\Tillamook County

DEPARTMENT OF COMMUNITY DEVELOPMENT
BUILDING, PLANNING & ON-SITE SANITATION SECTIONS

1510 – B Third Street
Tillamook, Oregon 97141
www.tillamook.or.us
Building (503) 842-3407
Planning (503) 842-3408
Sanitation (503) 842-3409
FAX (503) 842-1819
Toll Free 1(800) 488-8280

Land of Cheese, Trees and Ocean Breeze

Neskowin Coastal Hazard Area Permit #851-21-000283-PLNG: Capri & McMillan

NOTICE TO MORTGAGEE, LIENHOLDER, VENDOR OR SELLER:
ORS 215 REQUIRES THAT IF YOU RECEIVE THIS NOTICE,
IT MUST BE PROMPTLY FORWARDED TO THE PURCHASER

NOTICE OF ADMINISTRATIVE REVIEW
Date of Notice: October 22, 2021

Notice is hereby given that the Tillamook County Department of Community Development is considering the following:

#851-21-000283-PLNG: A request for approval of a Neskowin Coastal Hazard Area Permit for the construction of a single-family dwelling on a property located within the Unincorporated Community Boundary of Neskowin, zoned Neskowin Low Density Residential (NeskR-1) and within the Neskowin Coastal Hazards Overlay (Nesk-CH) Zone. The subject property is accessed via Surf Road and designated as Tax Lot 2000 of Section 36BC in Township 5 South, Range 11 West of the Willamette Meridian, Tillamook County, Oregon.

Notice of the application, a map of the subject area, and the applicable criteria are being mailed to all property owners within 250 feet of the exterior boundaries of the subject parcel for which the application has been made and other appropriate agencies at least 14 days prior to this Department rendering a decision on the request.

Written comments received by the Department of Community Development prior to 4:00p.m. on November 5, 2021 will be considered in rendering a decision. Comments should address the criteria upon which the Department must base its decision. A decision will be rendered no sooner than November 8, 2021.

A copy of the application, along with a map of the request area and the applicable standards/criteria for review are available for inspection on the Tillamook County Department of Community Development website: https://www.co.tillamook.or.us/commdev/landuseapps and is also available for inspection at the Department of Community Development office located at 1510-B Third Street, Tillamook, Oregon, 97141.

If you have any questions about this application, please contact Sarah Absher, CFM, Director at 503-842-3408 x 3317 or by email: sabsher@co.tillamook.or.us.

Sincerely,

Sarah Absher

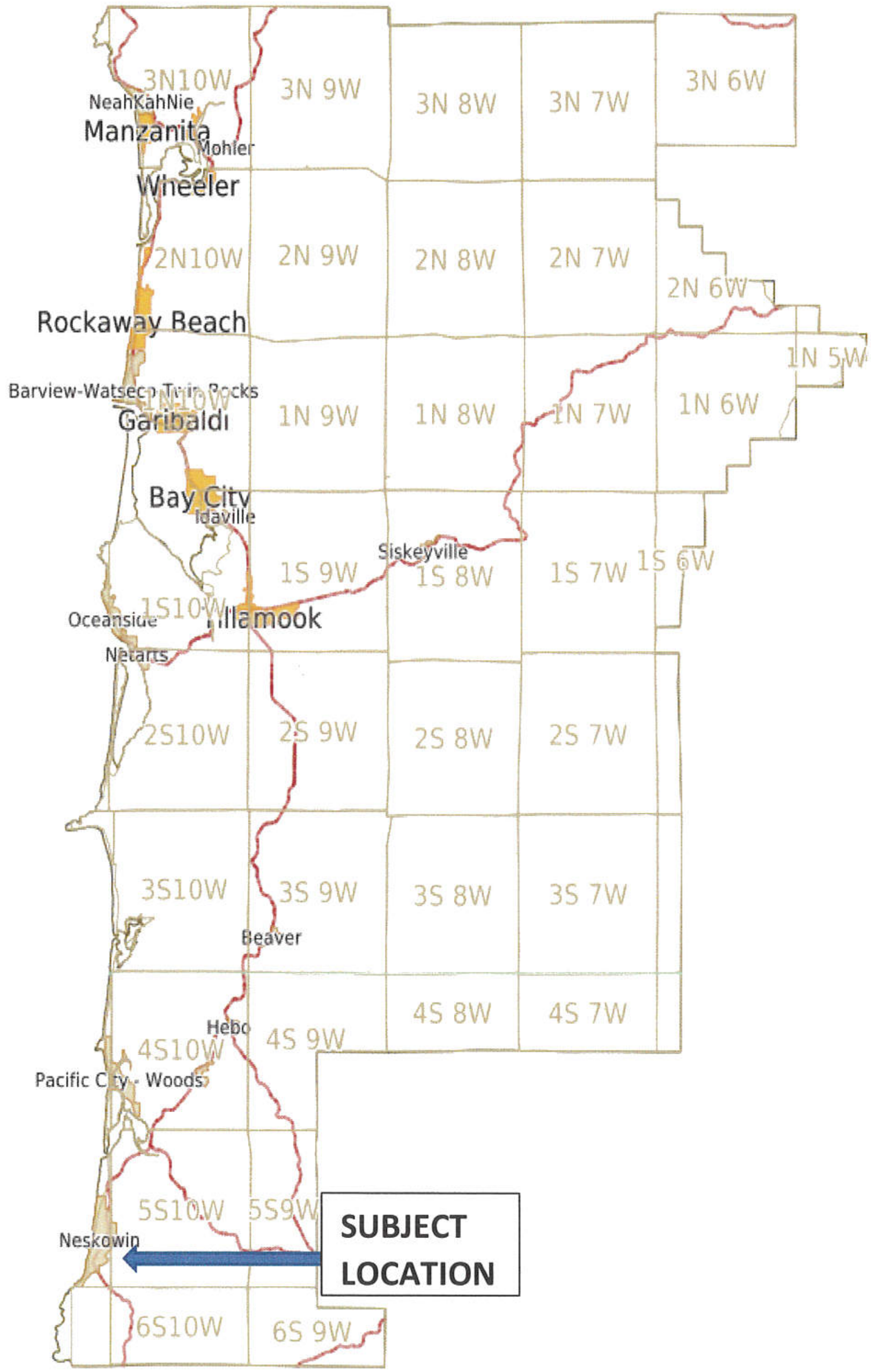
Sarah Absher, CFM, Director

Enc. Applicable Ordinance Standards/Criteria
Maps

TCLUO SECTION 3.570(4)(e): A decision to approve a Neskowin Coastal Hazard Area Permit shall be based upon findings of compliance with the following standards:

