tree that is perched and leaning towards the edge of a landslide scarp feature that extends to the beach. No active springs or seeps, or indications of recent instability were observed in the general area.

Tree N48

This fir tree is located about 25 ft (Elevation 145 ft) below the slope crest of house #110 (Figure 10). This straight-trunked, 12-inch DBH fir tree is located within an evenly sloped area, surrounded by other fir trees with equal DBH diameters including 4-inch DBH madrona trees (Figure 11). Adjacent to this tree is a cedar tree stump, anecdotal information from BMAC indicates that this was cut in 2006. The general area has a moderate to dense understory of brush. No active springs or seeps, or indications of recent slope instability were observed in the general area.

Tree N49

This cedar tree is located about 35 ft (Elevation 135 ft) below the slope crest of house #110 (Figure 10). This 12-inch DBH tree exhibits a slight downslope curvature at its base and is located above and adjacent to a group of 4-inch DBH madrona trees and 12+ DBH fir trees (Figure 11). Several cut stumps surround the general area; anecdotal information from BMAC indicates that these were cut in 2006. The general area has a moderate to dense understory of brush. Upslope of this tree location at least two 8- to 10-inch high Pacific Yew saplings were observed, anecdotal information from BMAC indicates that these were planted in 2006. No active springs or seeps, or indications of recent slope instability were observed in the general area.

CONCLUSIONS AND RECOMMENDATIONS

In general, the northern section of the Kala Point slope appears to be relatively stable with the exception of the 100-ft section north of house #210, which appears marginally stable. The erosional processes acting on and eroding the entire Kala Point bluff is typical of all Puget Sound bluffs. The

geology of the bluff affects the geotechnical properties of the bluff soils, but its most significant impact on stability appears to be stratigraphic and hydrologic. Most landslides in the region occur where permeable sand and gravel units lie directly on top of less permeable silts and clays, allowing a perched water table to develop and soils to become locally saturated (Tubbs 1974). The most common scenario is where advance outwash overlies proglacial lakebed clay or glacial lacustrine clay, as present along Kala Point. On coastal bluffs, erosion of the toe by wave action ultimately leads to steepening of the slope and the increasing likelihood of failure, but whereas toe erosion is a relatively slow process on most Puget Sound bluffs, landslides typically occur in response to transient increases in groundwater soil saturation, or removing large areas of vegetative growth. As a result, wave action and undercutting may set the stage for future slope failures but rarely precipitate landslides. Removing and disturbance of the vegetative cover can trigger mass movement of the slope and ultimately increase the natural rate of slope retreat. This is most apparent in the recent limbed/topped alder zone below houses #234, #240, and #260 which is also located in a larger historic landslide feature (Figure 3). In addition to cutting the seven trees proposed by the Cedarview Group, we strongly advise that this zone be reviewed by BMAC and addressed with an erosion control blanket along the crest to protect exposed soils, such as ACF West 900 gram Coir matting or similar. We also highly recommend that this zone be mitigated by planting select, native, low-height growing trees for a range of soil and light conditions this October, as advised by a licensed arborist.

Based on conditions observed during our August 18 and 27, 2010 site reconnaissance visits and our understanding of subsurface conditions in the area, it is our opinion that cutting of the selected seven trees (N43 through N49) located near the crest of the northern sector slope bluff will not adversely affect slope erosion or global slope stability, provided the following mitigation measures are followed. Our recommendations are based on the position and wind exposure of the trees, as well as the stable and vegetated areas surrounding the trees. We further recommend cutting the unnamed tree N4x located at the crest of a toe scarp (Figure 8) to limit future topsoil removal and erosion when it eventually does topple. Tree cutting has the added advantage over tree topping because the thick re-growth of suckers or sprouts resulting from tree topping can make the tree top heavy and more likely to catch the wind. This increases the chances of blow-down in a storm, which could potentially uproot trees and leave bare soil exposed to erosion. In addition, topping of trees can severely impact the trees' health and lead to increased chance of blow-down during a storm. Anecdotal information from BMAC notes that N44 and N45 were topped over 10 years ago. Currently, four (N44 though N49) of the seven trees are exposed to the wind despite the fact that two tree, N46 and N 47 are limbed 50 percent above the ground. The loose and granular nature of the underlying slope soils causes them to be highly erodible upon exposure to the elements. Re-establishment of vegetative growth can be a long process once forest duff and topsoil has

been removed. Currently, there is a high risk that future wind storms will topple these trees causing them to uproot and leave unstable areas exposed. In addition, N47 is highly curved at its base and placing strain on the slope.

Mitigation Measures

Mitigation measures should reduce both short- and long-term slope stability and erosion impacts that are likely to occur as a result of tree removal. We recommend the following mitigation measures when considering removal of the select seven fir trees:

- Tree cutting should be conducted during the dry season (April 1 and November 1) to limit soil disturbance and erosion per JCC 18.22.170(3).
- Tree cutting should not involve stump removal as such activities result in ground disturbance and increased erosion prior to the re-establishment of a vegetative cover. Stump roots provide reinforcement and anchoring of the soil/vegetation mat. Over time this reinforcement decreases as the stumps rot, however, they still provide that critical role while new planting is allowed to become established. Unlike other species, fir tree stumps do not re-sprout and cause future view management issues.
- All disturbed bare areas created during tree cutting, including newly opened canopy areas that will be created in cutting N43 and N47, should be re-planted with suitable native species. Without proper management, some brush species thrive and flourish when a tree overstory is removed, creating a view management problem. This is particularly true for species such as oceanspray, and salmonberry which can grow up to about 12 ft high and elderberry which can reach heights of 20 ft. Alders will flourish, but repeated cutting of alders increases their mortality rate. Another species encouraged by increased light levels is Himalayan blackberry which is difficult to control. Future long-term slope erosion, especially the upper 10 to 15 ft directly below houses #234, #240, and #260 with exposed vertical scarps, should be mitigated by planting select, native, low-lying, drought-tolerant vegetation for a range of soil and light conditions. Salal, Evergreen huckleberry, and Oregon grape are all valuable native species that supply wildlife habitat, erosion control benefits, and are easily maintained. Species such as sword fern, snowberry, and red huckleberry are also valuable native species that are more adaptive and able to survive environmental modifications. A qualified landscape architect should be selected to choose the appropriate plants for the site conditions and plant them along the slope crest accordingly. The Washington State Department of Ecology discusses coastal bluff planting and appropriate site maintenance practices on its website (http://www.ecy.wa.gov/programs/sea/pubs/93-31/intro.html).
- Monitoring to determine the success of the planting restoration and effectiveness of long-term surface water management is an important element to ensure continued slope stability. It is therefore recommended that a long-term monitoring plan be incorporated into the project. This monitoring plan should include annual plant inspections for a minimum of five years. We also recommend that the slope section north of house #210 include annual geotechnical slope stability inspections for two years. If the planting plan is proven to be a success, plant inspection may be discontinued after three years. Plant inspections should be conducted by a qualified firm and should include photos of the restoration area and percent cover, survival rates of plant stock and any contingency plans if necessary. Geotechnical slope stability inspections should also be conducted by a qualified firm and inspection reports should include additional mitigation measures dependant on observed conditions.

