February 16, 2022

Daniel Platt
68 School Street
Hingham, MA 02043

Subject: Geohazard & Geotechnical Review
Lot 1801 - St. Andrews Lane – Bandon, Oregon
GCN/True North Project 1592/22-0065

This report presents our Geohazard and Geotechnical Review Study for the proposed single family residence development located in Bandon, Oregon. The report summarizes the work accomplished and provides our conclusions and recommendations for site development. Our Report has been prepared in accordance with our proposal dated August 17, 2021.

PROJECT INFORMATION

The undeveloped project site is located west of the Pacific Ocean on a low dune that rises to about 140 feet above Agate Beach. The planned home will be situated near the top of the dune, just beyond a nearly flat ridgetop. It will be located over a slight depression and shallow ravine that bisect the ridge. A private drive on the south property line is elevated about 10 feet above the base elevation of the home. A short bridge will provide access from the drive to the home.

The proposed residence will be a lightly loaded, two story home of wood-frame construction. Cuts and fills in the dune sand are expected to be less than 6 feet high. Stormwater likely will be discharged on the site. A detached guest house may later be added at the rear of the home. Landscaping includes a putting green on a relatively flat area about 150 feet north of the house footprint.

The site relative to surrounding features is shown in Figure 1. The preliminary site layout is shown in Figure 2.

SCOPE OF WORK

The purpose of our services is to explore the site and provide recommendations for design and construction. The following describes our specific scope of services:

- Review available geologic mapping materials
- Identify and review available historic aerial photos, online geologic and LiDAR maps, and reports covering the site and the immediate surrounding area.
- Review nearby water well and geotechnical boring information available from the Oregon State Water Resources Department.
- Conduct a detailed reconnaissance and mapping of the immediate vicinity of the site in general conformance with Coos County Code, Section 4.11.150 “Geological Hazards Special Development Review Standards” and prepare this report in general conformance with Section 4.11.155 Geological Assessment review, Item A.3. Engineering Geologic Reports, and related sections.

- Drill two hand auger borings and conduct Dynamic Cone Penetrometer (DCP) testing to help understand the near surface soil properties. The DCP tests penetrated to practical refusal at depths up to 13 feet below the existing ground surface. Hand auger borings were not consider necessary due to surface exposures of near surface soil and rock in the sea cliff on the beach.
- Provide a written Geohazard and Geotechnical Report summarizing our explorations, geotechnical analysis, conclusions, and recommendations that include:
    - A discussion on the regional geology and the seismic setting of the site including the general geologic features of the surface and underlying deposits.
    - Discussion of tectonic faulting in the area and seismic design criteria in accordance with the Oregon Structural Specialty Code.
    - An opinion regarding the general slope conditions in and around the project site.
    - Summary logs of the explorations including a plan map of the locations explored.
    - A cross-section through the proposed new home location showing the stratigraphy.
    - Recommendations for site preparation, grading and drainage, compaction criteria, and wet-weather earthwork procedures.
    - Recommendations for excavation, utility trenches, backfill materials, and backfill compaction.
    - Recommendations for design and construction of shallow-spread foundations, including allowable design bearing pressures, minimum footing depth and width, lateral resistance to sliding, and estimates of settlement.
    - Geotechnical recommendations for the design and construction of concrete floor slabs, including an anticipated value for subgrade modulus.
    - Design criteria for cast-in-place embedded building walls including lateral earth pressure, drainage, backfill material, and backfill compaction.
    - A discussion of groundwater conditions on the site and recommendations for subsurface drainage of foundations, floor slabs, and pavement.

SITE CONDITIONS

The site is located north of downtown Bandon in a sparsely developed residential area along St. Andrews Lane. The following paragraphs describe the area geology, surface, and subsurface features.

SITE GEOLOGY

The site is situated south of Cape Arago above the Pacific Coastline and Threemile Creek. Ancient stream and near-beach erosion and depositional processes contributed primarily to the current surface and subsurface conditions on the site.

Geologic units in the site area include ancient beach/dune sand at the ground surface. The ancient sand unit is underlain by marine sedimentary deposits composed of sandstone and mudstone. The sedimentary deposits are underlain by rock known as beds of Sacchi Beach (Eocene), a member of the Tyee Formation, which generally consists of siltstone and sandstone.[1]

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[1] *Smith, R.L and Roe, W.P., 2006, Geologic Map of Oregon: Oregon Dept. of Geology and Mineral Industries Geological Map Series, OGCD-7.*

The surficial sand and underlying sedimentary sandstone/mudstone units are visible in the sea cliffs to the south and north of property. These units were also found in our explorations on the site.

Geologic mapping of the area is provided in Figure 3.

GENERAL SURFACE CONDITIONS

The site is located east and upslope of Agate Beach, and south of Three Mile Creek. The site is undeveloped and heavily vegetated with mature conifers and underbrush.

Dodge Surveying and Planning produced a survey of the eastern side of the site. Dodge labeled the "BLUFF/FEMA" line shown in Figure 2 to identify a distinct break in the slope. The areas downslope and west of the of the break were not surveyed. The descriptions below are based on the survey data provided by Dodge.

On the project site, the dune forms a nearly flat ridgetop that is 30 to 70 feet wide at an elevation of about 140 feet above MSL. The dune slopes gently downward from the ridgetop toward the ocean at an inclination of about 3.6H:1V (Horizontal to Vertical) (15 degrees). The dune slopes moderately downward to the east and an inclination of about 2.6H:1V (21 degrees).

Most of the mature Douglas fir, hemlock, and other conifers on the site, of similar growth habit, are positioned within the eastern and central areas of the property and on the upper slopes above the beach "BLUFF/FEMA" line shown on Figure 2. None of these mature conifers show tilting or curved trunks suggestive of historic ground movement.

Low brush, grass, and stunted pine trees are found throughout the area west of the "BLUFF/FEMA" line. Some of mature pine trees appear stunted with curved trunks, an indicator of growth habit subjected to strong onshore wind. Aerial photos of the site spanning the years from 1939 through 2021 show a gradual increase in vegetation on the site. The photos are provided in Attachment B.

During our walking review of old road cuts on the site, and at the beach/vegetation line, we observed no surface indicators of groundwater seepage, which, if present would indicate the presence of shallow, perched groundwater on the site.

Information about landslides identified on the site is provided below in the Engineering Geologic Hazards section of this report.

SUBSURFACE CONDITIONS

GENERAL

We investigated subsurface conditions of the site on September 22, 2021, with two DCP tests, designed DCP-1 and DCP-2, to refusal depths of up to 13 feet below ground surface (bgs) on September 22, 2021. The approximate locations of the DCPs are shown on Figure 2. DCP logs are provided in Attachment A.

The dynamic cone penetrometer is a device used for measuring the strength and variability of unbound layers of soil and granular material. The device uses 1-inch diameter rods with depth markings every 3.9 inches and a replaceable 60˚ cone tip. The rods are driven with a 35-pound drop hammer over a 15-inch distance.

Data from a DCP test is processed to produce a penetration index (PI) that correlates directly with Standard Penetration Test (SPT) N-values. The correlated SPT N-value from the DCP are shown in the DCP logs.

We encountered a very soft organic silt layer at the ground surface in both exploration locations that was about 1 foot thick. The organic layer was underlain by loose to medium dense fine sand. Based on review of the exposed soil in the bluff and shallow soil probing throughout the site, we anticipate that this layer consists of ancient beach/dune sand. The ancient beach/dune sand layer extended to depths of 10 to 12 feet below ground surface.

We encountered practical refusal on soft rock at approximate depths ranging of 10 to 12 feet respectively in DCP-1 and DCP-2. The rock is mapped as sandy siltstone, a marine sedimentary deposit.

Based on our understanding of the site topography and the results of our explorations, we generated an interpolated geologic profile, designated A-A’, the location of which is shown in Figure 5. The interpolated soil and rock profile A-A’ is shown in Figure 6.

GROUNDWATER

We did not encounter groundwater in our explorations on the site. Based on nearby water well logs from locations near the site, we expect that ground water 40 to 50 feet bgs.

SEISMIC SETTING

The Oregon coastal area is subject to seismic events stemming from three possible sources: the Cascadia Subduction Zone (CSZ), intraslab faults within the Juan de Fuca Plate, and crustal faults in the North American Plate.

The site is also located within 10 miles of four Quaternary crustal faults that are mapped or inferred. The faults of the site are The Pioneer Anticline that runs through the site, the South Slough thrust and reverse faults about 2.4 miles northeast, the South Slough syncline (U-shaped fold) 4 miles northeast, the East South Slough faults 7 miles northeast, and the Coquille anticline about 7 miles southwest.

The anticlines and faults have been formed during ongoing east-west compression in the forearc of the Cascadia subduction zone along the central Oregon coast. As with other folds and faults located in the Cascadia forearc, it is unknown if coseismic displacements on this fold are always related to great megathrust earthquakes on the subduction zone, or whether some displacements are related to smaller earthquakes in the North American plate[2].

The USGS considers the faults to be greater than 10,000 years old and are considered inactive.

The contribution of potential earthquake-induced ground motion from all known sources, including the faults described above, are included in probabilistic ground motion maps developed by the USGS.

Ground Motion Maps indicate the site would be exposed to a peak ground acceleration (measurement for ground shaking) of 1.05 PGA in a USGS Cascadia magnitude (M) 9.0 scenario[3].

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[2] *Quaternary Fault and Fold Database of the United States, https://earthquakes.usgs.gov/hazards/qfaults*

[3] *Ian P. Madin and William J. Burns,” Ground motion, ground deformation, tsunami inundation, coseismic subsidence, and damage potential maps for the 2012 Oregon Resilience Plan for Cascadia Subduction Zone Earthquakes, Department of Geology and Mineral Industries, Open-File Report O-13-06, 2012.*

Based on site explorations and geologic mapping, the site falls into Site Class C for seismic design. Seismic design parameters for the project site are provided in Table 1 below.

TABLE 1 – SEISMIC DESIGN PARAMETERS

MAPPED MAXIMUM CONSIDERED EARTHQUAKE SPECTRAL RESPONSE ACCELERATION PARAMETER (SITE CLASS C)			
LAT	**43.253**	**LON**	**124.386**
S_S		2.17G	
S_1		0.97G	
MAPPED MAXIMUM CONSIDERED EARTHQUAKE SPECTRAL RESPONSE ACCELERATION PARAMETER			
F_A		0.9	
F_V		0.8	
S_{MS}		1.95G	
S_{M1}		0.78G	
DESIGN SPECTRAL RESPONSE ACCELERATION PARAMETER			
S_{DS}		1.30G	
S_{D1}		0.52G	

LIQUEFACTION

Liquefaction is the result of seismically induced densification and subsequent ground deformation in soil that is beneath the water table. Due to the depth of groundwater and shallow bedrock, the site is not considered to be subject to liquefaction.