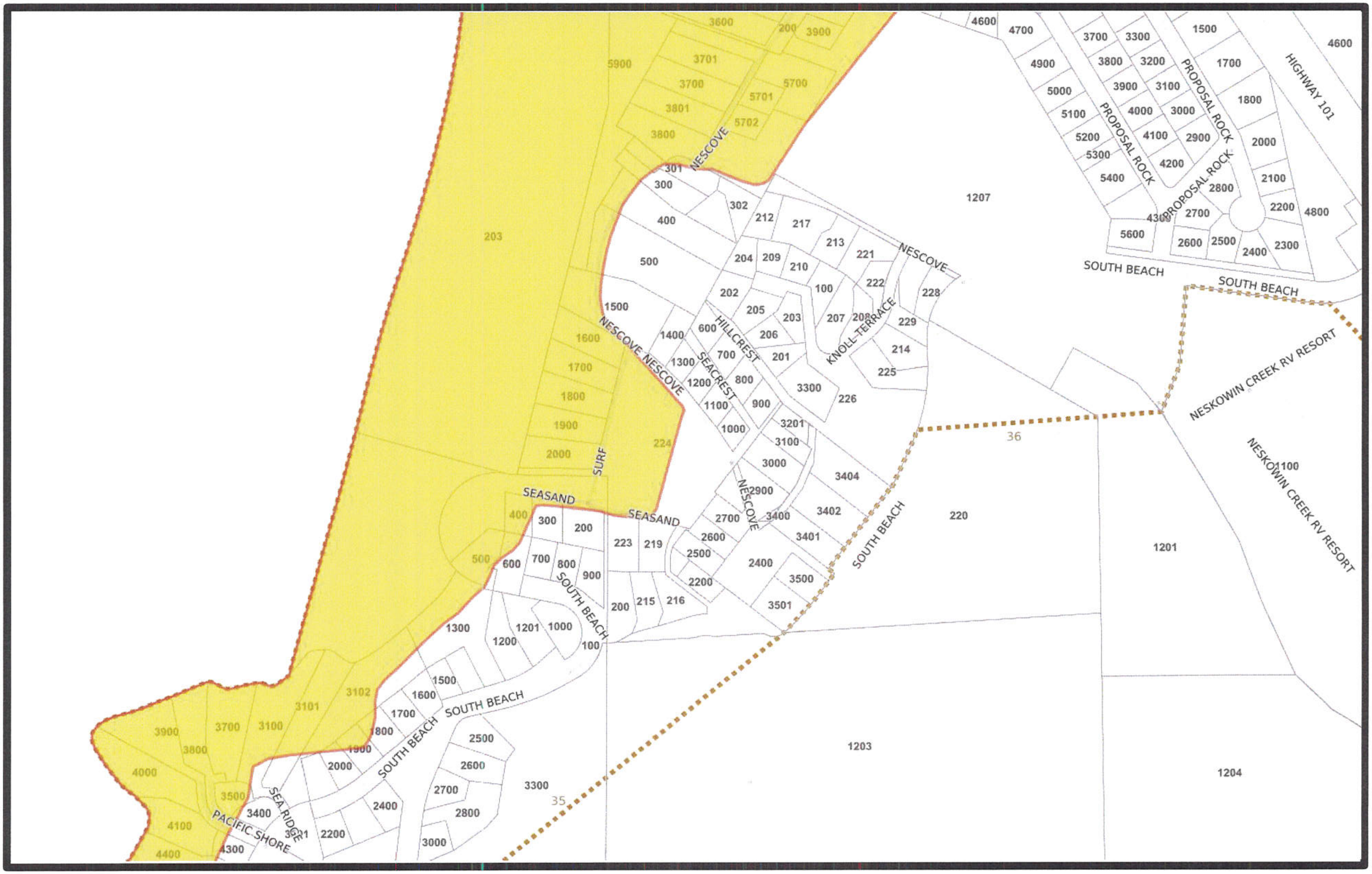
(A) The proposed development is not subject to the prohibition of development on beaches and certain dune forms as set forth in subsection (8) of this section;
(B) The proposed development complies with the applicable requirements and standards of subsections (6), (7), (8), and (10) of this section;
(C) The geologic report conforms to the standards for such reports set forth in subsection (5) of this section;
(D) The development plans for the application conform, or can be made to conform, with all recommendations and specifications contained in the geologic report; and
(E) The geologic report provides a statement that, in the professional opinion of the engineering geologist, the proposed development will be within the acceptable level of risk established by the community, as defined in subsection (5)(c) of this section, considering site conditions and the recommended mitigation.

VICINITY MAP



#851-21-000283-PLNG: Capri & McMillan

Map



Generated with the GeoMOOSE Printing Utilities

Tillamook County Department of Community Development
1510-B Third Street, Tillamook, OR 97141 | Tel: 503-842-3408 Fax: 503-842-1819
www.co.tillamook.or.us

PLANNING APPLICATION

OFFICE USE ONLY
Date Stamp: RECEIVED JUL 15 2021 BY: Email
☐Approved ☐Denied
Received by: NT
Receipt #:
Fees: $615.00
Permit No: 851-21-000283-PLNG

Applicant ☐ *(Check Box if Same as Property Owner)*

Name: Dustin Capri - Capri Arch. Phone: 541-961-0503
Address: 747 SW 13th Street
City: Newport State: OR Zip: 97365
Email: dustin@capriarchitecture.com

Property Owner

Name: Dan & Christina McMillan Phone: 971-237-1967
Address: 12050 NE Kuehne Road
City: Carlton State: OR Zip: 97111
Email: christinalmac@gmail.com

Request: Construct New Single-Family Residence in Neskowin Coastal Hazards Overlay Zone

Type II	Type III	Type IV
☐ Farm/Forest Review	☐ Extension of Time	☐ Ordinance Amendment
☐ Conditional Use Review	☐ Detailed Hazard Report	☐ Large-Scale Zoning Map Amendment
☐ Variance	☐ Conditional Use (As deemed by Director)	☐ Plan and/or Code Text Amendment
☐ Exception to Resource or Riparian Setback	☐ Ordinance Amendment	
☐ Nonconforming Review (Major or Minor)	☐ Map Amendment	
☐ Development Permit Review for Estuary Development	☐ Goal Exception	
☐ Non-farm dwelling in Farm Zone		
☐ Foredune Grading Permit Review		
■ Neskowin Coastal Hazards Area		

Location:

Site Address: Surf Road, Neskowin, OR

Map Number:	5S	11W	36BC	2000
	Township	Range	Section	Tax Lot(s)

Clerk's Instrument #: ____________________

Authorization

This permit application does not assure permit approval. The applicant and/or property owner shall be responsible for obtaining any other necessary federal, state, and local permits. The applicant verifies that the information submitted is complete, accurate, and consistent with other information submitted with this application.

Property Owner Signature (Required) 30 JUNE 2021
Date

Applicant Signature 30 JUNE 2021
Date

PLANNING LAND USE APPLICATION

NESKOWIN COASTAL HAZARDS OVERLAY ZONE

TAX LOT #2000, MAP 5S-11W-36BC

capriarchitecture

30 JUNE 2021

capriarchitecture

747 SW 13th Street Newport, OR 97365 | p.541.961.0503 | p.503.349.6246 | dustin@capriarchitecture.com | amanda@capriarchitecture.com