In addition to the mitigation measures above, we further recommend that KPOA, as part of bluff stewardship, consider removing or upgrading the three on-slope piping systems observed below house #210, #234, and #240. Under no circumstances should surface water be discharge at the crest from upland drainage sources (roof/driveway flows, draining of hot tubs, etc.). Release of flows onto landslide hazard areas typically cause erosional issues and occasionally lead to slope failures.

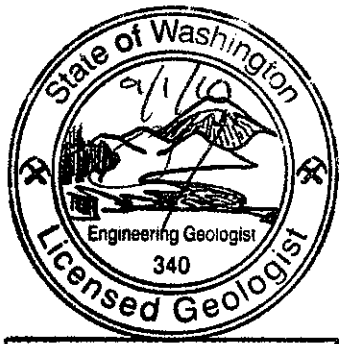
USE OF THIS REPORT

This letter report was prepared for the exclusive use of the Cedarview Group of Port Townsend, Washington for specific application to this project. The use by others, or for purposes other than intended, is at the user's sole risk. The findings, conclusions, and recommendations presented herein are based on our understanding of the project and on subsurface conditions observed during our site visits on August 18 and 27, 2010. Within the limitations of scope, schedule, and budget, the conclusions and recommendations presented in this letter report were prepared in accordance with generally accepted geotechnical engineering principles and practices in the area at the time the letter report was prepared. We make no other warranty either express or implied.

We appreciate the opportunity to provide geotechnical services on this project. If you have any questions or comments regarding the information contained in this report, or if we may be of further service, please call.

LANDAU ASSOCIATES, INC.

Colin B. Turnbull, L.E.G.
Senior Engineering Geologist



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Attachments:
Figure 1 - Vicinity Map
Figure 2 - Site Map of Trees Proposed to be Removed
Figure 3 - Site Reconnaissance and Topographic Plan
Figure 4 – Aerial and Select Tree Location Photographs
Figure 5 – Site Photograph Profile of North End
Figures (6 - 11) - Site Photographs

REFERENCES

Neil H. Twelker & Associates, Inc. 1981. *Retreat of Sea Cliff, Vicinity of Kala Point, Jefferson County, Washington*. Prepared for Kala Point Development Company. March 16.

Schasse, H.W, Slaughter, S.L. 2005. *Geologic Map of the Port Townsend South and part of the Port Townsend North* 7.5-minute quadrangle, Jefferson County, Washington: Washington Division of Geology and Earth Resources Geologic Map GM-57, 1 sheet, scale 1:24,000.

Shannon & Wilson. 2006. *Geotechnical Evaluation of Slope Stability of Waterfront Common Area East of Cedarview Drive and Proposed Tree Removal, Kala Point, Washington*. Prepared for Messrs Pete Juliano and Ron Tacker. July 27.

Tubbs, Donald W. 1974. Landslides in Seattle. Information Circular 52, Washington Department of Natural Resources, Division of Geology and Earth Resources. Available: http://www.tubbs.com/ic52/ic52.htm

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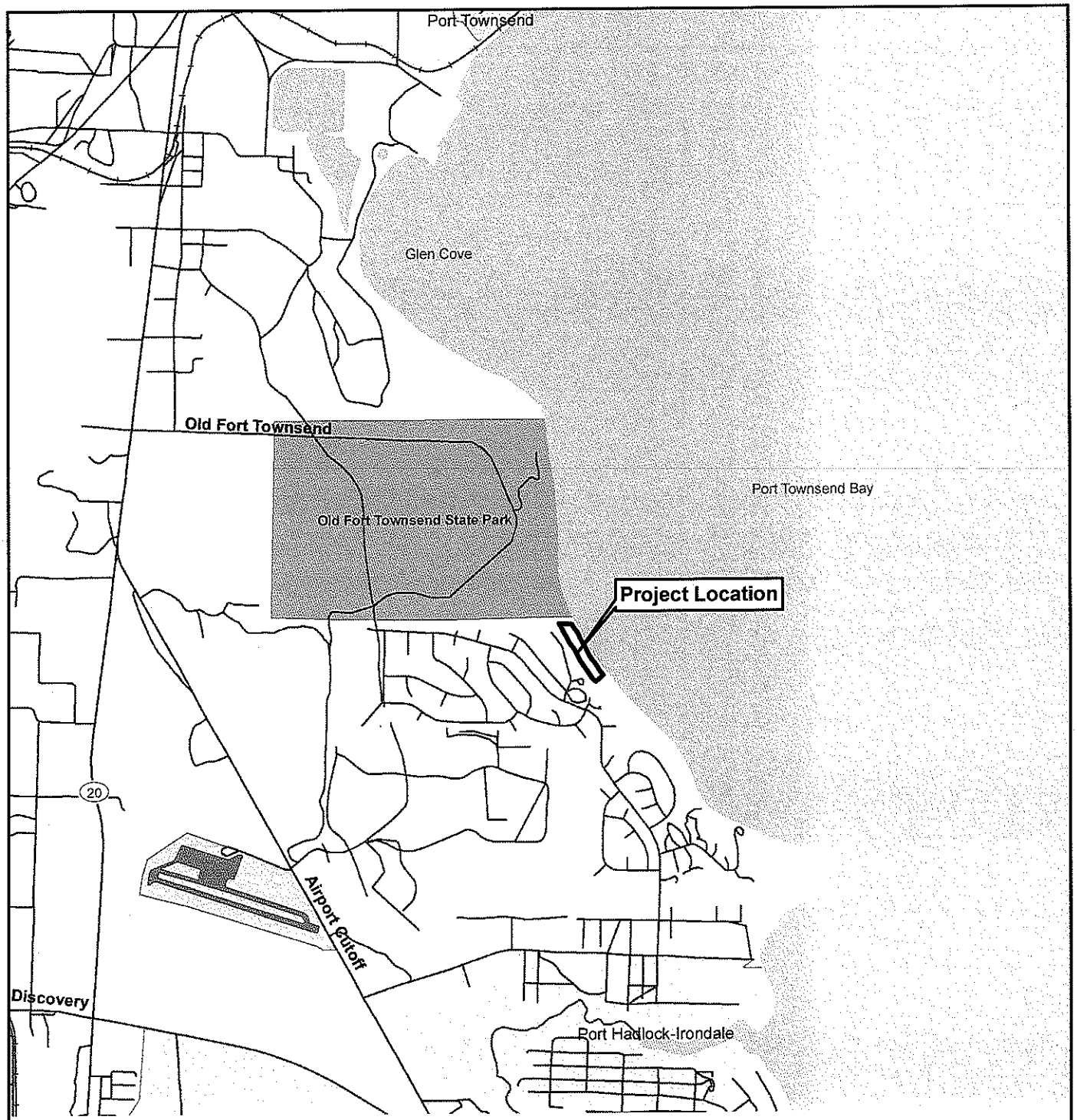