TSUNAMI INUNDATION

Recent tsunami inundation mapping of the Coos County region along the Oregon Coast indicate that the entire site is located in a region susceptible to inundation during a Cascadia Subduction Zone event. Depending on the magnitude of the event, wave heights at the site extending to elevation 60 feet above means sea level (NAVD88) are expected[4]. Because site is located at an approximate elevation of 140 feet above MSL[5], the future building areas are not subject to Tsunami Inundation.

ENGINEERING GEOLOGIC HAZARDS

We reviewed the available literature, historic aerial photographs, and nearby well logs and conducted a reconnaissance of the project site to determine the geologic makeup and geomorphology of the embankment at the project site. Our work evaluated the specific features identified on and near the site and presents our overall geologic interpretation of the project site area.

LANDSLIDES

The beach area is mapped by the Oregon Department of Geology and Mineral Industries (DOGAMI) as having high to moderate risk to geologic hazards related to coastal erosion and

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[4] *Tsunami Inundation Map Coos-08, Local Source (Cascadia Subduction Zone) Tsunami Inundation Map Charleston - Cape Arago, Plate 1, Oregon, Oregon Department of Geology and Mineral Industries, 2012.*

[5] *Note that site topographic mapping on Figure 2 is based on an arbitrary benchmark.*

landslides. Coos County maps the site as having moderate to high susceptibility to landslides per Landslide Susceptibility Overview Map of Oregon, 2016.

Two landslides have been mapped by (DOGAMI) and have been presented in publications produced within the past eleven years. The mapping and accompanying database entries provide little information about the slides. Topographic indicators of suggesting the presence of landslides in the slope that face the ocean are visible in the LiDAR images provided by DOGAMI.

The site layout is shown in Figure 2. The landslides mapped by DOGAMI are shown in Figure 4. The LiDAR image of the site is provided in Figure 7.

Additional descriptions of the landslides and observations during site reconnaissance on September 22, 2021 are provided below:

1. BurnWJ2011-76[6] is located with its toe along the Pacific shoreline. It extends into the northwest corner of the project site and the proposed putting green that is about 250 feet from the planned home.

The putting green is surrounded on the north, south, and east by relatively steep natural slopes that vary from about 1.5H:1V (Horizontal to Vertical) to about 2H:1V. The slope faces are smooth. Topography in the vicinity of the depression and the presence of straight, mature confers suggest that, if a landslide occurred at this location, it was at least over 80 years in the past and likely was more than 150 years ago, defined by DOGAMI as an ancient landslide.

2. WiletJ2015-1436[7] is also located with its toe along the Pacific shoreline and extends into the southwest corner of the site. An approximated 100-foot-long, 1 to 3 foot tall, near vertical slope break is evident at the location shown in Figure 2. The feature is likely the headscarp of the landslide, describing its far eastern edge and the limit of the mapped slide. The head scarp is about 150 feet to the west and downslope of planned home.

Other than the two areas detailed, we did not observe other indicators of landslide activity on the site.

OTHER HAZARDS OF INTEREST

Flooding of the planned building area is not a concern because of the elevation at the ridgetop where the home will be constructed. Coos County maps the extreme western portion of the site as subject to the 100-year flood and maps the west and north portion of the site as subject to earthquake induced tsunami inundation.

CONCLUSIONS AND RECOMMENDATIONS FOR DEVELOPMENT

Based on the results of our review of available geologic, landslide, and LiDAR mapping; and our recent soil explorations, laboratory testing, and site reconnaissance, it is our opinion that the use of the site "can be accomplished without measures to mitigate or control the risk of geologic hazard to the site" (Coos County Code).

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[6] *Burns, W.J., Madin, I.P, Mickelson, K.A., and Williams, K.J., 2011, Open-File Report O-11-01, Partial Landslide Inventory of the Western Portion of Coos County, Oregon, Oregon Department of Geology and Mineral Industries., map scale 1:10,000.*

[7] *Burns, W.L, et al., 2016, Landslide Susceptibility Overview Map of Oregon: Oregon Department of Geology and Mineral Industries, Open File Report O-16-02, OGCD-7*

Landslides present on the western portion of the site are the result of ancient events or normal beach and headland deposition and erosional processes.

The planned location for the new home is set back from the “Bluff/FEMA line established by Coos County sufficiently far that the risk of future large-scale and deep-seated ground movement that would damage the home is remote.

We recommend that the building be supported on 6-inch-thick granular pads that are in turn supported on undisturbed native soil.

CONSTRUCTION CONSIDERATIONS

Sandy soil near the ground surface may be subject to rutting in both the dry and wet seasons. It would be advisable to place a minimum 6-inch-thick granular pavement over the native sand to support of construction traffic.

SITE PREPARATION

Trees, shrubs, and brush should be removed from all building and paved areas. Root balls should be grubbed out to a depth such that roots greater than ½-inch in diameter are removed. The depth of excavation to remove root balls of trees could exceed 5 feet bgs.

TRENCH EXCAVATION & BACKFILL

Trench construction and maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. Local, state, and federal safety codes should be followed.

Trench backfill beneath structures and asphalt pavement should consist of well-graded granular material with a maximum particle size of ¾-inch and less than 8 percent by weight passing the U.S. Standard No. 200 Sieve. The material should be free of roots, organic matter, and other unsuitable materials.

Trench backfill in the bedding zone and pipe zone should be placed and compacted in maximum lifts of 6 inches. Trench backfill above the pipe zone should be placed and compacted with a minimum of two lifts. A minimum cover of 3 feet over the top of the pipe should be placed before compacting with a hydraulic plate compactor (hoe-pack).

WET WEATHER CONSTRUCTION

The base rock thickness determined for post construction traffic may not support construction traffic or pavement construction when the subgrade soil is wet. An increased thickness of base rock or other methods to support construction traffic could be required If construction is planned for periods when the subgrade soils are not dry and firm.

We recommend that a minimum of 2-inch thickness of lightly compacted granular material be placed at the base of spread footing excavations made in wet weather conditions. The granular material reduces the risk of subgrade disturbance during placement of forms and reinforcement.

STRUCTURAL FILL

Near-Surface On- Site Soil*: The* on-site soil is suitable for use as structural fill provided it can be moisture-conditioned.

Imported Granular Material*:* Imported granular fill material may include sand, gravel, or fragmented rock with a maximum size of 6 inches and with not more than about 8 percent passing the No. 200 sieve (washed analysis). Material satisfying these requirements can usually be placed during periods of wet weather. The first lift of granular fill placed over a fine-grained subgrade should be about 18 inches thick and subsequent lifts about 12 inches thick when using medium- to heavy-weight vibratory rollers. Granular structural fill should be limited to a maximum size of about 1-½ inches when compacted with hand-operated equipment. Lift thicknesses should be limited to less than 8 inches when using hand-operated vibratory plate compactors.

Free-Draining Fill*:* Free-draining material should have less than 2 percent passing the No. 200 sieve (washed analysis). Examples of materials that would satisfy this requirement include ¾ to ¼ inch, 1½ to ¾ inch, or 3- to 1-inch crushed rock.

Compaction*:* Fill within building, pavement, and sidewalk areas should be placed as compacted structural fill. Structural fill should be compacted to at least 95percent of the maximum dry density as determined by ASTM D 698. Fill in non-structural areas may be compacted to 90 percent of ASTM D 698. The moisture content for compaction should be within 3 percent of optimum.

FOUNDATIONS

In our opinion, the proposed structure can be supported on continuous or isolated column footings founded on 6-inch-thick granular pads or new structural fill that is in turn supported on undisturbed native soil.

Continuous wall and spread footings and retaining wall footings should be proportioned for an allowable bearing pressure of 1,500 pounds per square foot (psf). We recommend a minimum foundation width of 14 inches. Footing embedment should be as required by the Oregon Structural Specialty Code.

The recommended allowable bearing pressure applies to the total of dead plus long-term live loads. The allowable bearing pressure may be increased by a factor of 1/3 for short-term wind or seismic loads.

Differential and total settlement of footings is anticipated to be less than ½ inch and 1-inch under static conditions, respectively.

GRANULAR PADS

Granular pads should extend 6 inches horizontally beyond the margins of the footings for each foot of the pad thickness or to the depth of firm, undisturbed native soil. The granular pads should consist of ¾-inch minus crushed rock that is fairly well graded between coarse and fine, contains no organic matter or other deleterious materials, and has less than 8 percent passing the U.S. Standard No. 200 Sieve. The imported crushed rock should be compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D 698.

LATERAL RESISTANCE

Lateral loads of buildings can be resisted by passive earth pressure on the sides of footings or by friction on the base of the footings but not both. We recommend using the equivalent fluid pressures and coefficients of friction provided in Table 2 below.

TABLE 2 – LATERAL RESISTANCE FACTORS

SOIL TYPE	EQUIVALENT FLUID PRESSURE (ɣ – PCF)	FRICTION COEFFICIENT (μ)
ON-SITE SAND	300	0.35
IMPORTED CRUSHED ROCK	800	0.45

In order to develop the tabulated capacity for passive resistance using on-site sand, concrete must be placed directly against the walls of the footing excavations. When using the value for imported crushed rock, the rock should extend a minimum horizontal distance equal to the footing embedment and should be compacted to not less than 95% of the dry density as determined by ASTM D698. Adjacent floor slabs, pavements, or the upper 12-inch depth of adjacent, unpaved areas should not be considered when calculating passive resistance.

SLAB-ON-GRADE FLOORS

Satisfactory subgrade support for lightly loaded building floor slabs can be obtained on the undisturbed native soil or on engineered structural fill. A subgrade modulus of 100 pounds per cubic inch may be used to design floor slabs.

A minimum 6-inch-thick layer of free draining fill should be placed and compacted over the prepared subgrade to assist as a capillary break and blanket drain. The free draining fill layer may be capped with a 1- to 2-inch-thick layer of clean ¾ inch minus crushed rock that contains no more than 5 percent fines.

A vapor retarder manufactured for use beneath floor slabs should be installed above the free draining fill in inhabited spaces and spaces that will receive floor coverings. Careful attention should be made during construction to prevent perforating the retarder and to seal edges and utility penetrations. We recommend following ACI 302.1, Chapter 3 for vapor retarder installation.

SITE DRAINAGE AND STORM WATER DISPOSAL

Foundation and crawl space drainage should be sloped to drain to a sump or low point drain outlet. Water should not be allowed to pond within crawl spaces.

Roof drains should be connected to a tightline drainpipe leading to storm drain outlet facilities. Pavement surfaces and open space areas should be sloped such that surface water runoff is collected and routed to suitable discharge points. Ground surfaces adjacent to buildings should be sloped to drain away from the buildings.

RETAINING WALLS & EMBEDDED BUILDING WALLS

The following recommendations assume that the walls are less than 12 feet in height, backfill extends a distance behind the wall equal to the wall height, and that the backfill is well drained and meets the requirements detailed above for imported granular material. Reevaluation of our recommendations will be required if retaining walls vary from these assumptions.

In general, cantilever retaining walls yield under lateral loads and should be designed with active lateral earth pressures. Restrained walls, such as embedded building walls and vaults should be designed to withstand at-rest lateral earth pressures. We recommend using the lateral earth pressures shown in Table 3 below. The loads are provided as equivalent fluid density (G).