APPLICATION FORM

McMillan Residence

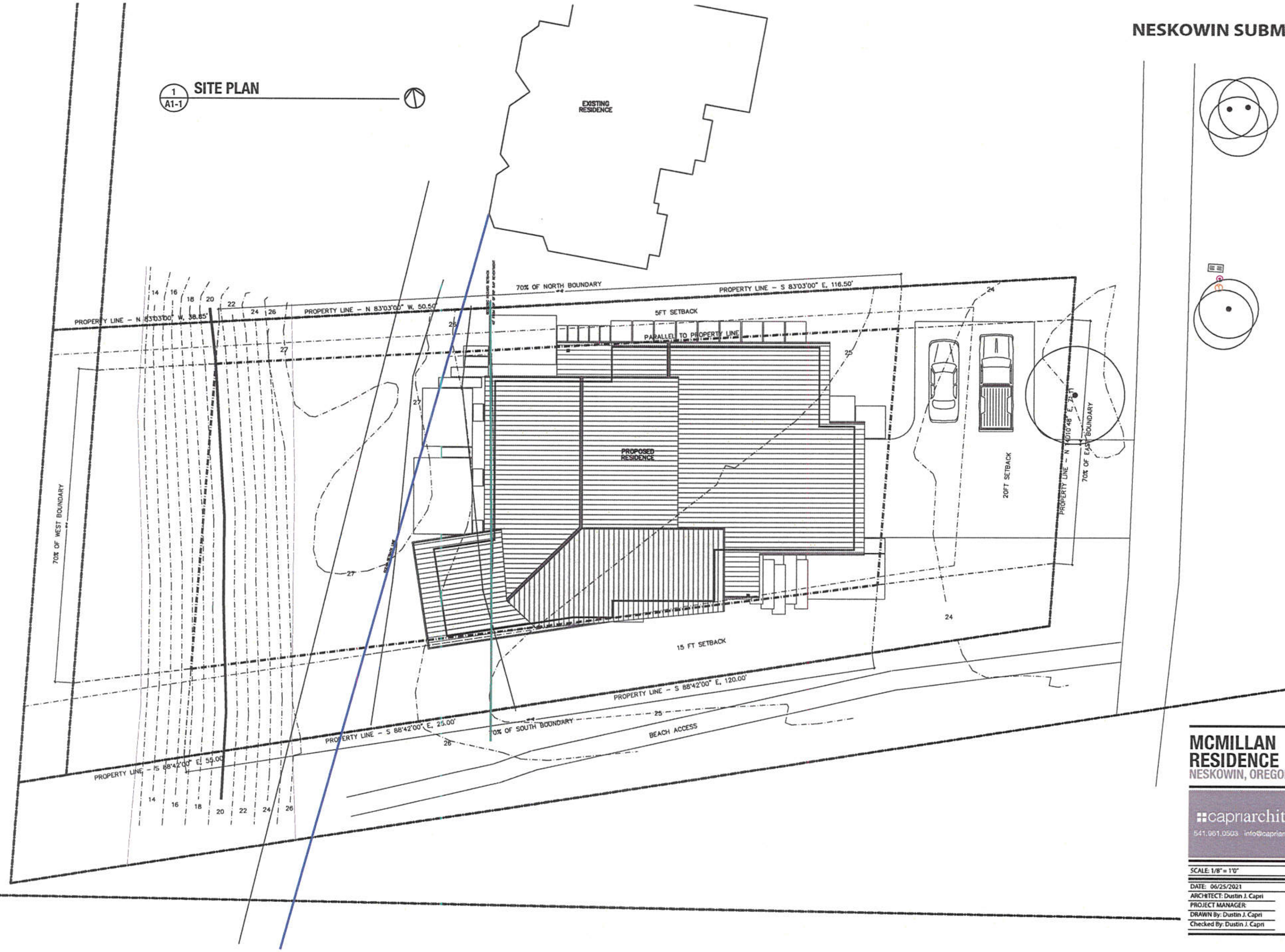
capriarchitecture

747 SW 13th Street Newport, OR 97365 | p.541.961.0503 | p.503.349.6246 | dustin@capriarchitecture.com | amanda@capriarchitecture.com

SITE PLAN

NESKOWIN SUBMITTAL

1 A1-1 SITE PLAN



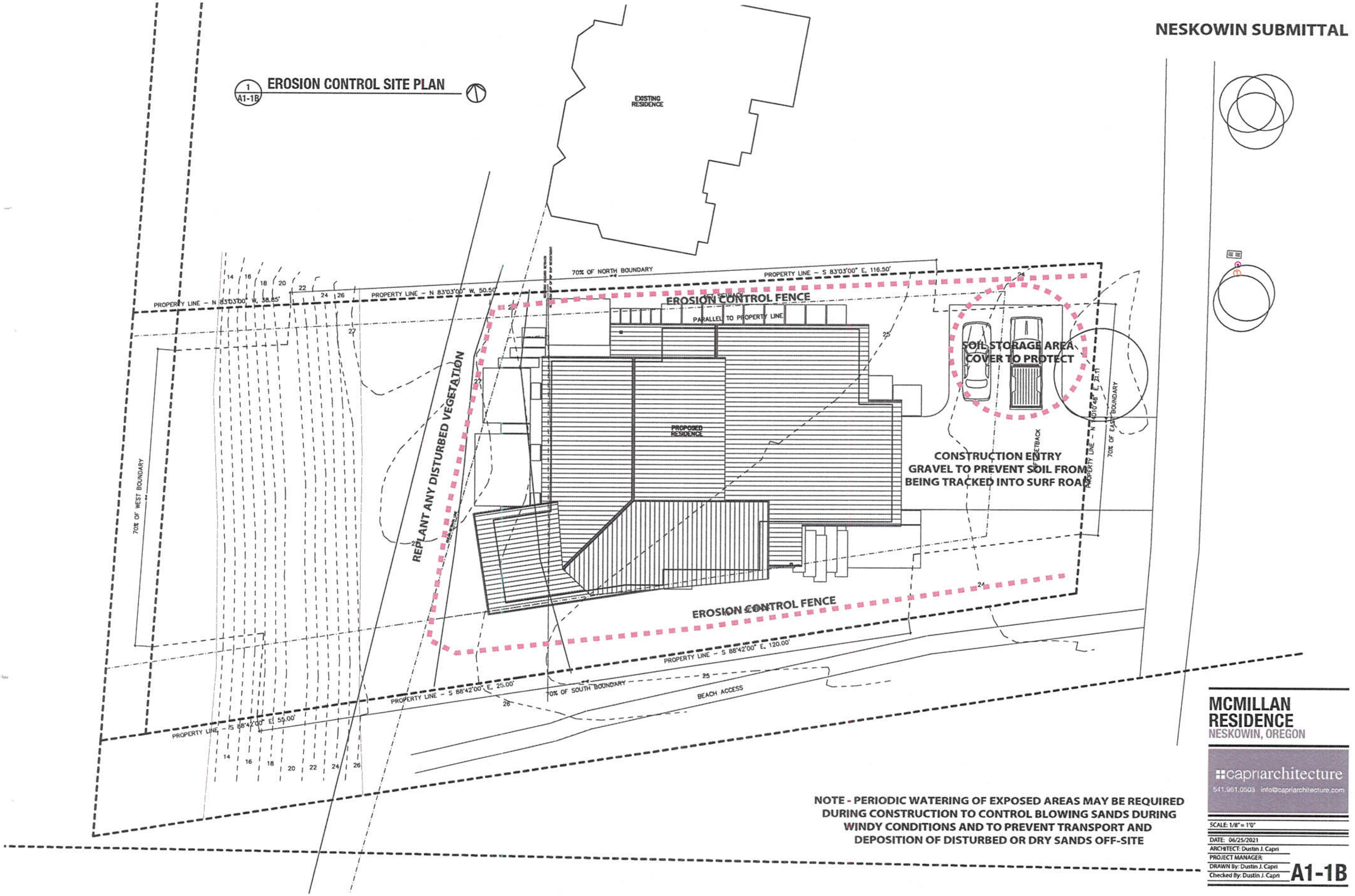
MCMILLAN RESIDENCE
NESKOWIN, OREGON

capriarchitecture
541.961.0503 info@capriarchitecture.com

SCALE: 1/8" = 1'0"
DATE: 06/25/2021
ARCHITECT: Dustin J. Capri
PROJECT MANAGER:
DRAWN By: Dustin J. Capri
Checked By: Dustin J. Capri

A1-1

NESKOWIN SUBMITTAL



NOTE - PERIODIC WATERING OF EXPOSED AREAS MAY BE REQUIRED DURING CONSTRUCTION TO CONTROL BLOWING SANDS DURING WINDY CONDITIONS AND TO PREVENT TRANSPORT AND DEPOSITION OF DISTURBED OR DRY SANDS OFF-SITE

MCMILLAN RESIDENCE
NESKOWIN, OREGON

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A1-1B

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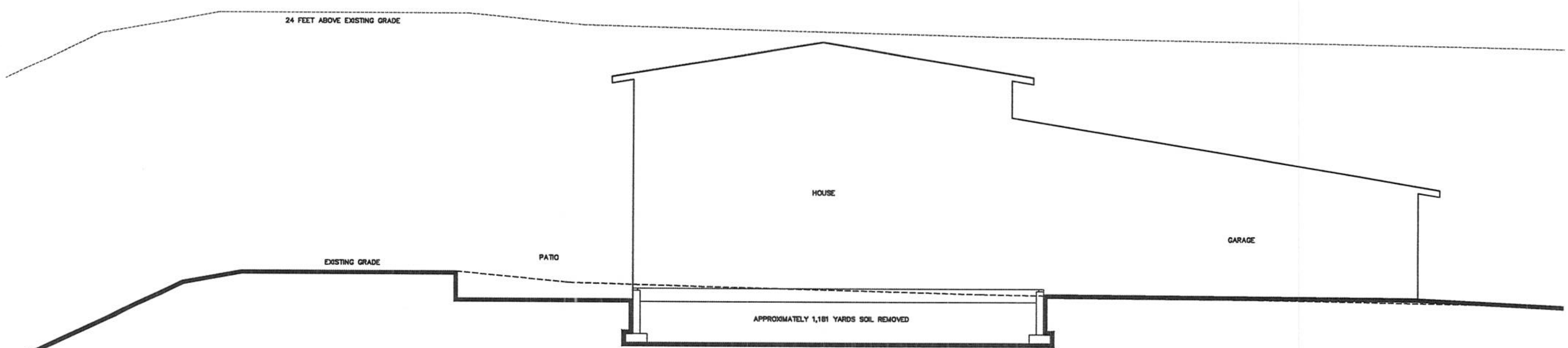
EXCAVATION / FILL ESTIMATES

McMillan Residence



1 A1-2 SITE SECTION

MCMILLAN RESIDENCE
NESKOWIN, OREGON

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SCALE: 1/8" = 1'0"
DATE: 06/25/2021
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A1-2

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GEOLOGIC REPORT

McMillan Residence

Geologic Hazards and Geotechnical Investigation
Tax Lot 2000, Map 5S-11W-36BC
Neskowin, Tillamook County, Oregon

Prepared for:
Christina and Dan McMillan
12050 NE Kuehne Road
Carlton, Oregon 97111

Project #Y204352

April 24, 2020

H.G. Schlicker & Associates, Inc.