Data Source: ESRI 2008

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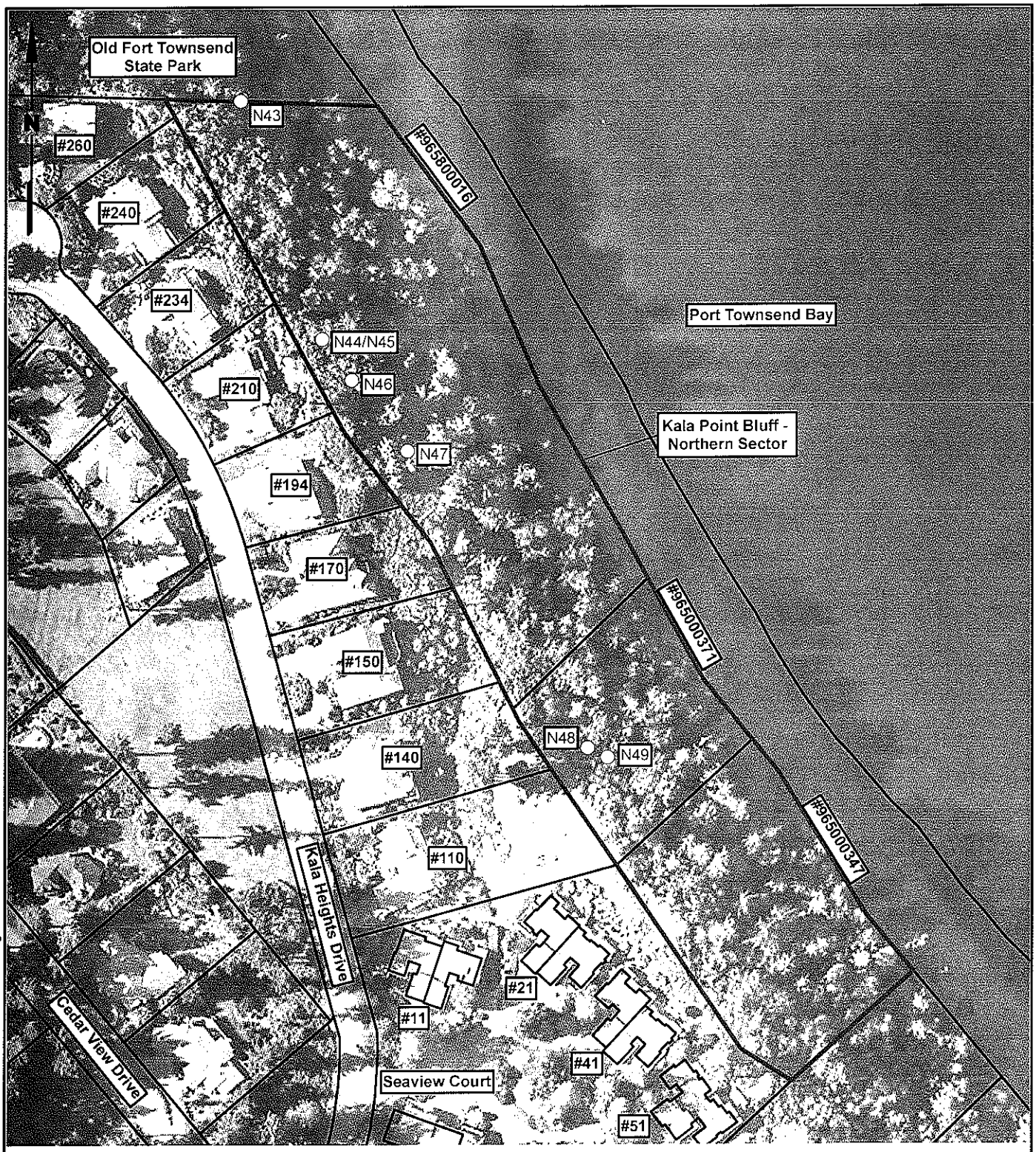
Geologic Reconnaissance Kala Point Bluff (Northern Sector) Port Townsend, Washington	**Vicinity Map**	Figure 1



Legend

N47 ○ Approximate Locations of Selected Trees with Tree Designation ID (Surveyed with Field Grade GPS)