Diagrams showing use of the lateral earth pressures in design calculations are provided in Figure 8.

TABLE 3 - EQUIVALENT FLUID DENSITY (G) ACTING ON RETAINING WALLS

Wall Type	Backfill Condition	Backfill Component (PCF)	Surcharge Component (PSF)	Seismic Component (PCF)
YIELDING WALL	FLAT	30	80	15
	2H:1V	45		28
NON-YIELDING WALL	FLAT	50	120	15
	2H:1V	70		28

Static lateral earth pressures acting on a retaining wall should be increased to account for surcharge loadings resulting from any traffic, construction equipment, material stockpiles, or structures located within a horizontal distance equal to the wall height. We have included lateral earth pressures for surcharge loads up to 250 psf placed as a distributed load within the distance H from the wall face.

Retaining wall drains should consist of a perforated drainpipe embedded in a minimum 1-foot-wide zone of free draining fill that is wrapped 360 degrees around by a geotextile filter that overlaps a minimum of 6 inches. The geotextile filter should be placed between the granular materials and the native soil to prevent movement of fines into the clean granular material. The geotextile filter should be a non-woven fabric with an apparent opening size between the U.S. Standard No. 70 and No. 100 Sieve sizes and a water permittivity of greater than 1.5 sec^{-1}.

Backfill for retaining walls should extend a horizontal distance of H/2 from the back of wall, where H is the embedded height, and compacted as recommended for structural fill, except for backfill placed immediately adjacent to walls. To reduce pressure on walls, backfill located within a horizontal distance of 3 feet from retaining walls should be compacted to approximately 90 percent of the maximum dry density, as determined by ASTM D698, and should be compacted in lifts less than 6 inches thick using hand-operated tamping equipment (such as a jumping jack or vibratory plate compactor).

ASPHALT DRIVEWAYS

We recommend a pavement section consisting of a minimum of 2.5 inches of asphalt concrete (AC) pavement underlain by a minimum of 8.0 inches of crushed rock base (CRB) for areas trafficked by automobiles and light trucks.

ADDITIONAL SERVICES

Because the future performance and integrity of the structural elements will depend largely on proper site preparation, drainage, fill placement, and construction procedures, monitoring and testing (geotechnical special inspection) by experienced geotechnical personnel should be considered an integral part of the design and construction process.

- Review construction plans and specifications to verify that our design criteria presented in this report have been properly integrated into the design.
- Attend a pre-construction conference with the design team and contractor to discuss geotechnical related construction issues.

- Observe fill areas and footing subgrade both before fill material or base rock is placed and before footings are constructed in order to verify the soil conditions.
- Prepare a post-construction letter-of-compliance summarizing our field observations, inspections, and test results.

LIMITATIONS

This report was prepared for the exclusive use of you and members of your design/construction team for this specific project. It should be made available to prospective contractors for information on the factual data only, and not as a warranty of subsurface conditions, such as those interpreted from the explorations and discussed in this report.

The recommendations contained in this report are preliminary, and are based on information derived through site reconnaissance, subsurface testing, and knowledge of the site area. Variation of conditions within the area and the presence of unsuitable materials are possible and cannot be determined until exposed during construction. Accordingly, GCN's recommendations can be finalized only through GCN's observation of the project's earthwork construction. GCN accepts no responsibility or liability for any party's reliance on GCN's preliminary recommendations.

Unanticipated soil conditions are commonly encountered and cannot fully be determined by exploratory methods. Such unexpected conditions frequently require that additional expenditures be made to attain properly constructed projects. Therefore, a contingency fund is recommended to accommodate the potential for extra costs.

Within the limitations of the scope of work, schedule, and budget, the analyses, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no warranty, either express or implied.

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We appreciate the opportunity to be of continued service to you. Please call if you have questions concerning this report or if we can provide additional services.

Sincerely,
GEO Consultants Northwest, Inc.

DAVID K. RANKIN
E858

EXPIRES 06/1/2022
David Rankin, C.E.G.
Principal, Engineering Geologist

85828PE
NOVEMBER 8, 2011
TIMOTHY J. NORTH
EXPIRES: 12/31/22
Tim North, PE
Consulting Geotechnical Engineer

Figures:	Figure 1 - Site Vicinity
	Figure 2 - Site Layout and Explorations
	Figure 3 – Geologic Map
	Figure 4 – Mapped Landslides
	Figure 5 – East Portion with Slope Inclinations & Section
	Figure 6 – Section A-A’
	Figure 7 – LIDAR Image
	Figure 8 – Retaining Wall Pressures
Attachments:	Attachment A – Field Exploration Program
	Attachment B – Historic Aerial Photos

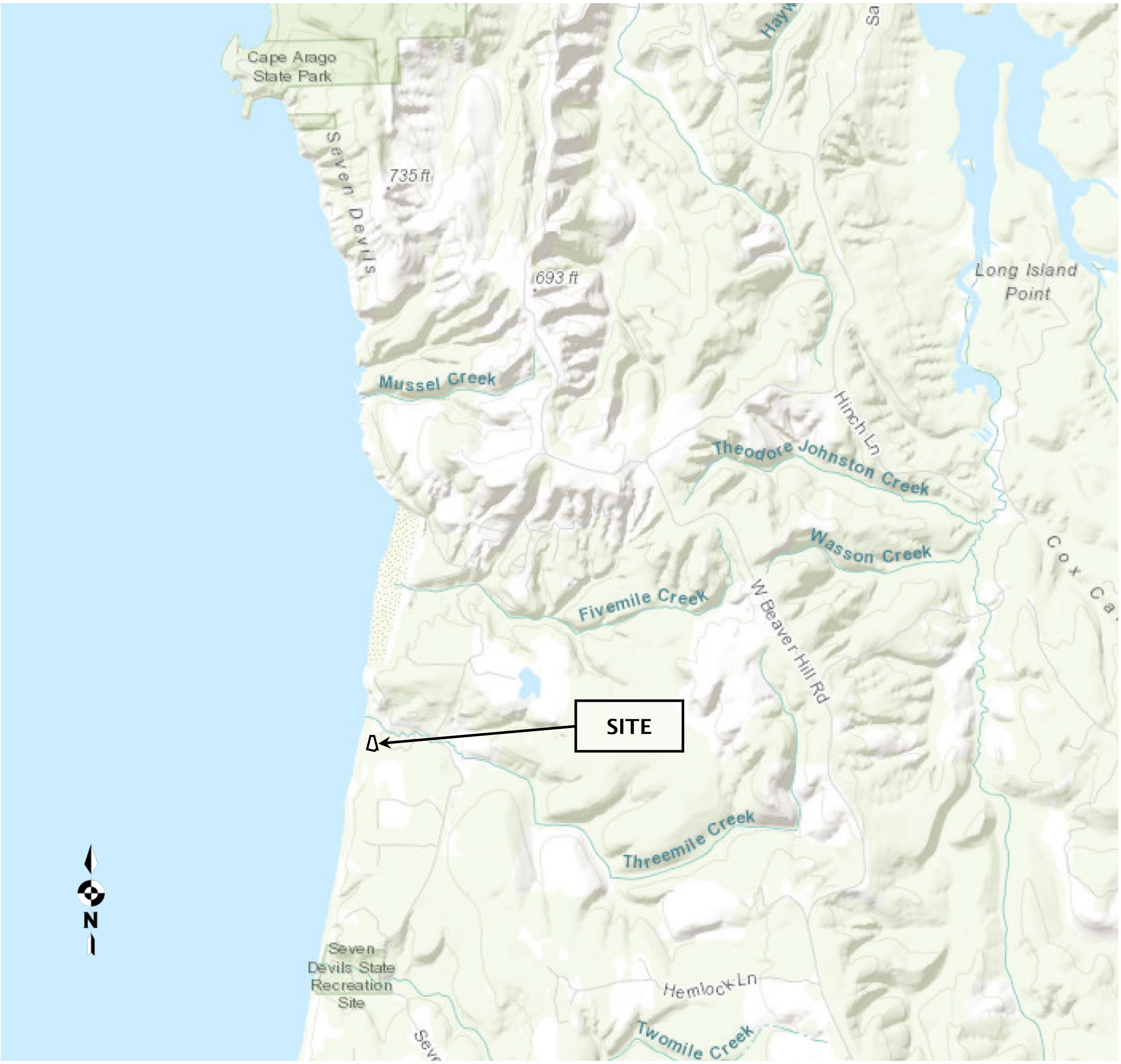
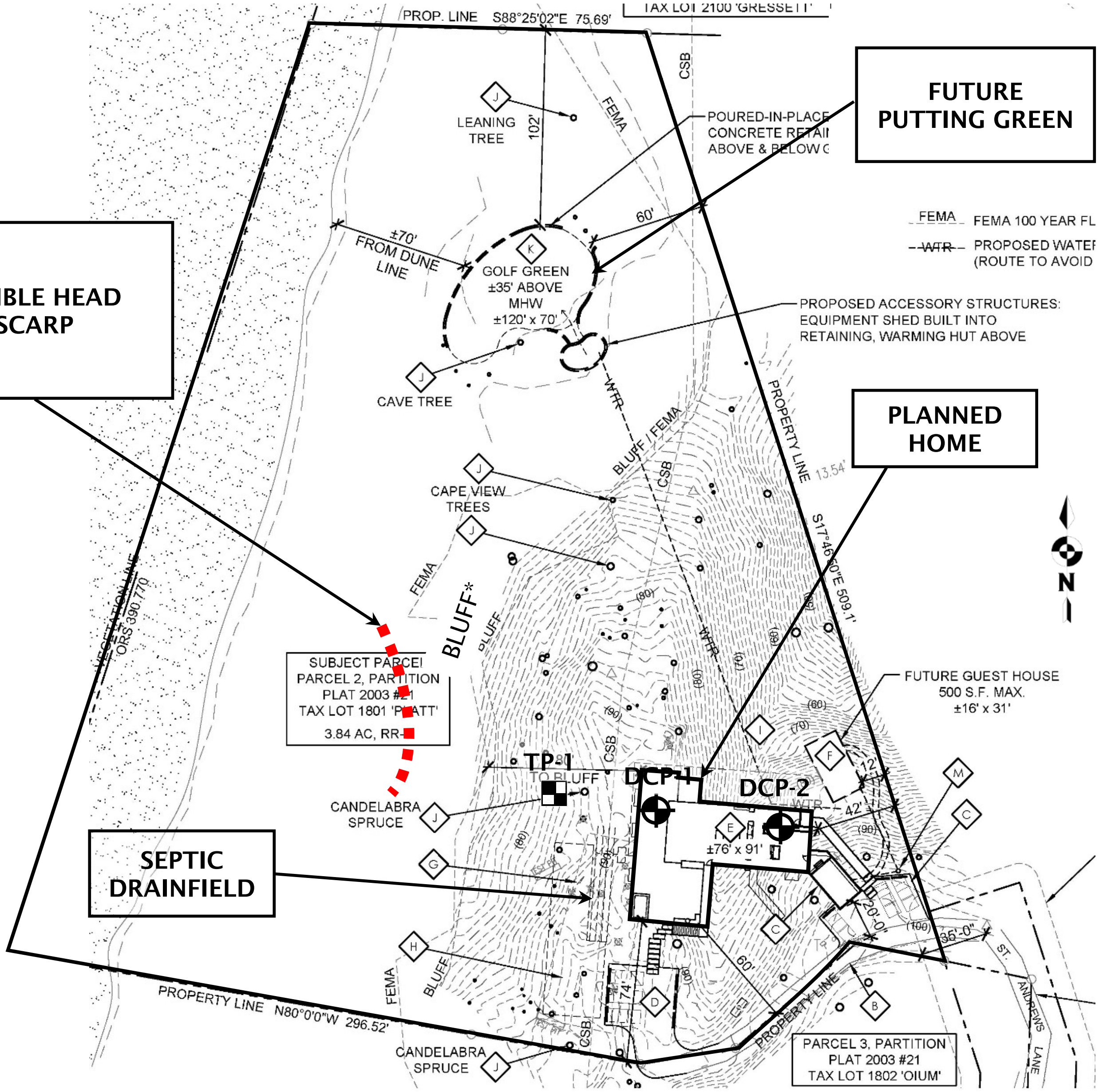