H.G. Schlicker & Associates, Inc.
607 Main Street, Suite 200 · Oregon City, Oregon 97045
(503) 655-8113 · FAX (503) 655-8173

Project #Y204352 April 24, 2020

To: **Christina and Dan McMillan**
12050 NE Kuehne Road
Carlton, Oregon 97111

Subject: **Geologic Hazards and Geotechnical Investigation**
Tax Lot 2000, Map 5S-11W-36BC
Neskowin, Tillamook County, Oregon

Dear Christina and Dan McMillan:

The accompanying report presents the results of our geologic hazards and geotechnical investigation for the above subject site.

After you have reviewed our report, we would be pleased to discuss it and to answer any questions you might have.

This opportunity to be of service is sincerely appreciated. If we can be of any further assistance, please contact us.

H.G. SCHLICKER & ASSOCIATES, INC.

J. Douglas Gless, MSc, RG, CEG, LHG
President/Principal Engineering Geologist

JDG:aml

Project #Y204352 April 24, 2020

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H.G. Schlicker & Associates, Inc.
607 Main Street, Suite 200 · Oregon City, Oregon 97045
(503) 655-8113 · FAX (503) 655-8173

Project #Y204352 April 24, 2020

To: **Christina and Dan McMillan**
12050 NE Kuehne Road
Carlton, Oregon 97111

Subject: **Geologic Hazards and Geotechnical Investigation**
Tax Lot 2000, Map 5S-11W-36BC
Neskowin, Tillamook County, Oregon

Dear Christina and Dan McMillan:

1.0 Introduction

At your request and authorization, representatives of H.G. Schlicker and Associates, Inc. (HGSA) visited the subject site on April 21, 2020, to complete a geologic hazards and geotechnical investigation of Tax Lot 2000, Map 5S-11-36BC located in Neskowin, Tillamook County, Oregon (Figures 1 and 2; Appendix A). It is our understanding that you would like to construct a house on the lot.

This report addresses the engineering geology and geologic hazards at the site with respect to the proposed construction. The scope of our work consisted of a site visit, site observations and measurements, subsurface exploration with hand augered borings, a slope profile, limited review of the geologic literature, interpretation of topographic maps, lidar, and aerial photography, and preparation of this report of our findings, conclusions and geotechnical recommendations for home construction.

2.0 Site Description

The subject site is an oceanfront lot located on a younger stabilized dune in the community of Neskowin, Oregon (Figure 1). The property consists of Tax Lot 2000, Map 5S-11-36BC, a 0.4-acre lot approximately 71 to 92 feet wide north to south and 206 to 210 feet deep east to west. An oceanfront protective structure (riprap revetment) is located on the dune slope on the western portion of the site; this revetment is contiguous with other revetments to the north and south (Figure 3; Appendix A).

The site is bounded to its north by a developed lot, to its south by a beach access pathway, to its east by Surf Road, and to its west by the beach and the Pacific Ocean. Access to the site is via Surf Road to the east.

The site east of the riprap revetment is gently sloping down to the east at approximately 2 to 5 degrees at elevations between approximately 24 to 28 feet (NAVD 88) (Figures 3 and 4). The riprap revetment slopes down to the beach at approximately 30 degrees. We observed an area approximately 8 feet wide near the base of the exposed revetment where it appeared that armor stone had been plucked from the revetment in the past damaging the revetment (Appendix A).

At the time of our site visit, the site was vegetated with lawn grass, European beachgrass, salal, ferns, and young shore pine trees (Appendix A).

2.1 The history of the site and surrounding areas, such as previous riprap or dune grading permits, erosion events, exposed trees on the beach, or other relevant local knowledge of the site.

The site is located on loose dune sand, which is easily eroded by ocean wave activity, and wind when devoid of vegetation. During the winters of 1998, 1999, 2000, and 2001 severe storms resulted in substantial ocean wave erosion, which removed active dunes present west of the subject lot and eroded the western part of the dune on which the property lies. As reported by local residents, up to 10 feet of erosion has been observed during a single storm event. Ocean wave erosion has also resulted in the lowering of the beach elevation by several feet, allowing higher energy waves to impact the dune. The increase in ocean wave erosion observed along much of the Oregon Coast in the recent past is a consequence of the mid- to late 1990s El Niño/La Niña events, which altered ocean currents and transported much of the beach sand offshore. There has been some rebuilding of the beach in the last few years, but this has been a slow process. As a result, nearly all of Neskowin's oceanfront residences have had oceanfront protection installed. In the area of this site, the oceanfront has been protected with riprap revetments for hundreds of feet to the north and south.

Severe storms in the winter of 2007–2008 partly undermined many of the revetments in the Neskowin area. However, the riprap revetments significantly reduce the potential for erosion when maintained and repaired as necessary.

At the time of our site visit, numerous tree stumps were exposed on the beach (Appendix A). Locally referred to as the "Neskowin Ghost Forest," the tree stumps are the remnants of an approximately 2000-year-old Sitka Spruce forest (Hart and Peterson, 1997).

2.2 Topography, including elevations and slopes on the property itself.

The site is located on a younger stabilized dune. Elevations on the site range from approximately 26 to 28 feet (NAVD 88) along the western portion of the property to approximately 24 feet (NAVD 88) along the eastern portion of the property. The site slopes gently to the east at approximately 2 to 5 degrees (Figures 3 and 4; Appendix A).

The riprap revetment west of the site generally slopes down to the beach at approximately 30 degrees (Figures 3 and 4; Appendix A).

2.3 Vegetation cover.

At the time of our site visit, the site was vegetated with lawn grass, European beachgrass, salal, ferns, and young shore pine trees (Appendix A). Review of historical aerial photography from 1953, 1971, 1977, 1983, 1991, 1998, and satellite imagery from 1994 to 2019, indicate that the dune sand at the site has become increasingly vegetated since development began in the area.

2.4 Subsurface materials – the nature of the rocks and soils.

Subsurface exploration was completed by advancing three hand-augered borings to depths up to approximately 13 feet below the ground surface (bgs). The borings generally encountered approximately 6 feet of loose to medium-dense dune sand overlying dense dune sand. Subsurface materials are discussed in detail in Section 4.1.

2.5 Conditions of the seaward front of the property, particularly for sites having a sea cliff.

The seaward front of the property is located at the crest of a younger vegetated dune. The dune crest was densely vegetated with European beachgrass, and the seaward slope is protected by a riprap revetment. The riprap revetment appeared to be in generally good condition. The quality of the armor stone used for the construction of the revetment was variable and consisted of a mixture of highly fractured basalt breccia and relatively unfractured basalt (Appendix A). Additional observations are addressed and illustrated in Section 3.0 and Appendix A.

2.6 Presence of drift logs or other flotsam on or within the property.

At the time of our site visit, we did not observe any drift logs or flotsam on or within the property, or on the beach to the west of the property.

2.7 Description of streams or other drainage that might influence erosion or locally reduce the level of the beach.

Neskowin Creek discharges onto the beach approximately 2000 feet north of the site (Figure 1). Historical satellite imagery from Google Earth indicates that although

Neskowin Creek's stream channel meanders approximately 500 feet north and south on the beach, the stream generally enters the ocean near the east side of proposal rock and does not typically appear to influence the level of the beach fronting the site.