Parcel

Project Site

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 150 300

Scale in Feet

Data Source: I3 Imagery 2009; Jefferson County

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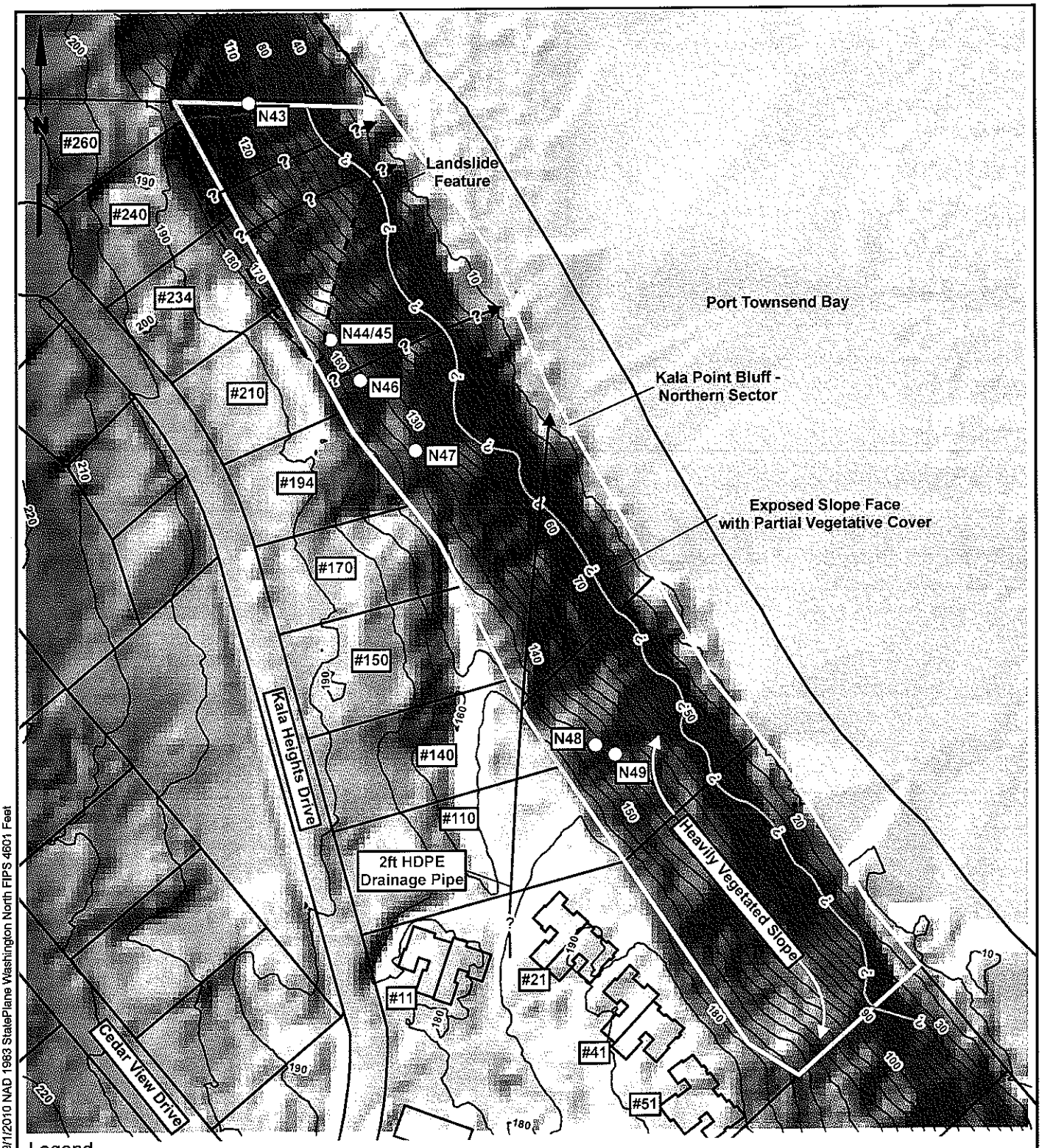
Geologic Reconnaissance
Kala Point Bluff
(Northern Sector)
Port Townsend, Washington

Site Map of Trees Proposed to be Removed

Figure 2



Legend

- 10ft Major Contour
- Corrugated, Solid, 12-inch, PVC Drain Line
- Approximate Area of Recent Tree Cutting
- Landslide Feature
- Parcel