IMAGE FROM METROMAPS
AGATE LANE, BANDON
LAT 43.243 N LON 124.386 W; T1N, R1W, SEC11

GEO CONSULTANTS NORTHWEST	PROJECT 1592	**PLATT RESIDENCE AGATE LANE - BANDON**

2839 SE Milwaukie
Portland, OR 97202

JAN 2022 Drawn By: blh	**SITE VICINITY**	**FIGURE 1**

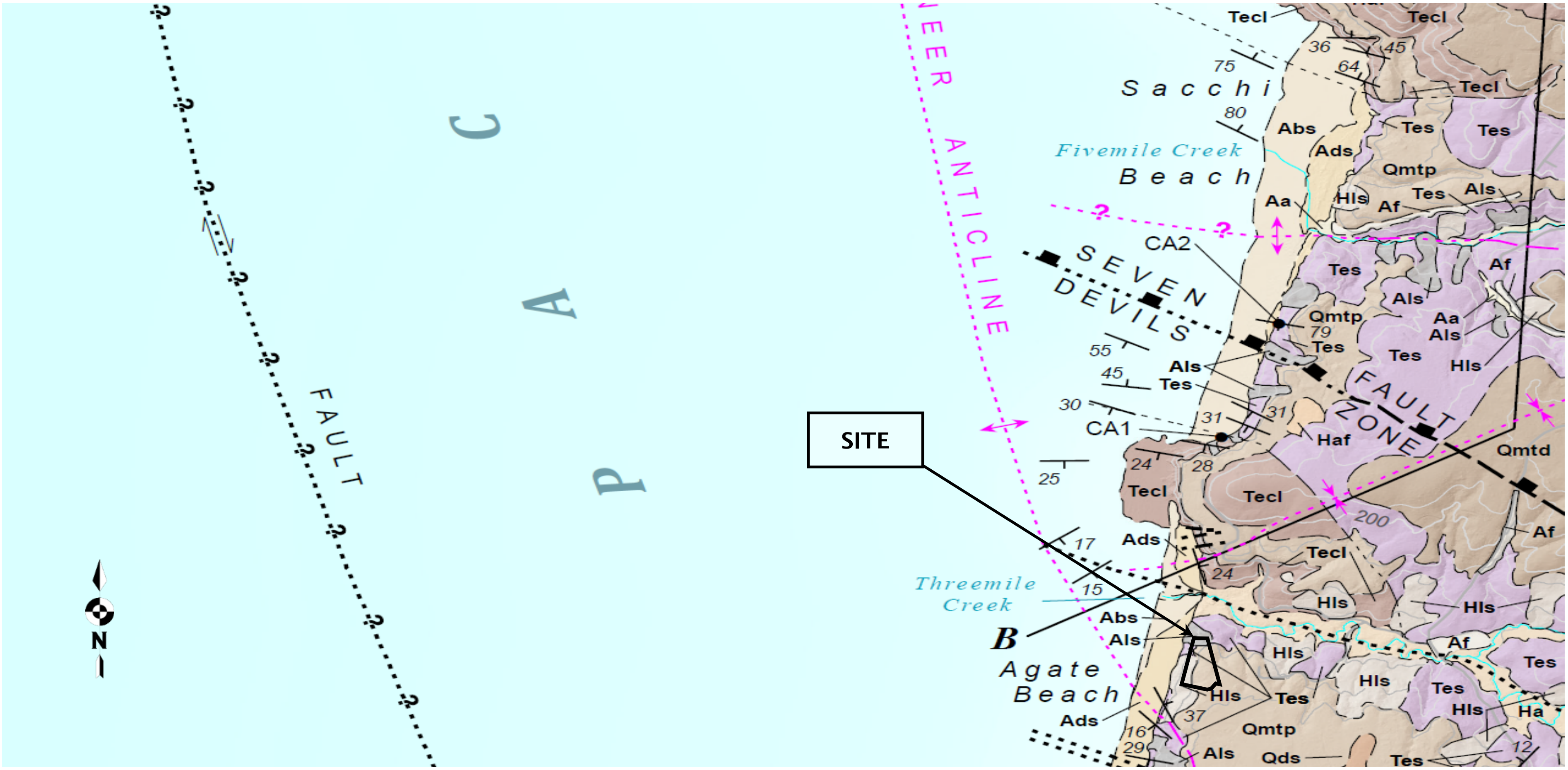


⊕ HAND AUGER WITH DCP DRILLED SEPTEMBER 22, 2021 – LOCATIONS APPROXIMATE

BASE DRAWING "SEA LION RESIDENCE, OVERALL SITE PLAN", DATED NOVEMBER 22, 2021.

ELEVATIONS SHOWN BASED ON ARBITRARY BENCHMARK - OFFSET APPROXIMATELY 52 FEET FROM EGM96

GEO CONSULTANTS NORTHWEST	PROJECT 1592	**PLATT RESIDENCE AGATE LANE - BANDON**	
2839 SE Milwaukie Avenue Portland, OR 97202	JAN 2022 Drawn By: tac	**SITE LAYOUT & EXPLORATIONS**	**FIGURE 2**



Oregon Department of Geology and Mineral Industries, "Geologic Map of the Cape Arago 7.5' Quadrangle, Coos County, Oregon", Whiley, T.J., et al., OFR O-15-04, 2015.

Als: landslide deposits

Abs: beach deposits

Ads: foredune deposits

Hls: Landslide deposits (Holocene)

Qmtp: Pioneer Terrace sediments (marine coastal terrace deposits)

Tes: siltstone/sandstone beds at Sacchi Beach (middle Eocene)