2.8 Proximity of nearby headlands that might block the long shore movement of beach sediments, thereby affecting the level of the beach in front of the property.

The site is located approximately 500 feet north of the Cascade Head headlands and approximately 8.6 miles south of Cape Kiwanda. Ocean current interaction with the northern extent of the Cascade Head headland generally removes sand along the beach fronting the site and reduces the level of the beach.

Proposal Rock is located approximately 1900 feet north of the site and does not appear to affect the subject site substantially.

2.9 Description of any shore protection structures that may exist on the property or on nearby properties.

An existing riprap revetment is present on the western portion of the subject site and is connected to other oceanfront revetments, which extend for hundreds of feet to the north and south along Neskowin Beach.

2.10 Presence of pathways or stairs from the property to the beach.

There is a pathway integrated into the revetment approximately 20 feet south of the site.

2.11 Existing human impacts on the site, particularly any that might alter the resistance to wave attack.

Human impacts are not contributing to alteration of the resistance of the riprap revetment to wave attack at this site.

3.0 Description of the Fronting Beach

Neskowin Beach fronts the site to the west. Detailed descriptions of the characteristics of the beach are provided below.

3.1 Average widths of the beach during the summer and winter.

The beach at the site has a highly variable width, which is primarily dependent upon tide levels, and it tends to be narrower in the winter than in the summer. Although the beach can be more than 300 feet wide, at high tide, there is often no walkable beach. The beach here is very dynamic and changes morphology frequently, primarily due to rip current formation.

3.2 Median grain size of beach sediment.

During our site visit, we observed fine-grained to medium-grained beach sand.

3.3 Average beach slopes during the summer and winter.

Beach slopes vary from approximately 2 to 5 degrees depending upon recent accretion or erosion. The beaches tend to be flatter in the summer.

3.4 Elevations above mean sea level of the beach at the seaward edge of the property during summer and winter.

Lidar data from 2016 shows the junction between the beach and the revetment was at an elevation of approximately 8 feet (NAVD 88) (Figures 3 and 4). Allan and Hart (2005) surveyed the elevation of the beach/dune junction in 1997, 1998, and 2002 at approximately 20 feet, 14 feet, and 16 feet, respectively. Winter elevations primarily depend on beach profiles formed by storm conditions.

3.5 Presence of rip currents and rip embayments that can locally reduce the elevation of the fronting beach.

Rip currents and rip current embayments commonly contribute to erosion along the oceanfront in Neskowin. Narrow beaches and near-shore relatively deep water conditions contribute to rip current and rip current embayment formation.

During our site visit, we did not observe any rip current embayments in the area of the site; however, rip currents and rip current embayments have developed immediately west of the site, as seen in historical satellite imagery.

3.6 Presence of rock outcrops and sea stacks, both offshore and within the beach zone.

Proposal Rock is located approximately 1900 feet north of the site.

3.7 Information regarding the depth of beach sand down to bedrock at the seaward edge of the property.

Based on our experience with Neskowin sites in the vicinity, we estimate that bedrock lies more than 20 feet below the beach level.

4.0 Geologic Hazards Analysis

Our geologic hazards analysis is presented below.

4.1 Subsurface Materials

The site lies in an area that has been mapped as Pleistocene beach sand (Schlicker et al., 1972). Neskowin lies on a large dune complex, which is approximately 4 miles long, north to south, and extends from the coastline east to the base of the hills. This dune complex consists of numerous individual dunes, which vary in age and stability. The area of the site has been mapped as a younger stabilized dune (open dune sand conditionally stable), which is a dune that has become conditionally stable regarding wind erosion (USDA et al., 1975). The dune consists of tan, loose, fine-grained sand with a very thin, poorly developed topsoil. Based on our review of stereo pairs of aerial photographs, prior to 1953, active dunes had been present in the area of the site but have become increasingly vegetated as development in the area progressed. Schlicker et al. (1972) also mapped the area of the site as an area of high groundwater. Snavely et al. (1996) mapped the area of the site as Quaternary alluvial deposits with Quaternary beach sand west of the site.

At the time of our April 21, 2020 site visit, we completed subsurface exploration with three hand-augered borings logged by a geologist from our office who visually classified the soils encountered according to the Unified Soil Classification System (USCS) as follows:

B-1	**Depth (ft.)**	**USCS**	**Description**
	0 – 2.5	SP	Disturbed SAND; tan, wet, loose. Fine to medium-grained dune sand with grass roots in top 2 inches and occasional rock fragments up to 3-inch diameter.
	2.5 – 9.5	SP	SAND; tan, wet, medium dense to dense. Fine to medium-grained dune sand. Refusal on a rock fragment at approximately 9.5 feet. Free groundwater was not encountered.

B-2	**Depth (ft.)**	**USCS**	**Description**
	0 – 3.5	SP	Disturbed SAND; tan, wet, loose. Fine to medium-grained dune sand with grass roots in top 2 inches. Decaying wood and ½ inch diameter roots from 2.5 to 3.5 feet.
	2.5 – 13.0	SP	SAND; tan, wet, medium dense to dense. Fine to medium-grained dune sand. Boring terminated at maximum reach of auger. Free groundwater was not encountered.

B-2	Depth (ft.)	USCS	Description
	0 – 3.0	SP	Disturbed SAND; tan, wet, loose. Fine to medium-grained dune sand with grass roots in top 2 inches and occasional rock fragments up to 3-inch diameter.
	2.5 – 9.0	SP	SAND; tan, wet, medium dense to dense. Fine to medium-grained dune sand. Boring terminated in dense sand at approximately 9.0 feet. Free groundwater was not encountered.

The borings generally encountered approximately 2 to 3 feet of tan, loose, wet, disturbed dune sand overlying tan, wet, medium dense to dense dune sand. We anticipate that loose sand at least three feet thick will be encountered throughout the site.

4.2 Structure

Structural deformation and faulting along the Oregon Coast is dominated by the Cascadia Subduction Zone (CSZ), which is a convergent plate boundary extending for approximately 680 miles from northern Vancouver Island to northern California. This convergent plate boundary is defined by the subduction of the Juan de Fuca plate beneath the North America Plate and forms an offshore north-south trench approximately 60 miles west of the Oregon coast shoreline. A resulting deformation front consisting of north-south oriented reverse faults is present along the western edge of an accretionary wedge east of the trench, and a zone of margin-oblique folding and faulting extends from the trench to the Oregon Coast (Geomatrix, 1995).

A northwest-trending strike-slip fault is mapped near the site, extending from Proposal Rock to the southeast approximately 4 miles (Snavely et al., 1996). Based on mapping, the fault appears to offset middle Tertiary geologic units.

An unnamed offshore fault is mapped approximately 10 miles west of the site (Personius et al., 2003). The fault is part of a mapped group of left- and right-lateral strike-slip, normal, and reverse faults which offset accretionary wedge sediments underlying the continental shelf and slope in the forearc of the Cascadia Subduction Zone; some of the faults in this group also offset the overlying sedimentary section and underlying oceanic basalts of the subducting Juan de Fuca Plate (Personius et al., 2003). Most of the offshore faults in this group have strikes oblique to the Cascadia deformation front, suggesting a strong lateral component of slip. No detailed information on the ages of faulted deposits has been published, but similar offshore structures offset late Pleistocene and Holocene sediments (Personius et al., 2003). An offshore thrust fault is also mapped approximately 3 miles west of the site (Personius et al., 2003).

The nearest mapped potentially active faults are located in the Tillamook Bay fault zone approximately 30 miles north of the site, which are northwest-striking faults that offset the Eocene Tillamook Volcanics on the west flank of the Coast Range. No displacements in Quaternary deposits have been documented, but the fault zone parallels the mountain front that controls the northeastern margin of Tillamook Bay and thus has geomorphic expression consistent with Quaternary displacement (Personius et al., 2003).

4.3 Slopes

Slopes are discussed in detail in Section 2.2 above.

4.4 Orientation of Bedding Planes in Relation to the Dip of the Surface Slope

The site lies in an area mapped as dune sands and Quaternary alluvium, which have beds of varying dip related to the surface slope. The underlying Basalt of Cascade Head has been mapped as dipping down to the north-northwest from 30 to 45 degrees (Snavely et al., 1996). Grades at the subject site are primarily related to past grading and fill activities rather than the orientation of underlying units.