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

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Scale in Feet

Data Source: Jefferson County

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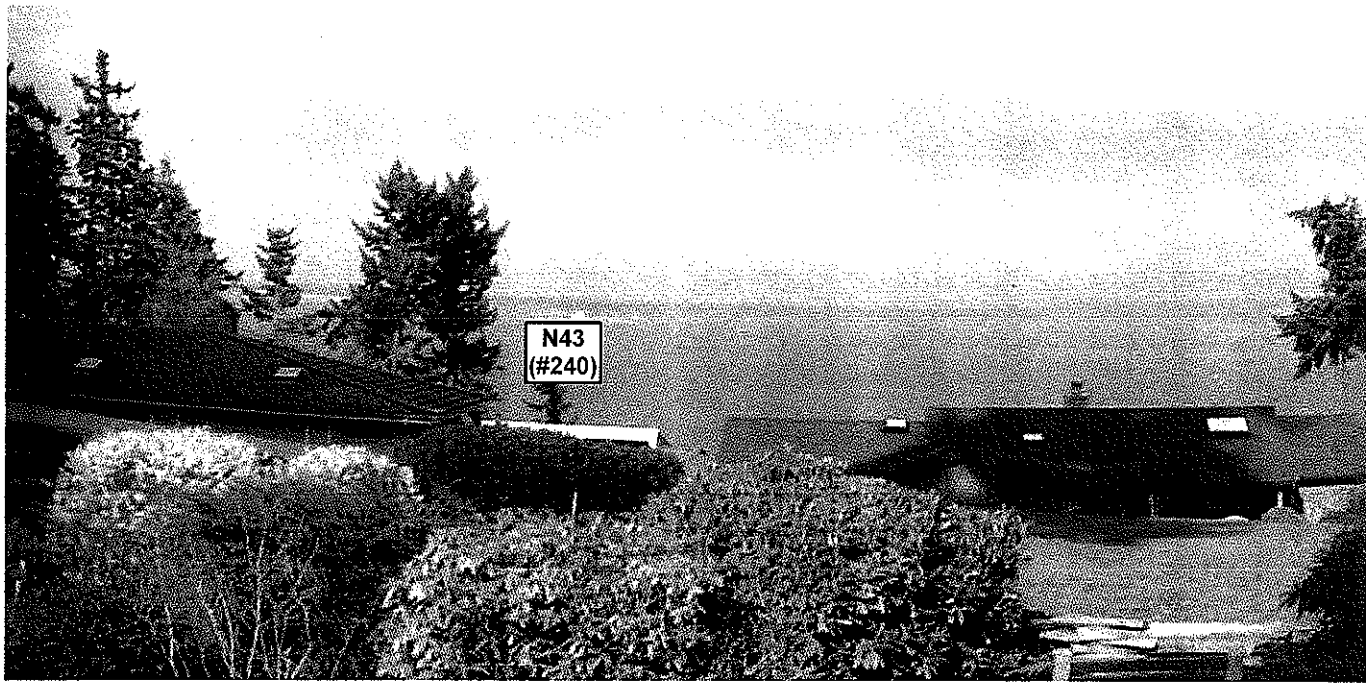
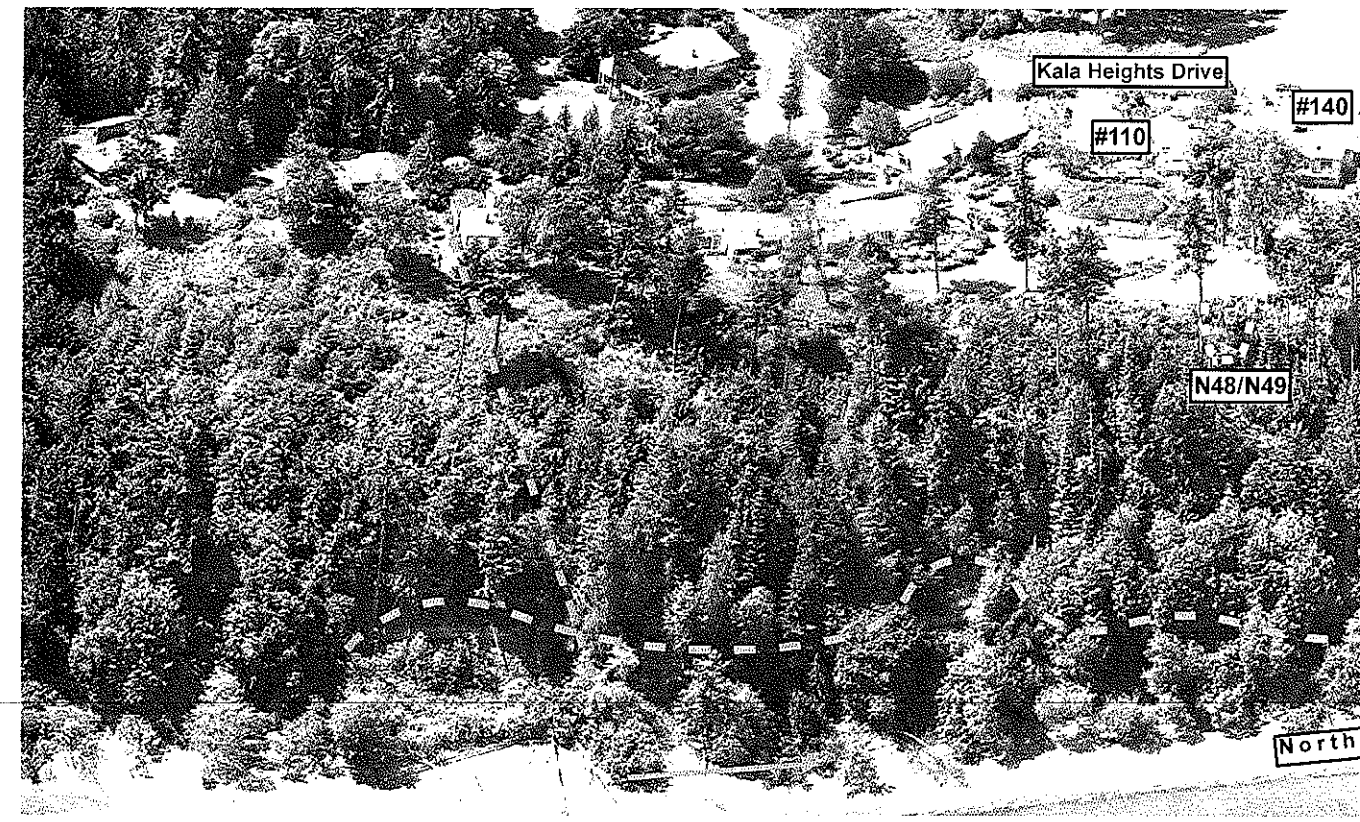
Geologic Reconnaissance
Kala Point Bluff
(Northern Sector)
Port Townsend, Washington