GEO CONSULTANTS NORTHWEST

2839 SE Milwaukie Avenue
Portland, OR 97202

PROJECT
1592

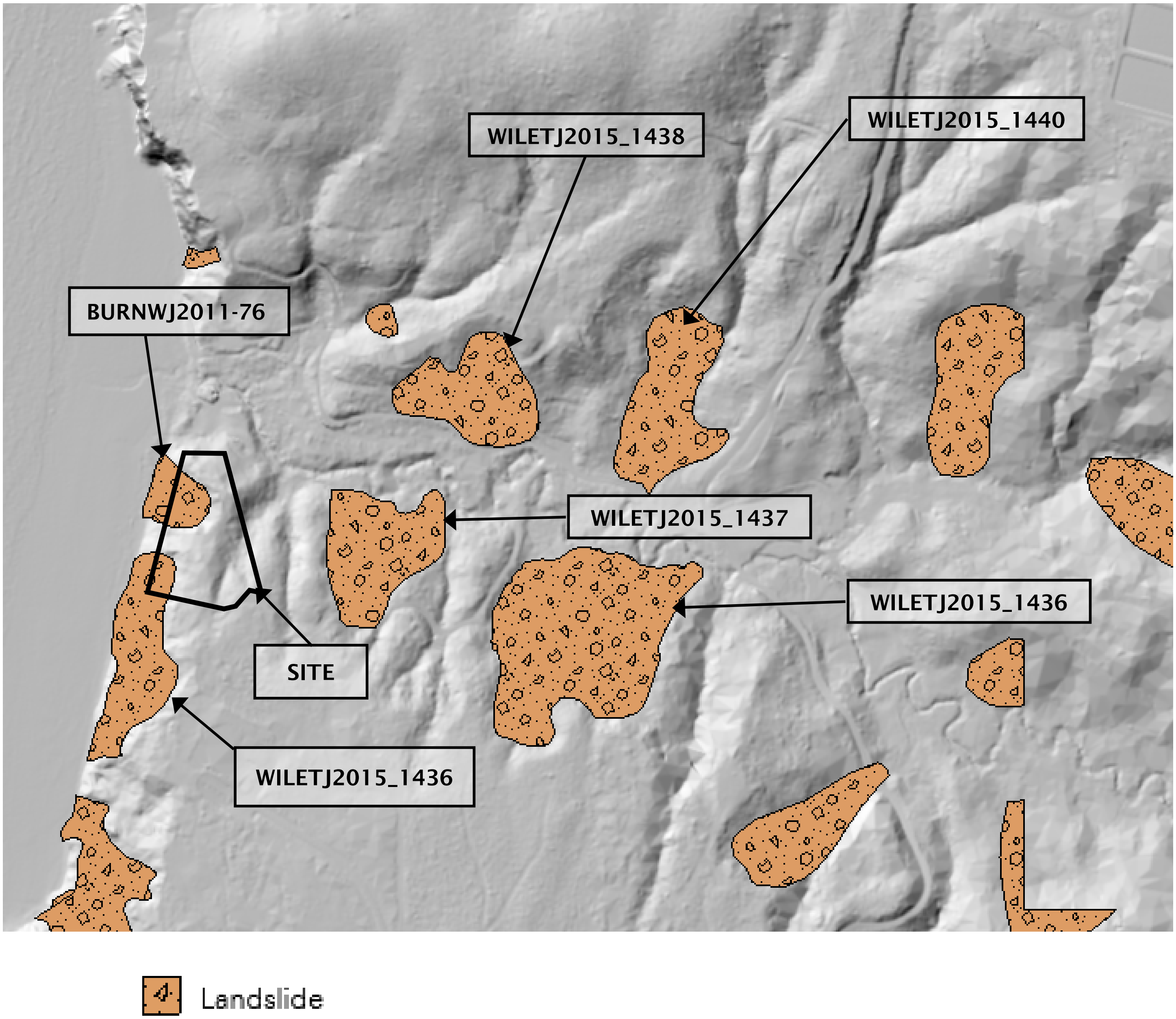
JAN
2022

Drawn
By: tac

PLATT RESIDENCE
AGATE LANE - BANDON

GEOLOGIC MAP

FIGURE 3

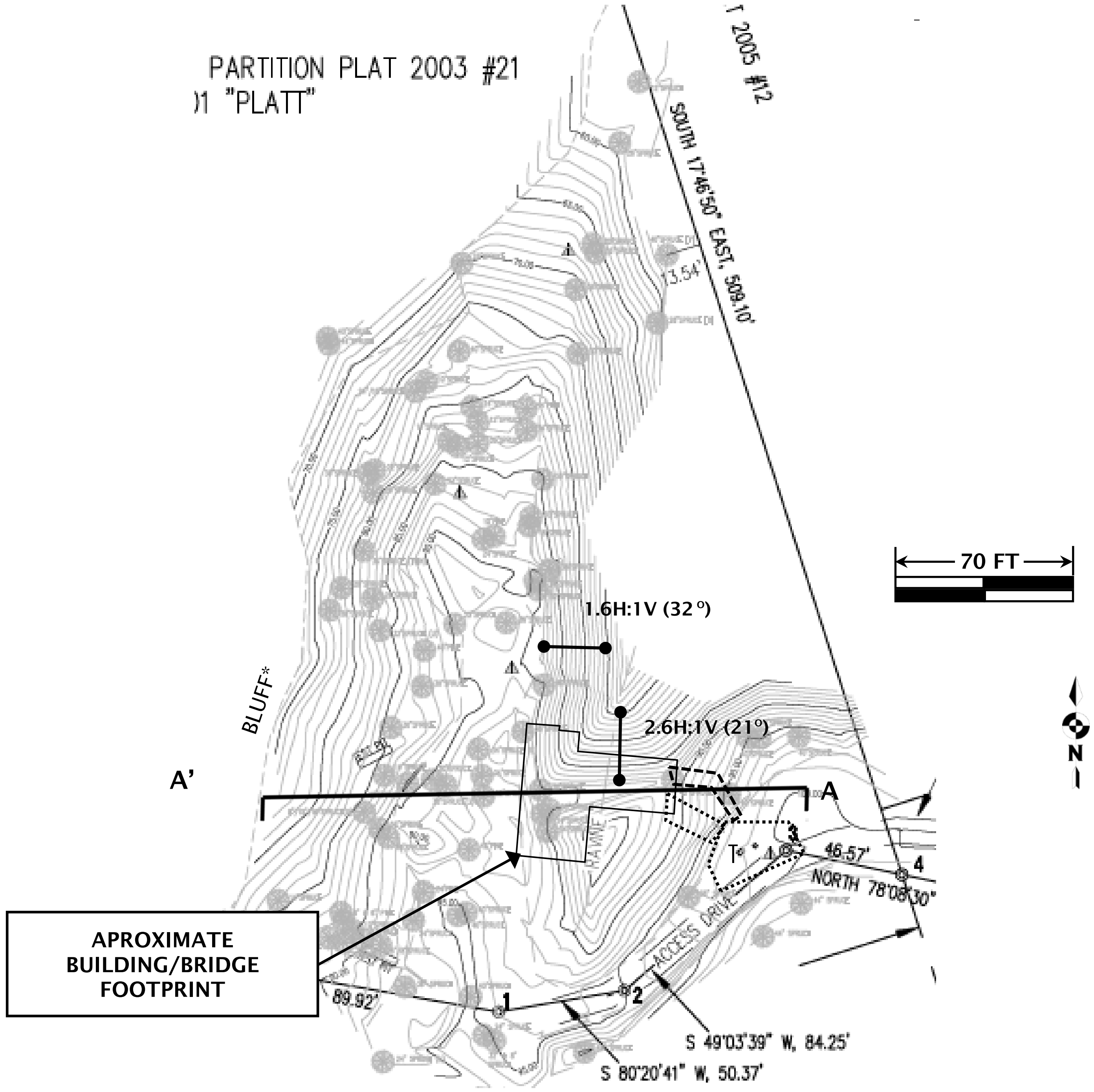


BASE DRAWING “LIDAR WITH LANDSLIDE INVENTORY” PREPARED BY OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

SCALE: 1 INCH = 600 FEET

N

GEO CONSULTANTS NORTHWEST	PROJECT 1592	**PLATT RESIDENCE** **AGATE LANE, BANDON**
2839 SE Milwaukie Avenue Portland, OR 97202	OCT 2021 Drawn By: tac	**MAPPED LANDSLIDES** — **FIGURE 4**



BASE DRAWING - SURVEY FOR DANIEL PLATT, PREPARED BY DODGE SURVEYING AND PLANNING, JUNE 12, 2021

ELEVATIONS SHOWN BASED ON ARBITRARY BENCHMARK - OFFSET APPROXIMATELY 52 FEET FROM EGM96

GEO CONSULTANTS NORTHWEST

PROJECT
1592

PLATT RESIDENCE
AGATE LANE - BANDON

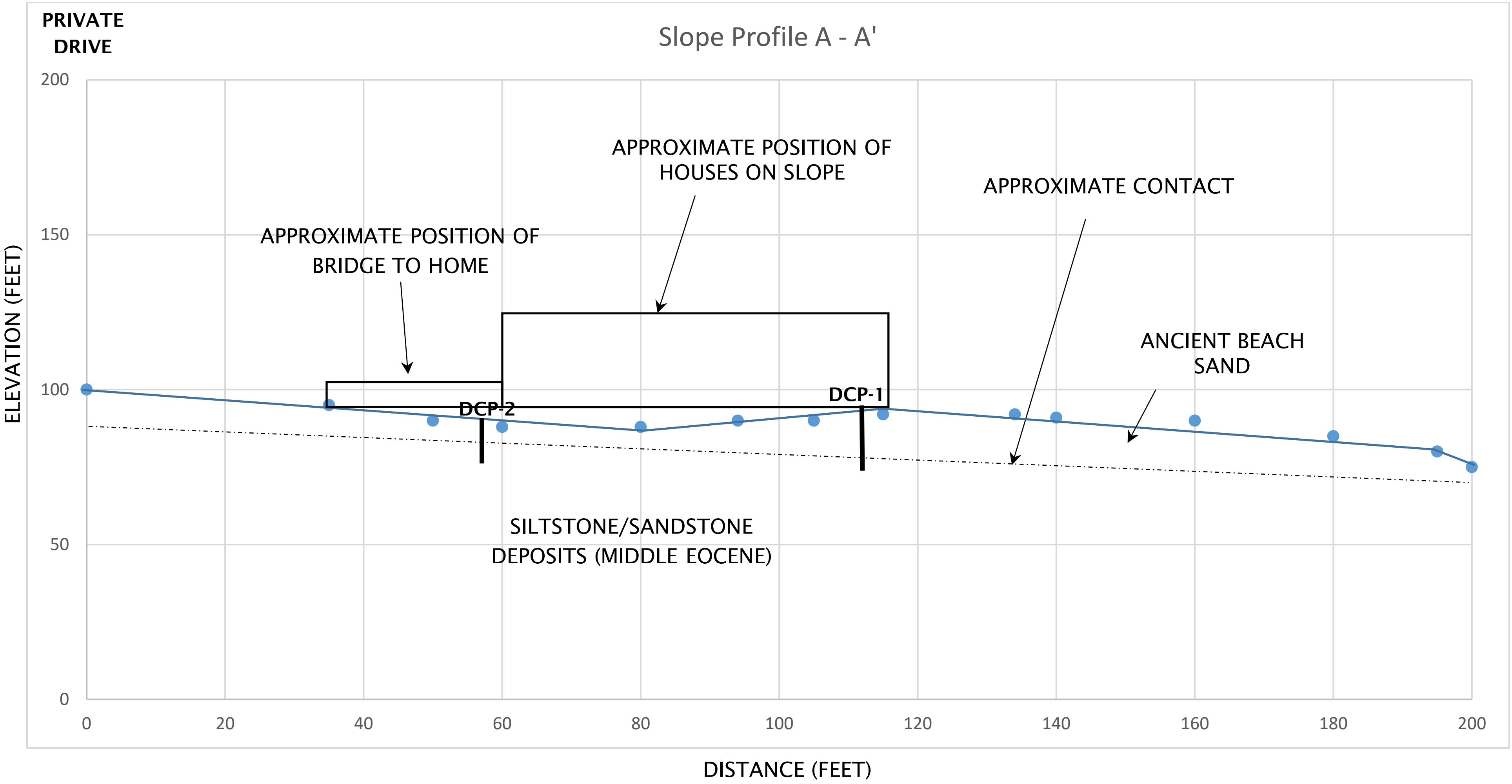
2839 SE Milwaukie Avenue
Portland, OR 97202

JAN
2022

Drawn
By: tac

SLOPE INCLINATIONS

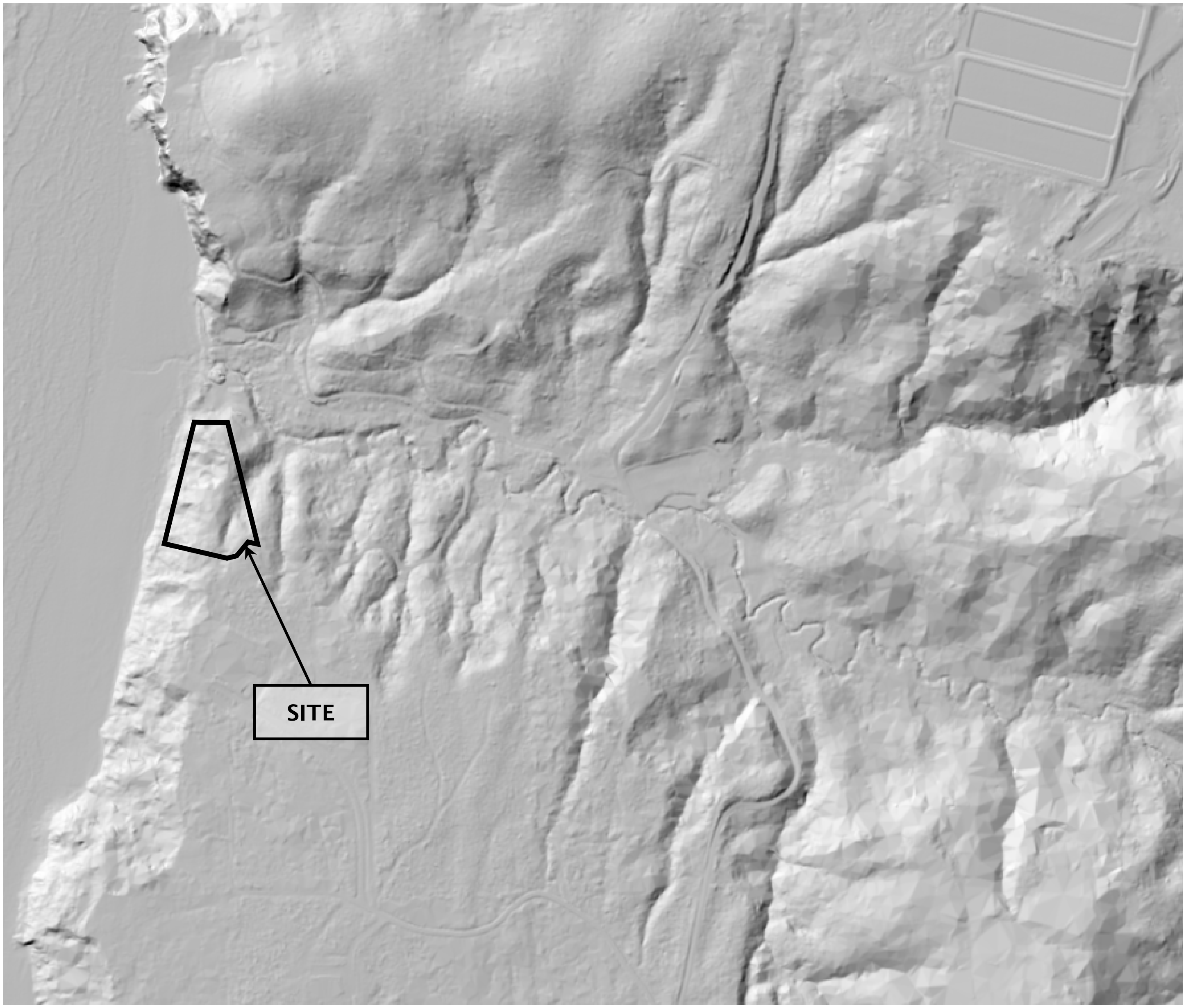
FIGURE 5



ELEVATIONS FROM OCEAN TERRACE BRIDGE HOUSE OVERALL SITE PLAN", DATED SEPTEMBER 16, 2021.