4.5 Site Surface Water Drainage Patterns

Stormwater at the site generally flows to the northeast, although much of it infiltrates into the sandy soils. At the time of our site visit, we observed no streams at or in the immediate vicinity of the site. The nearest stream is a small tributary of Neskowin Creek, located approximately 700 feet east of the site. Neskowin creek discharges onto the beach approximately 1900 feet north of the site (Figure 1).

4.6 Dune Stability and Erosion

The site is located on loose dune sand, which is easily eroded by ocean wave activity, and wind when devoid of vegetation. During the winters of 1998, 1999, 2000, and 2001 severe storms resulted in substantial ocean wave erosion, which removed active dunes present west of the subject lot and eroded the western part of the dune on which the property lies. As reported by local residents, up to 10 feet of erosion has been observed during a single storm event. Ocean wave erosion has also resulted in the lowering of the beach elevation by several feet, allowing higher energy waves to impact the western dune edge. The increase in ocean wave erosion observed along much of the Oregon Coast in the recent past is a consequence of the mid- to late 1990s El Niño/La Niña events, which altered ocean currents and transported much of the beach sand offshore. There has been some rebuilding of the beach in the last few years, but this has been a slow process. As a result, nearly all of Neskowin's oceanfront residences have had oceanfront protection installed. In the area of this site, the oceanfront has been protected with riprap revetments for hundreds of feet to the north and south.

The existing revetment located on the western portion of the subject site slopes down to the beach at approximately 30 degrees and consists of angular basalt boulders approximately 4 to 7 feet diameter on its lower portion and approximately 3 to 5 feet diameter on the upper portion (Figure 3; Appendix A). An approximately 8 feet wide area of the revetment appears to have been previously damaged and is missing armor stone near the base (Appendix A). Severe storms in the winter of 2007–2008 partly undermined the revetments in areas located along Neskowin Beach. The riprap revetment greatly reduces the potential for erosion when maintained and repaired as necessary.

Mapping by Allen and Priest (2001) identifies the site within the High Hazard Zone and the beach within the active zone. Coastal erosion hazard zone definitions and methodology are provided below.

The methodology provided by Allan and Priest (2001) defines four coastal erosion hazard zones for bluffs of Tillamook County, Oregon, as follows:

"*Four bluff erosion hazard zones will be specified on the Tillamook County coastline:*

> *1. Active Erosion Hazard Zone: Currently active erosion area (rapid soil creep on steep bluff or headwall slopes plus active or potentially active landslides).*
>
> *2. High Hazard Zone: High probability that the area could be affected by active erosion in the next ~60-100 years. This zone boundary will, in effect, be the minimum distance that the bluff top (or landslide headwall) might retreat in the next 60-100 years.*
>
> *3. Moderate Hazard Zone: Moderate probability that the area could be affected by active erosion in the next ~100 years. This zone boundary will, in effect, be the mean distance that the bluff top (or landslide headwall) is likely to retreat in the next 60-100 years. In general, this distance was approximately halfway between the high and low hazard zones.*
>
> *c. Low Hazard Zone: Low but significant probability that the area could be affected by active erosion in the next ~60-100 years. This includes; bluff tops that may retreat by maximum block failure at the end of an interval of gradual erosion, including some sub-aerial erosion, slope failures induced by Cascadia subduction zone earthquakes, or unusually high groundwater conditions. This zone boundary will, in effect, be the maximum distance that the bluff top (or landslide headwall) is likely to retreat in the next 60-100 years.*" (Allan and Priest, 2001).

It should be noted that mapping done for the 2001 study was intended for regional planning use, not for site-specific hazard identification.

The site is also mapped in an area of moderate landslide hazard susceptibility based on the DOGAMI methodology (Burns, Mickelson, and Madin, 2016). Based on our filed observations the risk of landsliding at the site is low under static conditions.

4.7 Regional Seismic Hazards

Abundant evidence indicates that a series of geologically recent large earthquakes related to the Cascadia Subduction Zone have occurred along the coastline of the Pacific Northwest. Evidence suggests that more than 40 great earthquakes of magnitude 8 and larger have struck western Oregon during the last 10,000 years. The calculated odds that a Cascadia earthquake will occur in the next 50 years range from 7–15 percent for a great earthquake affecting the entire Pacific Northwest, to about a 37 percent chance that the southern end of the Cascadia Subduction Zone will produce a major earthquake in the next 50 years (OSSPAC, 2013; OSU News and Research Communications, 2010; Goldfinger et al., 2012). Evidence suggests the last major earthquake occurred on January 26, 1700, and may have been of magnitude 8.9 to 9.0 (Clague et al., 2000).

There is now increasing recognition that great earthquakes do not necessarily result in a complete rupture along the full 1,200 km fault length of the Cascadia subduction zone. Evidence in the paleorecords indicates that partial ruptures of the plate boundary have occurred due to smaller earthquakes with moment magnitudes (Mw) < 9 (Witter et al., 2003; Kelsey et al., 2005). These partial segment ruptures appear to occur more frequently on the southern Oregon coast, as determined from paleotsunami studies. Furthermore, the records have documented that local tsunamis from Cascadia earthquakes recur in clusters (~250–400 years) followed by gaps of 700–1,300 years, with the higher tsunamis associated with earthquakes occurring at the beginning and end of a cluster (Allan et al., 2015).

These major earthquake events were accompanied by widespread subsidence of a few centimeters to 1–2 meters (Leonard et al., 2004). Tsunamis appear to have been associated with many of these earthquakes. In addition, settlement, liquefaction, and landsliding of some earth materials are believed to have been commonly associated with these seismic events.

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 100 to 200 years have been given in the literature (Rogers et al., 1996).

Liquefaction and Settlement

Liquefaction occurs when saturated, cohesionless soils are subjected to ground vibrations, resulting in a decrease in the volume of the soil. If drainage is unable to occur, the tendency to decrease in volume results in an increase in pore water pressure, and if the pore water pressure builds up to the point at which it is equal to the overburden pressure, the effective stress becomes zero, and the soil loses its strength and develops a liquefied state. Liquefaction is most common in saturated, loose, granular soils, sand or silty sand materials. Cohesive soils, such as clayey silt and clay, will generally not liquefy during earthquakes. Older sediments are also more resistant to liquefaction than recently deposited sediments (Idris and Boulanger, 2008).

DOGAMI's HazVu website (https://gis.dogami.oregon.gov/maps/hazvu/) has mapped the area of the site as having a moderate susceptibility to liquefaction. DOGAMI states: "Buildings and infrastructure sitting on these [liquefiable] soils are likely to be severely damaged in an earthquake."

Settlement can be the result of liquefaction of saturated soils, or simply a result of dry soil densifying under vibration (volumetric compression). Volumetric compression during an earthquake is the result of vibrations of the soil, which causes soil particles to settle into a denser state, decreasing the volume of the soil. The degree of settlement is primarily dependent upon the initial density of the soil and the magnitude and duration of ground vibration (shaking). The settlement caused by liquefaction is commonly differential, and the magnitude of settlement typically varies throughout a site, whereas settlement caused by volumetric compression tends to be more uniform.

4.8 Flooding Hazards

Based on the 2018 Flood Insurance Rate Map (FIRM, Panel #41057C1005F), the site east of the riprap revetment lies in an area rated as Zone X which is defined as an area of minimal flood hazard. The riprap revetment and beach west of the site lies in an area rated as Zone VE (El 27.3 Feet), which is defined as a coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

Although the area east of the site lies in an area rated Zone X, the top of the riprap revetment and overlying dune sand lies at an elevation of approximately 26 to 27 feet. The revetment may be subject to wave overtopping during severe storm events.

Based on the Oregon Department of Geology and Mineral Industries mapping (DOGAMI, 2012), the subject site lies within the tsunami inundation zone resulting from an approximately 8.7 and greater magnitude Cascadia Subduction Zone (CSZ) earthquake. The 2012 DOGAMI mapping is based upon five computer-modeled scenarios for shoreline tsunami inundation caused by potential CSZ earthquake events ranging in magnitude from approximately 8.7 to 9.1. The January 1700 earthquake event (discussed in Section 5.0 above) has been rated as an approximate 8.9 magnitude in DOGAMI's methodology. More distant earthquakes can also generate tsunamis.