Site Reconnaissance and Topographic Plan

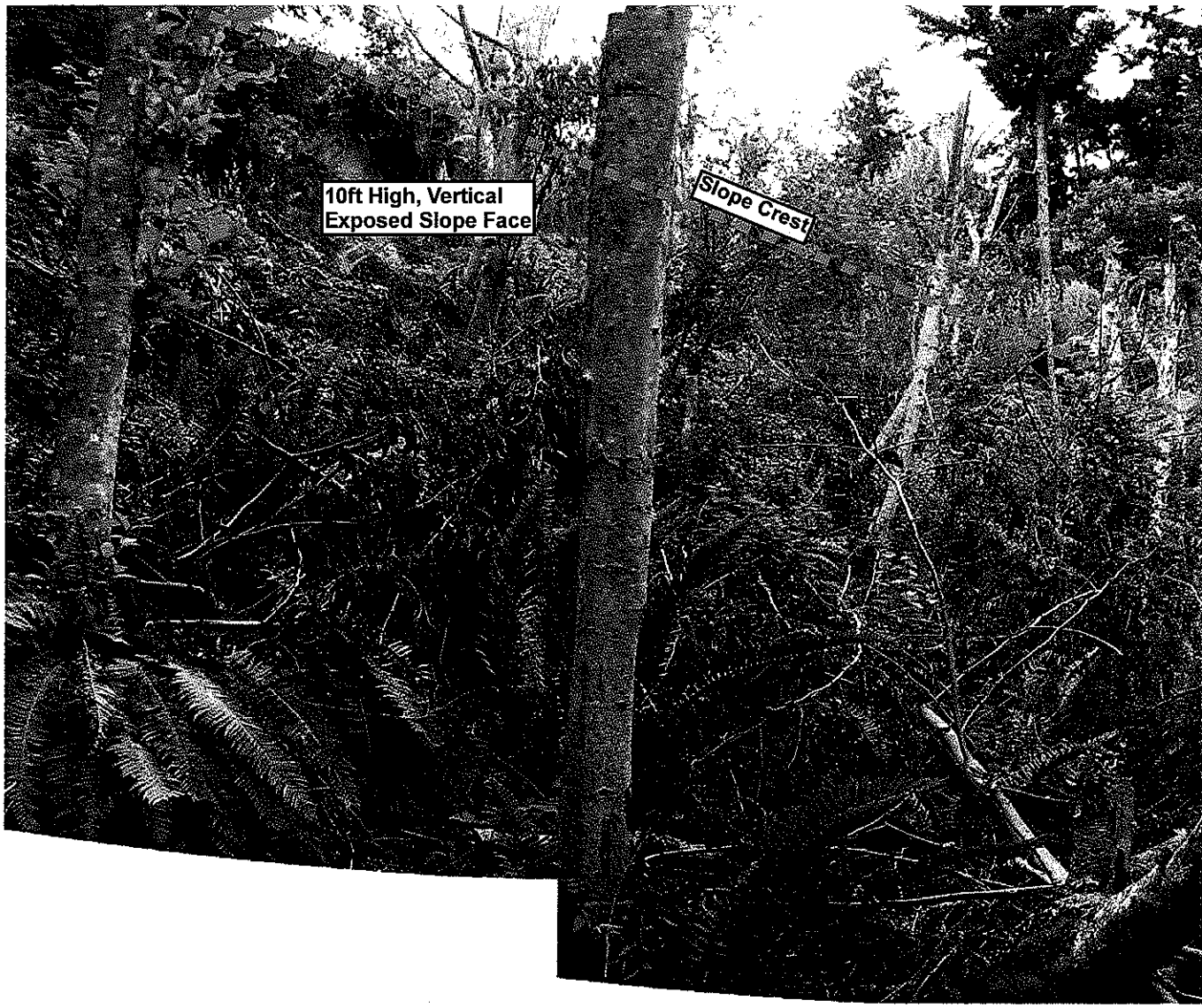
Figure 3



a. Bluff view looking northeast with select trees noted.



b. Aerial photograph taken June 30, 2006. View looking southwest.



a. Slope crest profile below #234, #240 and #260 showing recent clear-cut area. View looking northwest. August 18

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a. Located along the northern boundary below #260.

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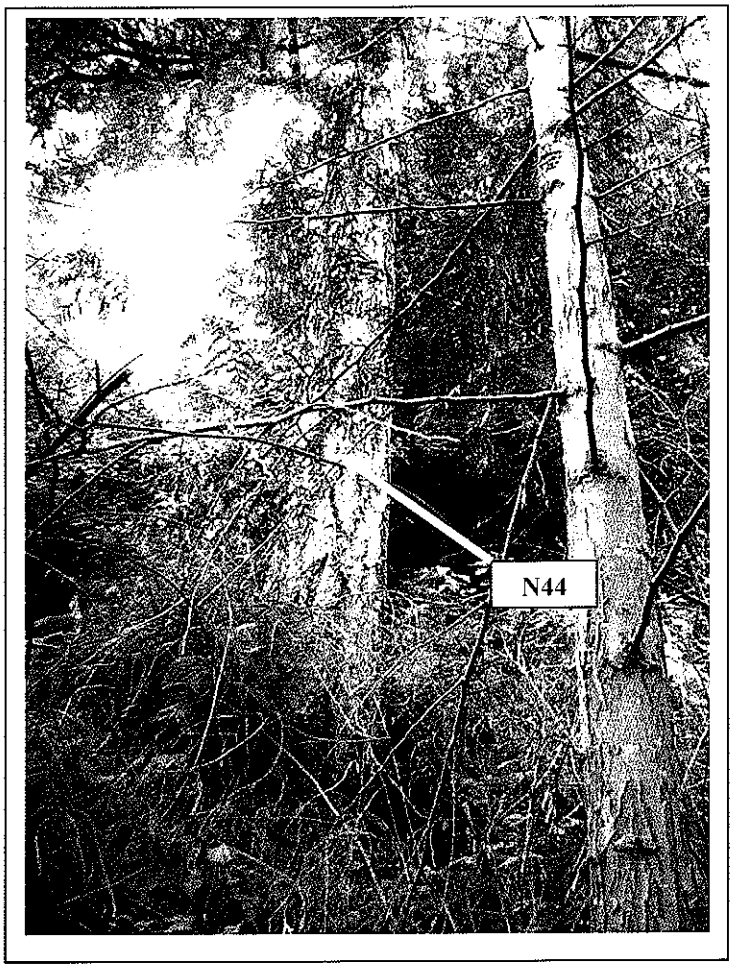
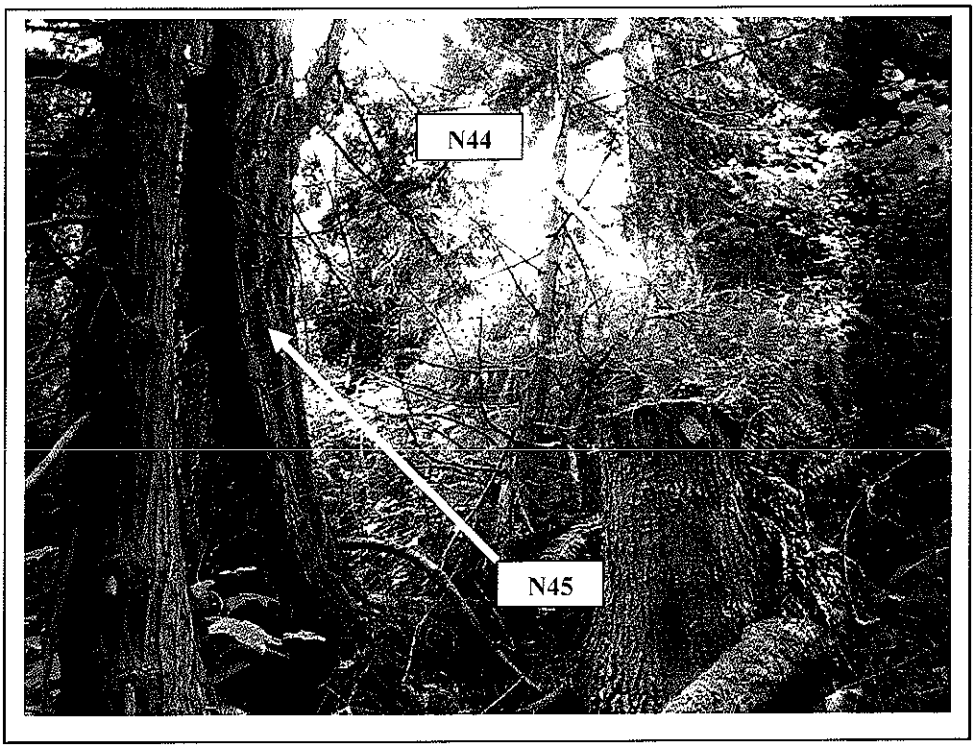
Geologic Reconnaissance
Kala Point Bluff
(Northern Sector)
Port Townsend, Washington