STRATIGRAPHY INFERRED FROM NEARBY WELL LOGS

GEO CONSULTANTS NORTHWEST	PROJECT 1592	**PLATT RESIDENCE AGATE LANE - BANDON**
2839 SE Milwaukie Avenue Portland, OR 97202	JAN 2022 Drawn By: tac	**SLOPE PROFILE A - A'** **FIGURE 6**

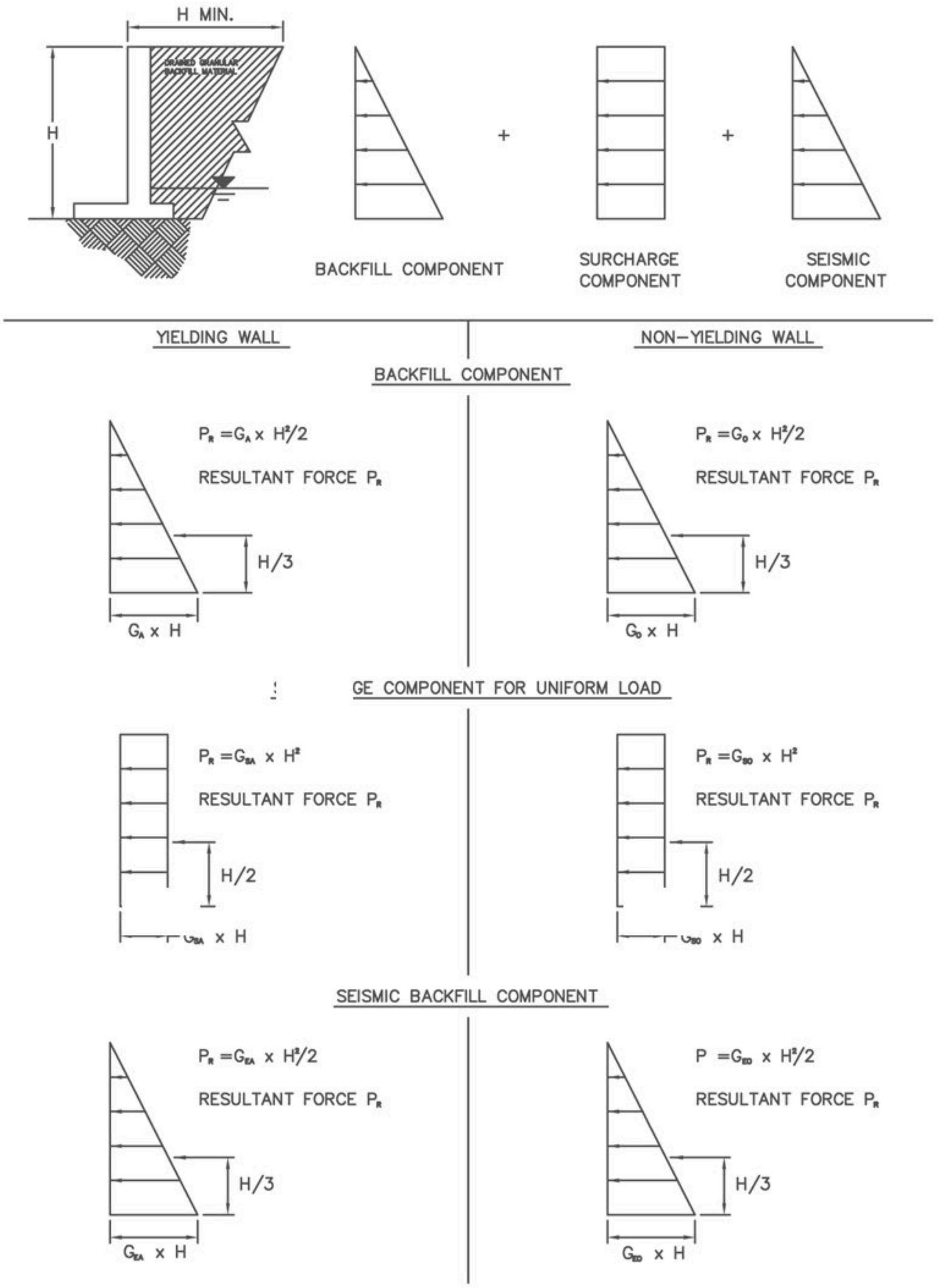


BASE DRAWING “LIDAR ELEVATIONS” PREPARED BY OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES

SCALE: 1 INCH = 600 FEET

N

GEO CONSULTANTS NORTHWEST	PROJECT 1592	**PLATT RESIDENCE** **AGATE LANE - BANDON**	
2839 SE Milwaukie Avenue Portland, OR 97202	JAN 2022 Drawn By: tac	**LIDAR IMAGE**	**FIGURE 7**



NOTE:

1. SEE REPORT TEXT FOR VALUE OF G.

A: ACTIVE O: AT–REST S: SURCHARGE E: EARTHQUAKE

GEO CONSULTANTS NORTHWEST	PROJECT 1592	**PLATT RESIDENCE** **AGATE LAN - BANDON**	
2839 SE Milwaukie Avenue Portland, OR 97202	JAN 2022 Drawn By: BLH	**RETAINING WALL PRESSURES**	**FIGURE 8**

ATTACHMENT A

FIELD EXPLORATION PROGRAM

KEY TO DCP LOGS

DCP LOGS: DCP-1 AND DCP-2

DEPTH (ft bgs)	GRAPHIC LOG	USCS SYMBOL	SOIL DESCRIPTION	SAMPLE	BLOW COUNT SPT N VALUE	MOISTURE CONTENT (%)	GROUNDWATER	FIELD TESTING	TESTING AND LABORATORY DATA
0	🟩	ML	Very soft, SILT with organics (rootlets); moist.		0 0 0				
5	🟨	SW	Loose to medium dense, SAND; moist. (ANCIENT BEACH TERRACE SAND)		2 5 3 3 3 3 10 7 7 8 8 9 12 12 11 12 13 9 9 9 7 11 11 11 11 11 23				
10	🟥	RK	Very stiff to hard, SANDY SILTSTONE; moist.						
15			Refusal at 10 feet in hard siltstone.						

BORING METHOD: DCP's

BOREHOLE DIAMETER:

DRILL RIG:

CONTRACTOR:

LOGGED BY: David Rankin, CEG

ELEVATION REFERENCE:

GROUND SURFACE ELEVATION:

CASING ELEVTATION:

LOCATION: See Figure 2

DRILLING DATES: 9/22/21

START CARD/TAG ID:

Platt - Agate Beach, Bandon

1592

GEO Consultants Northwest
2839 SE Milwaukie Avenue
Portland OR 97202
Tel 503-616-9425
Fax 1-866-293-9037

GEO CONSULTANTS NORTHWEST

LOG OF BORING

DCP-1

DEPTH (ft bgs)	GRAPHIC LOG	USCS SYMBOL	SOIL DESCRIPTION	SAMPLE	BLOW COUNT SPT N VALUE	MOISTURE CONTENT (%)	GROUNDWATER	FIELD TESTING	TESTING AND LABORATORY DATA
0	🟩	ML	Very soft, SILT with organics (rootlets); moist.		0 0 6				
5 10	🟨	SW	Loose to medium dense, SAND; moist. (ANCIENT BEACH TERRACE SAND)		6 6 6 6 6 6 6 6 6 7 8 8 8 8 7 14 9 9 9 9 9 9 9 9 8 8 6 8 7 10 11 12 12				
	🟥	RK	Very stiff to hard, SANDY SILTSTONE; moist.		12				
15			Refusal at 12 feet in hard siltstone.						

BORING METHOD: DCP's

BOREHOLE DIAMETER:

DRILL RIG:

CONTRACTOR:

LOGGED BY: David Rankin, CEG

ELEVATION REFERENCE:

GROUND SURFACE ELEVATION:

CASING ELEVTATION:

LOCATION: See Figure 2

DRILLING DATES: 9/22/21

START CARD/TAG ID:

Platt - Agate Beach, Bandon

1592

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Portland OR 97202
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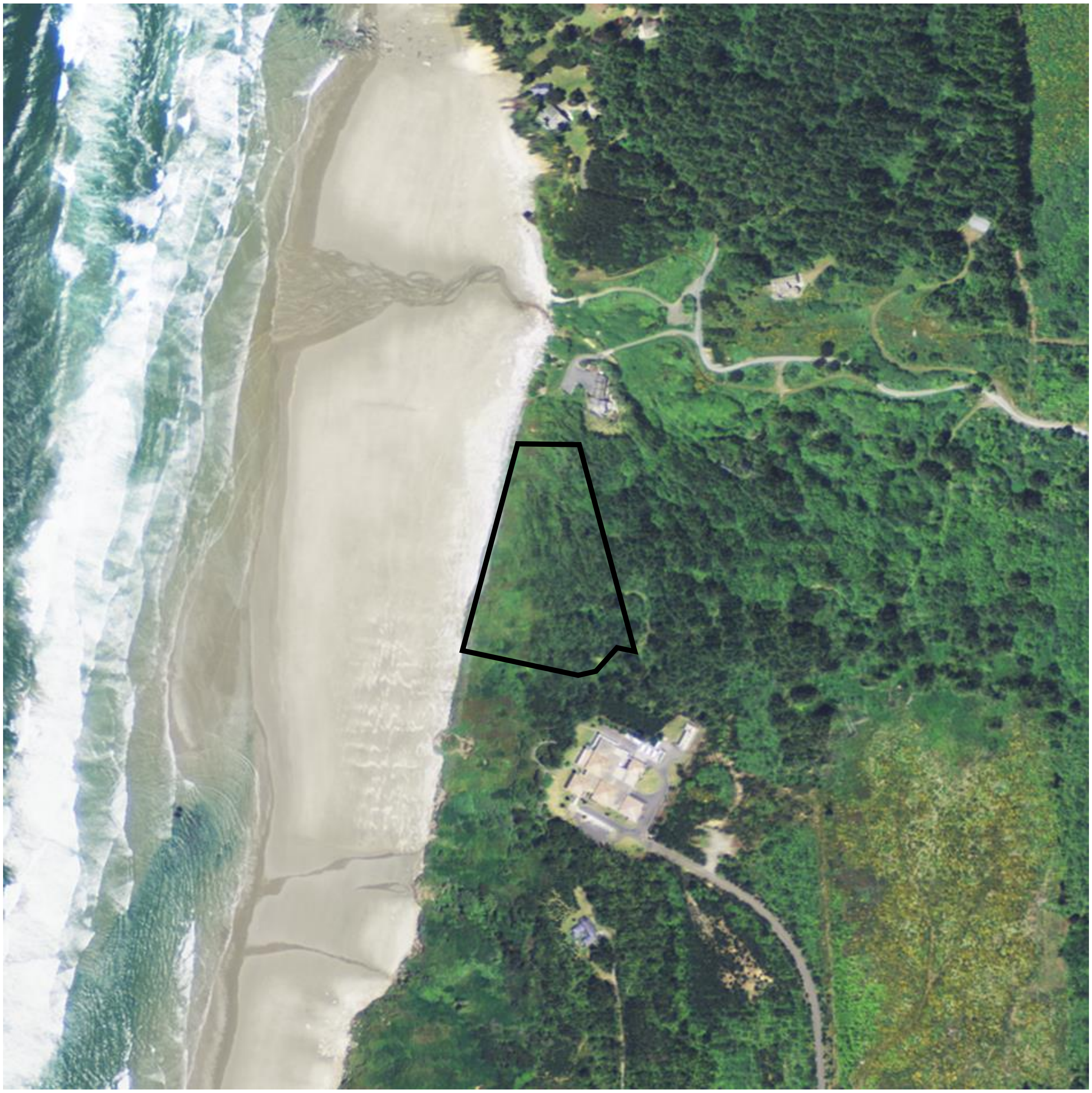
LOG OF BORING
DCP-2