4.9 Climate Change

According to most of the recent scientific studies, the Earth's climate is believed to be changing as the result of human activities which are altering the chemical composition of the atmosphere through the buildup of greenhouse gases, primarily carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons (EPA, 1998). Although there are uncertainties about exactly how the Earth's climate will respond to enhanced concentrations of greenhouse gases, scientific observations indicate that detectable changes are underway (EPA, 1998; Church and White, 2006). Global sea level rise, caused by melting polar ice caps and ocean thermal expansion, could lead to flooding of low-lying coastal property, loss of coastal wetlands, erosion of beaches and bluffs, and saltwater contamination of drinking water. Global climate change and the resultant sea level rise will likely impact the subject site through accelerated coastal erosion and more frequent and severe flooding. It can also lead to increased rainfall, which can result in an increase in landslide occurrence.

4.10 Analyses of Erosion and Flooding Potential

4.10.1 Analysis of DOGAMI beach monitoring data available for the site (if available).

DOGAMI beach monitoring data has been collected for Neskowin beach, approximately 3000 feet north of the site, regularly since 1997. Following the winter storms of 1998-99 and construction of the revetments along the beach, beach elevations have varied by several feet from minimum to maximum over the monitored period of 1997 to 2019; however, the riprap revetments have prevented any shoreline change at the 6 meter (~20 ft) elevation contour (Allan and Hart, 2005; Allan and Hart, 2007; Allan and Hart, 2008; Allan et al., 2015; NANOOS, accessed April 2020).

4.10.2 Analysis of human activities affecting shoreline erosion.

We did not observe any human activities along the bluff that are affecting the shoreline erosion. See Section 2.11 above.

4.10.3 Analysis of possible mass wasting, including weathering processes, landsliding, or slumping.

The erosive processes affecting the site are discussed in detail in Section 4.6 (above).

4.10.4 Calculation of wave run-up beyond mean water elevation that might result in erosion of the sea cliff or foredune.

Coastal erosion rates and hazard zones (as referenced in Allan and Priest, 2001) were presented in Section 4.6 Dune Stability and Erosion (above). In the dune-backed shoreline recession methodology applicable to the subject site, the total water level produced by the combined effect of wave runup plus the tidal elevation must exceed some critical elevation of the fronting beach, typically the elevation of the beach-dune junction. Wave runup elevation can change with many variables such as changing beach elevations, presence of transient dunes, etc. At the subject site, the dune is protected by the riprap revetment, and this shoreline recession methodology is not appropriate for the site.

4.10.5 Evaluation of frequency that erosion-inducing processes could occur, considering the most extreme potential conditions of unusually high-water levels together with severe storm wave energy.

On this stretch of dune-backed shoreline, erosion inducing processes are daily in the form of constant wave attack. High water levels and severe storms can cause rip currents, which have the potential to undermine the revetment at the site.

4.10.6 For dune-backed shoreline, use an established geometric model to assess the potential distance of property erosion, and compare the results with direct evidence obtained during site visit, aerial photo analysis, or analysis of DOGAMI beach monitoring data.

Not applicable to the subject site or nearby area, which is a dune-backed shoreline that has been extensively riprapped; see Sections 4.10.1 and 4.10.4 (above).

4.10.7 For bluff-backed shoreline, use a combination of published reports, such as DOGAMI bluff and dune hazard risk zone studies, aerial photo analysis, and fieldwork, to assess the potential distance of property erosion.

Not applicable to the subject site, which lies in a riprap revetment protected dune-backed shoreline area.

<u>4.10.8 Description of potential for sea level rise, estimated for local area by combining local tectonic subsidence or uplift with global rates of predicted sea level rise.</u>

Based on data from NOAA monitoring stations at South Beach and Garibaldi collected from 1970 to 2019, this general area of Oregon's coastline has a sea level rise of approximately 2 mm/year, which includes the combined effects of global rates of sea level rise and landmass elevation changes (NOAA Tides & Currents Sea Level Trends http://tideshttp://tidesandcurrents.noaa.gov/sltrends/sltrends.html). Additional observations are addressed in Section 4.9 of this report.

4.11 Assessment of Potential Reactions to Erosion episodes.

<u>4.11.1 Determination of legal restrictions of shoreline protective structures (Goal 18 prohibition, local conditional use requirements, priority for non-structural erosion control methods).</u>

As previously noted, riprap revetments are present west of the subject site and for hundreds of feet to the north and south in this oceanfront area of Neskowin. Lots were generally 'developed' on January 1, 1977; however, this is a legal issue that can have varying interpretations. Most lots in this area, including the subject site, generally meet Oregon's Goal 18 exception requirements to obtain protection when a structure is threatened by erosion.

According to the Ocean Shores Viewer (http://www.coastalatlas.net/oceanshores/, Accessed April 2020), the subject site appears to be Goal 18 eligible due to an exception for an oceanfront protective structure.

<u>4.11.2 Assessment of potential reactions to erosion events, addressing the need for future erosion control measures, building relocation, or building foundation and utility repairs.</u>

Residential development recommendations, including erosion control and foundation design recommendations, are presented in Section 5. The potential to move the house will be dependent upon design.

5.0 Development Standards and Recommendations

The main engineering geologic concerns at the site are:

1. Several feet of loose, disturbed, sandy soil is present throughout the site.

2. The site lies on dune sands, which are poorly consolidated and subject to settlement and liquefaction as well as ongoing coastal erosion if the revetment is damaged. Inherent risks of seismic hazards, coastal erosion, and future sand movement, including accretion at this site, must be accepted by the owner, future owners, developers, and residents.

3. There is an inherent regional risk of earthquakes along the Oregon Coast, which could cause harm and damage structures. Ground shaking during an earthquake can cause soil consolidation resulting in settlement of the structures and can cause soils to liquefy, resulting in the loss of bearing capacity and structural damage. The site also lies in a mapped tsunami hazard zone. A tsunami impacting the Neskowin area could cause harm, loss of life, and damage to structures and hazards associated with tsunami flooding resulting from a large seismic event that cannot be economically mitigated. These risks must be accepted by the owner, future owners, developers, and residents of the site.

Recommendations

During construction, disturbed, dry sands may be blown by winds, which can result in transport and deposition of sands off-site. Therefore, periodic watering or covering of exposed areas may be required to control blowing sands during windy conditions. Vegetation should be removed only as necessary, and exposed areas should be replanted following construction.

Provided the recommendations presented in this report are incorporated into design and construction, we believe that the proposed structure will be reasonably protected from the described erosion hazard for the life of the structure.

5.1 Development Density

It is our understanding that a single-family home will be located at the site.

5.2 Setback

Based on our site observations, with proper maintenance, the existing riprap revetment will prevent significant dune erosion at the site. However, during severe storm events the revetment may be overtopped by severe wave swash. We recommend all foundation elements for the house be setback a minimum of 40 feet from the top of the revetment.

5.3 Grading Practices

We recommend the following grading practices:

5.3.1 Site Preparation

All existing loose disturbed soil, fills, and debris should be stripped and removed from building, slab, and driveway areas prior to construction so that new foundations and structural fill materials can rest on dense native sand soils, recompacted fill sands at the site or imported granular fills. Fills need to be properly moisture conditioned when compacting.

We anticipate stripping depths to be approximately 3 feet. However, depths may vary depending on the variable thickness of loose disturbed soil at the site.

5.3.2 Cut and Fill Slopes

Temporary unsupported cut and fill slopes less than 9 feet high should be no steeper than 1.5 horizontal to 1 vertical (1.5H:1V). If temporary slopes greater than 9 feet high are desired, or if water seepage is encountered in cuts, our firm shall be contacted to provide additional recommendations. Temporary cuts in excess of 4 feet high and steeper than 1.5H:1V will likely require appropriate shoring to provide worker safety. Temporary cuts shall be protected from inclement weather by the use of plastic sheeting to help prevent erosion and/or failure.