Site Photograph
Select Tree N43

Figure
6





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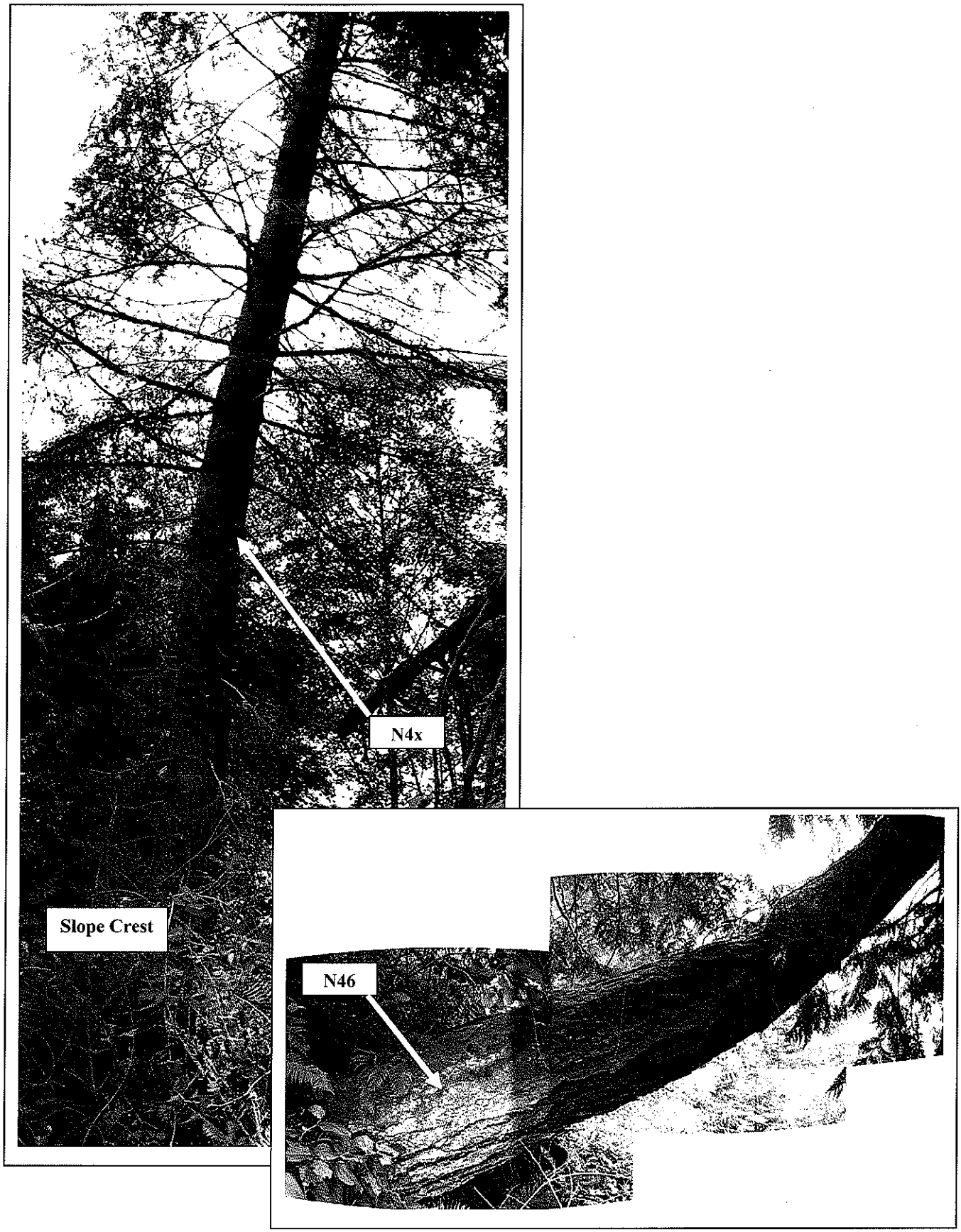
Geologic Reconnaissance
Kala Point Bluff
(Northern Sector)
Port Townsend, Washington