Page 1 of 1

ATTACHMENT B

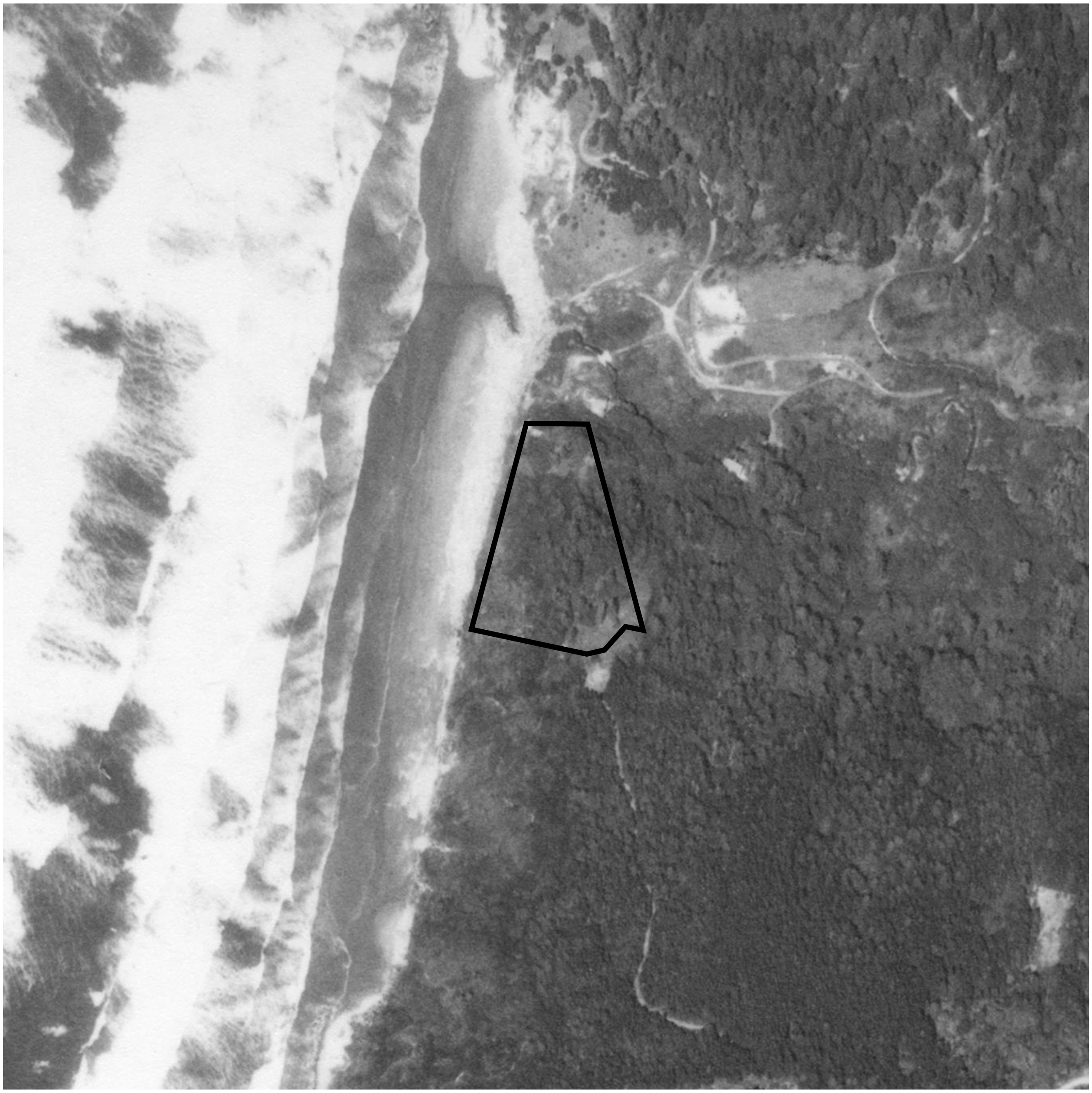
HISTORIC AERIAL PHOTOS



2012 University of Oregon Library

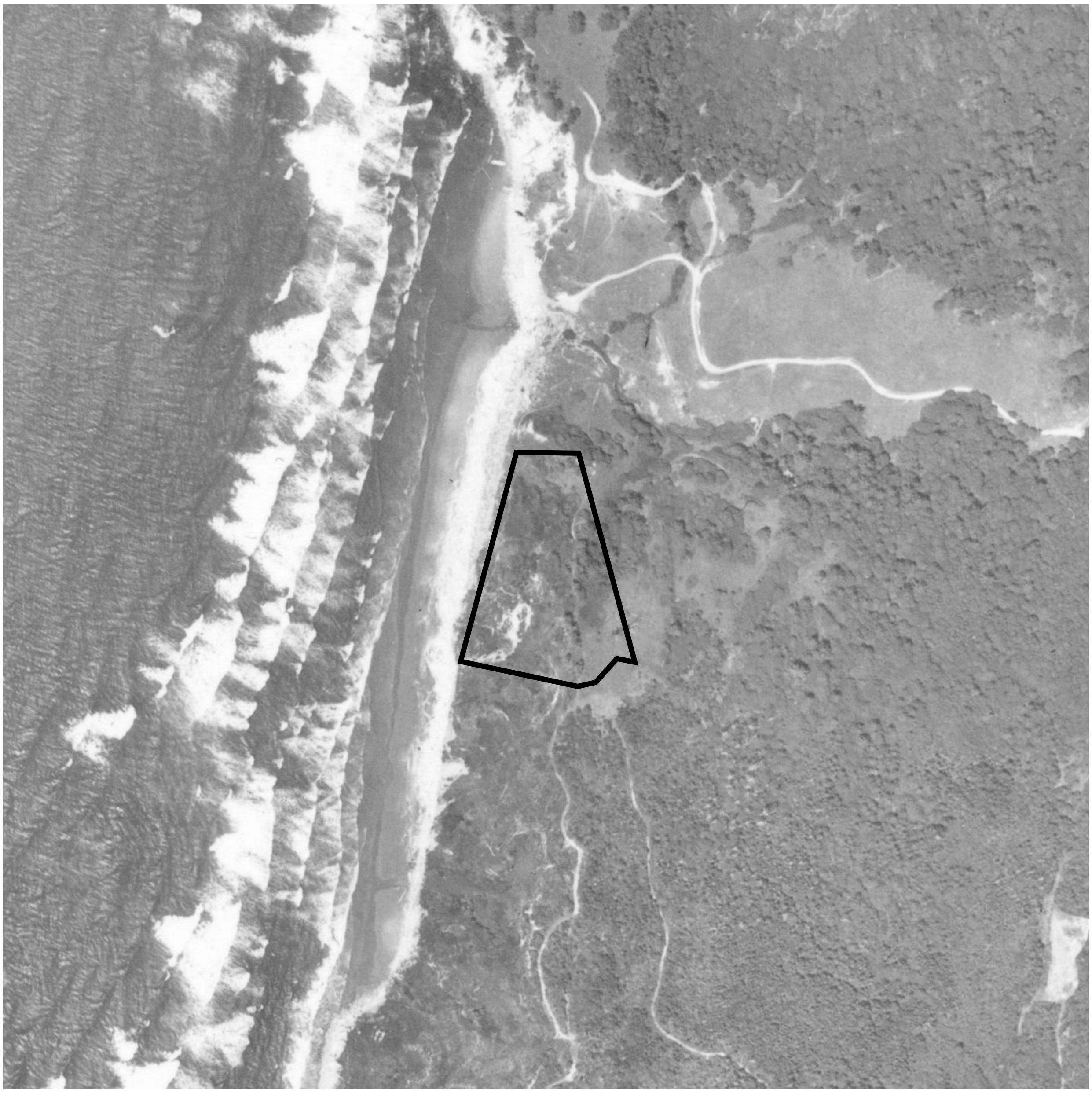
2002 University of Oregon Library

1994 University of Oregon Library

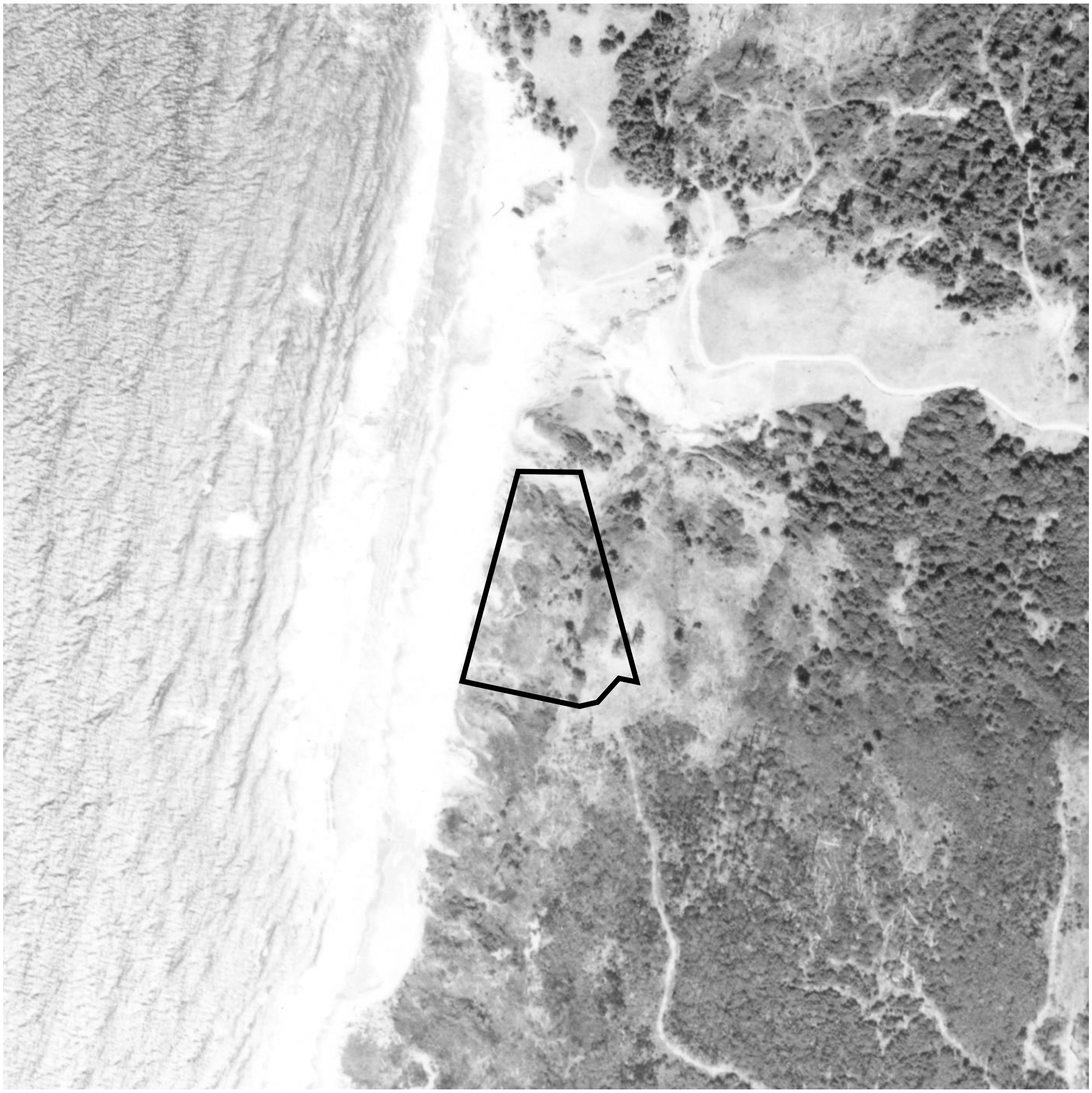


1986 University of Oregon Library

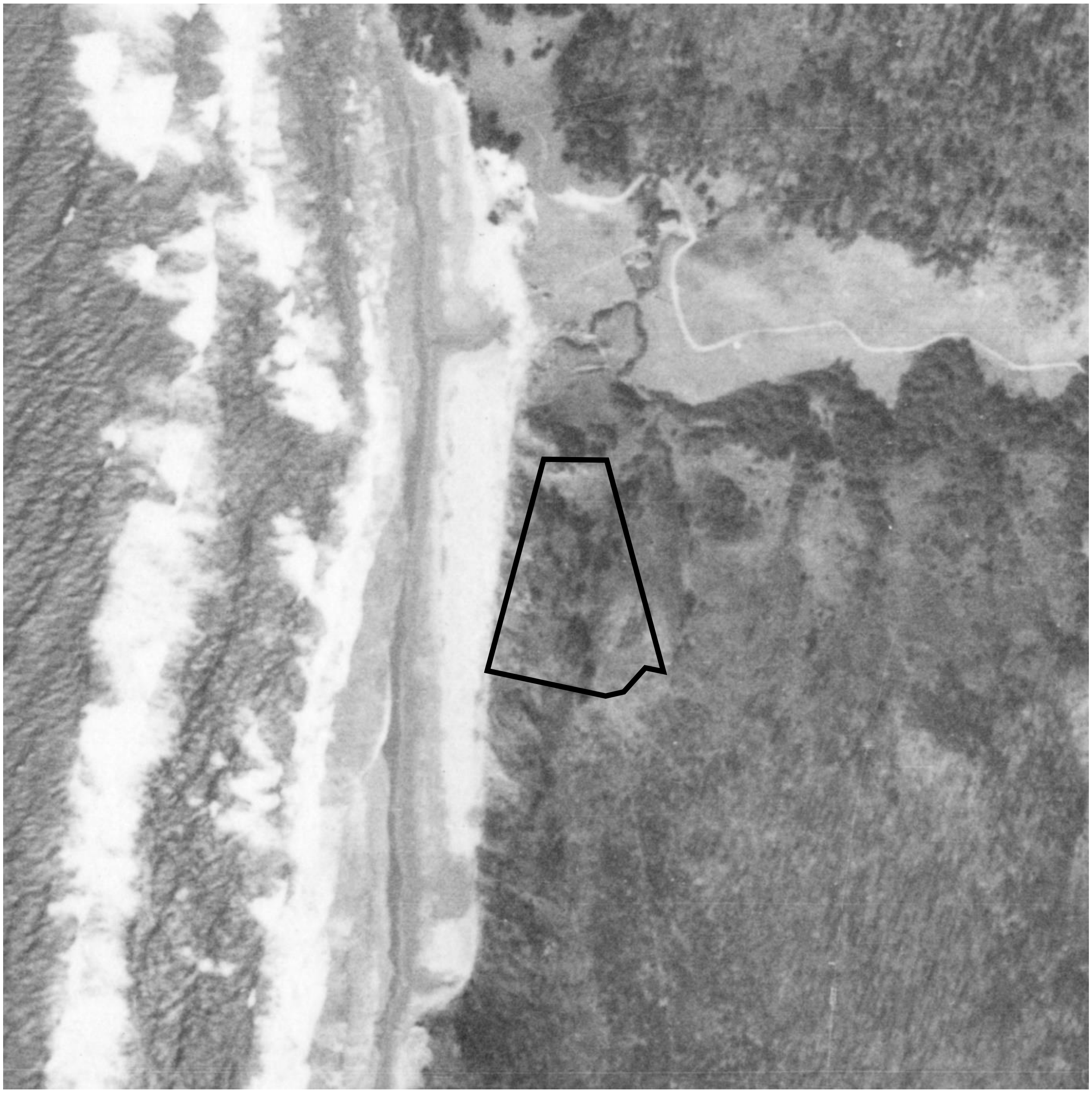
1971 University of Oregon Library



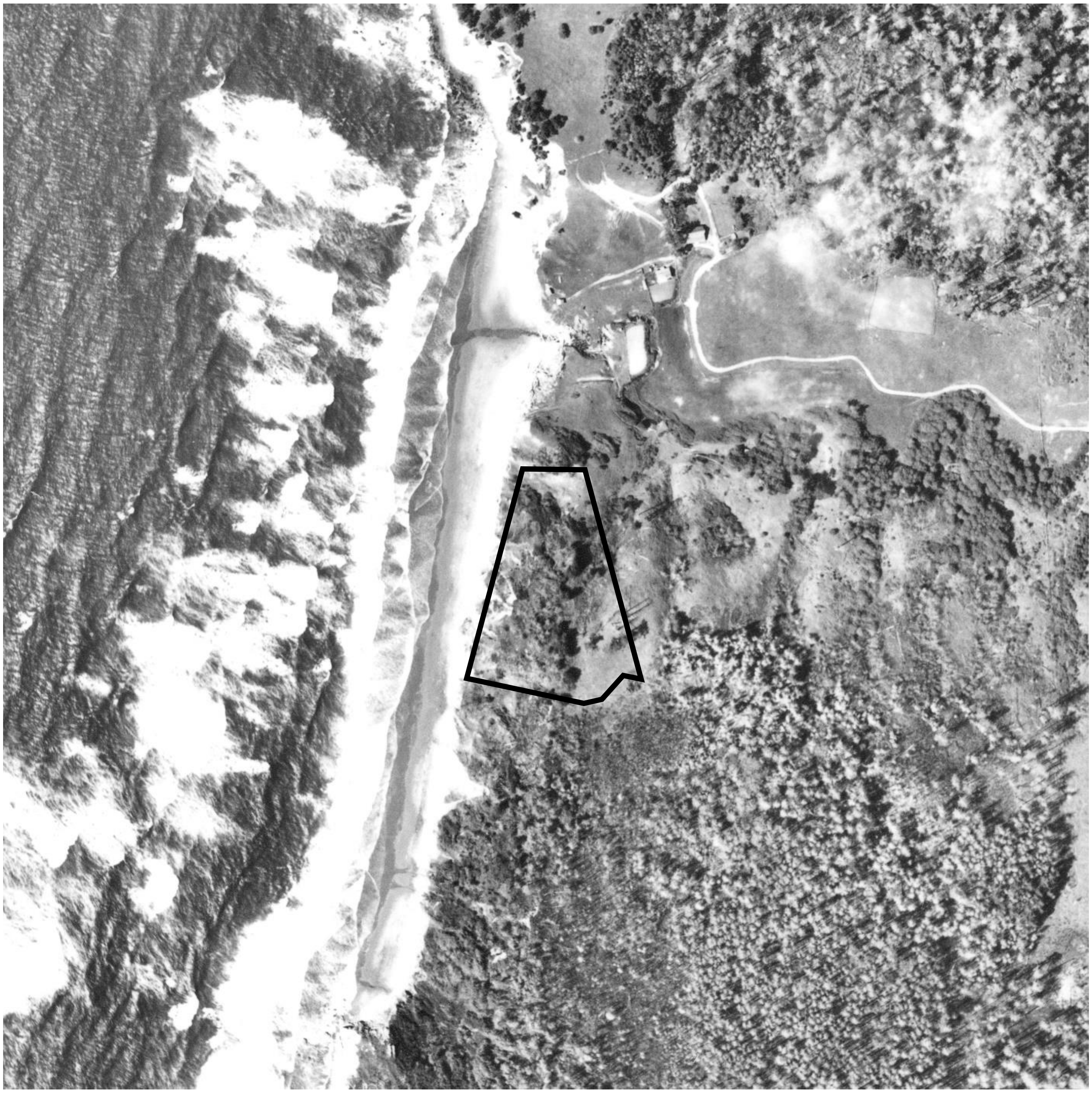
1967 University of Oregon Library



1954 University of Oregon Library



1942 University of Oregon Library



1939 University of Oregon Library