Site Photograph
Select Tree N44 and N45

Figure
7



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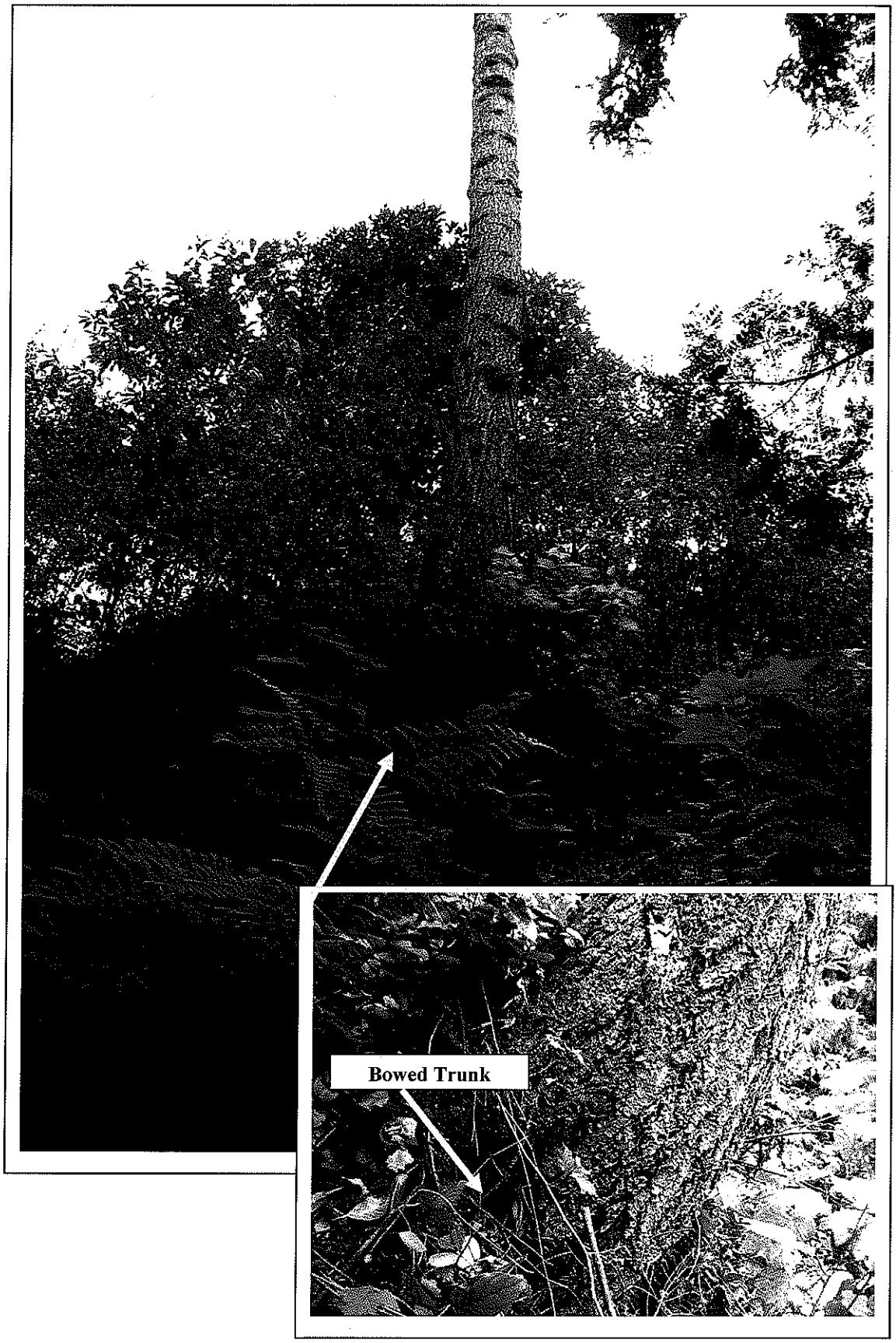
Geologic Reconnaissance
Kala Point Bluff
(Northern Sector)
Port Townsend, Washington

Site Photograph
Select Tree N4x and N46

Figure
8



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Geologic Reconnaissance
Kala Point Bluff
(Northern Sector)
Port Townsend, Washington

Site Photograph
Select Tree N47

Figure
9

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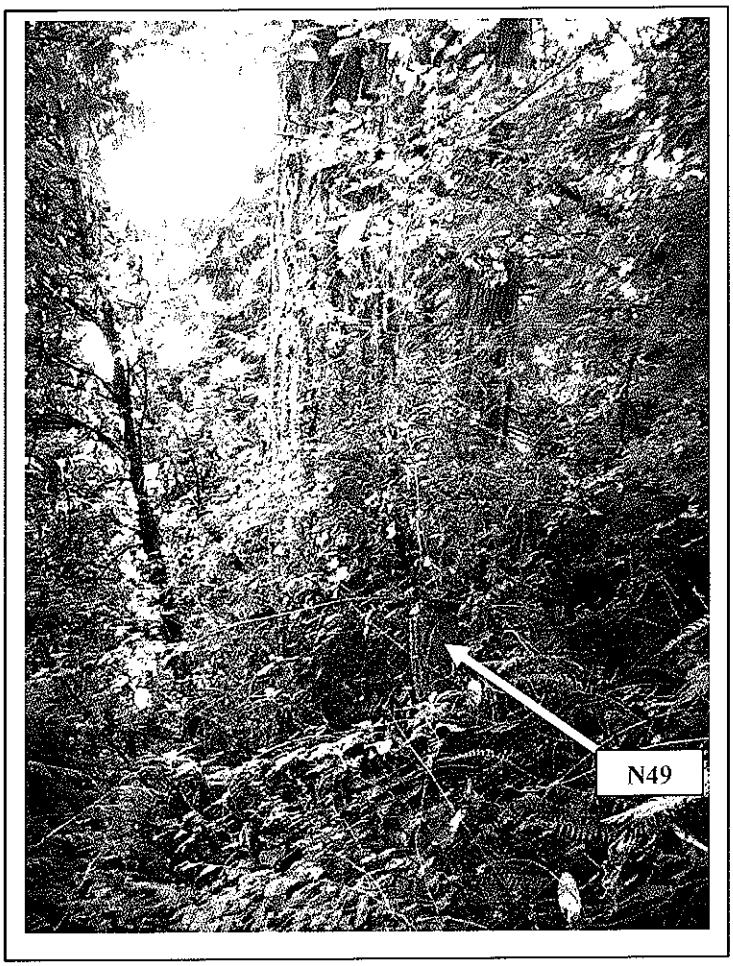
Geologic Reconnaissance Kala Point Bluff (Northern Sector) Port Townsend, Washington	**Site Photograph** **Select Trees N48/N49**	Figure 10



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Geologic Reconnaissance
Kala Point Bluff
(Northern Sector)
Port Townsend, Washington

Site Photograph
Select Trees N48/N49

Figure
11