Permanent unsupported cut and fill slopes shall be constructed no steeper than 2 horizontal to 1 vertical (2H:1V). Cut slopes steeper than 2H:1V shall be retained with an engineered retaining wall. Fill slopes steeper than 2H:1V shall be retained or be mechanically reinforced using geogrids, or other suitable products as approved by HGSA. Areas that slope steeper than 5H:1V and are to receive fill shall be benched. Benches shall be cut into native, non-organic, dense soil. The lowest bench shall be keyed a minimum of 2 feet into native, firm soil, and be a minimum of 6 feet wide.

TEMPORARY AND PERMANENT CUTS	
Temporary Cuts	1.5H:1V (maximum) [a]
Permanent Cuts	2H:1V (maximum) [a]
[a] All cuts greater than 9 feet high, or cuts where water seepage is encountered, should be approved by a representative of H.G. Schlicker & Associates, Inc.	

If the above cut and fill slope recommendations cannot be achieved due to construction and/or property line constraints, temporary or permanent retention of cut slopes may be required, as determined by a representative of our firm.

5.3.3 Structural Fill

Structural fills supporting building loads should consist of granular material, free of organics and deleterious materials, and contain no particles greater than 1½ inches in diameter so that nuclear methods (ASTM D2922 &ASTM D3017) can be easily used for field density testing. All areas to receive fill should be stripped of all loose soils organic soils, organic debris, existing fill, disturbed soils, and construction debris.

Proper test frequency and earthwork documentation usually require daily observation during stripping, rough grading, and placement of structural fill. Field density testing should generally conform to ASTM D2922 and D3017, or D1556. To minimize the number of field and laboratory tests, fill materials should be from a single source and of a consistent character. Structural fill should be approved and periodically observed by HGSA and tested by a qualified testing firm. Test results will need to be reviewed and approved by HGSA. We recommend that one density test be performed for at least every 18 inches of fill placed and every 200 cubic yards, whichever requires more testing. Because testing is performed on an on-call basis, we recommend that the earthwork contractor schedule the testing. Relatively more testing is typically necessary on smaller projects.

STRUCTURAL FILL	
Compaction Requirements	95% ASTM D1557, compacted in 8-inch lifts maximum, at or near the optimum moisture content (± 2%).
Benching Requirements [a]	Slopes steeper than 5H:1V that are to receive fill should be benched. Fills should not be placed along slopes steeper than 3H:1V, unless approved by H.G. Schlicker & Associates, Inc.
[a] Benches should be cut into native, non-organic, firm soils. Benches should be a minimum of 6 feet wide with side cuts no steeper than 1H:1V and no higher than 6 feet. The lowest bench should be keyed in a minimum of 2 feet into native, non-organic, firm soils.	

5.4 Vegetation Removal and Re-Vegetation Practices

Vegetation should be removed only as necessary, and exposed areas should be replanted following construction. Disturbed ground surfaces exposed during the wet season (November 1 through April 30) should be temporarily planted with grasses, or protected with erosion control blankets or hydromulch. Existing vegetation should be left undisturbed as much as possible.

Temporary sediment fences should be installed downslope of any disturbed areas of the site until permanent vegetation cover can be established.

Exposed sloping areas steeper than 3 horizontal to 1 vertical (3H:1V) should be mulched, seeded, and fertilized to provide erosion protection until permanent vegetation can be established. Erosion control blankets should be installed as per the manufacturer's recommendations.

5.5 Foundation Recommendations

Building loads may be supported on individual and/or continuous spread footings bearing on undisturbed, native, non-organic, firm soils, or properly designed and compacted structural fill placed on these soils.

Although not required, we recommend mitigation of possible liquefaction hazards during a major earthquake be accomplished through tying the foundation together and reinforcement of foundation elements as per OSSC 2014 1809.13 Footing Seismic Ties.

All footing areas should be stripped of all organic and loose soils, organic debris, and any existing fills. We anticipate that non-organic, sandy soils will be encountered throughout the excavation. The footprint area should be protected with a 2- to 3-inch layer of crushed rock compacted with a minimum of 3 passes of a vibratory compactor. Footing excavations should be completed using a smooth edge bucket to minimize disturbance of the subgrade.

Footings bearing in undisturbed, native, non-organic, firm soils or properly compacted structural fill placed on these soils may be designed for the following:

ALLOWABLE SOIL BEARING CAPACITIES	
Allowable Dead Plus Live Load Bearing Capacity [a]	1,500 psf
Passive Resistance	150 psf/ft embedment depth
Lateral Sliding Coefficient	0.35
[a] Allowable bearing capacity may be increased by one-third for short term wind or seismic loads.	

Our recommended minimum footing widths and embedment depths are as follows:

MINIMUM FOOTING WIDTHS & EMBEDMENT DEPTHS			
Number of Stories	One	Two	Three
Minimum Footing Width	15 inches	18 inches	20 inches
Minimum Exterior Footing Embedment Depth	18 inches	18 inches	18 inches
Minimum Interior Footing Embedment Depth [a]	6 inches	6 inches	6 inches

[a] Interior footings should be embedded a minimum of 6 inches below the lowest adjacent finished grade, or as otherwise recommended by our firm. In general, interior footings placed on sloping or benched ground should be embedded or set back in such a manner as to provide a minimum horizontal distance between the foundation component and face of the slope of one foot per every foot of elevation change.

5.6 Retaining Wall Recommendations

For static conditions, freestanding retaining walls should be designed for a lateral active earth pressure expressed as an equivalent fluid weight (EFW) of 35 pounds per cubic foot, assuming level backfill behind the wall equal to a distance of at least half the height of the wall. An EFW of 45 pounds per cubic foot should be used, assuming sloping backfill of 2H:1V.

At-rest retaining walls should be designed for a lateral at-rest pressure expressed as an EFW of 60 pounds per cubic foot, assuming level backfill behind the wall equal to a distance of at least half of the height of the wall. Walls need to be fully drained to prevent the build-up of hydrostatic pressures.

RETAINING WALL EARTH PRESSURE PARAMETERS	
Static Case, Active Wall (level backfill/grades)	35 psf/linear foot [a]
Static Case, Active Wall (2H:1V backfill/grades)	45 psf/linear foot [a]
Static Case, At-Rest Wall (level backfill/grades)	60 psf/linear foot [a]
Seismic Loading (level backfill/grades)	13.63 pcf $(H)^2$ [b]

[a] Earth pressure expressed as an equivalent fluid weight (EFW). The location of the earth pressure can be assumed to act at a distance of 0.33H above the base of the wall.

[b] Seismic loading expressed as a pseudostatic force, where H is the height of the wall in feet. The location of the pseudostatic force can be assumed to act at a distance of 0.6H above the base of the wall.

The above EFWs assume static conditions and no surcharge loads from vehicles or structures. If surcharge loads will be applied to the retaining walls, forces on the walls resulting from these loads will need to be added to the pressures given above.

For seismic loading, a unit pseudostatic force equal to 13.63 pcf $(H)^2$, where H is the height of the wall in feet, should be added to the static lateral earth pressure. The location of the pseudostatic force can be assumed to act at a distance of 0.6H above the base of the wall.

Backfill for walls should be placed in 8-inch horizontal lifts and machine compacted to 92 percent of the maximum dry density as determined by ASTM D1557. Compaction within 2 feet of the wall should be accomplished with lightweight hand-operated compaction equipment to avoid applying additional lateral pressure on the walls. Drainage of the retaining wall should consist of slotted drains placed at the base of the wall on the backfilled side and backfilled with free-draining crushed rock (less than 5% passing the 200 mesh sieve using a washed sieve method) protected by non-woven filter fabric (Mirafi 140N or equivalent) placed between the native soil and the backfill.

Filter fabric protected free-draining crushed rock should extend to within 2 feet of the ground surface behind the wall, and the filter fabric should be overlapped at the top per the manufacturer's recommendations. All walls should be fully drained to prevent the build-up of hydrostatic pressures. All retaining walls should have a minimum of 2 feet of embedment at the toe or be designed without passive resistance.

5.7 Drainage and Storm Water Management

Surface water should be diverted from building foundations and walls to approved disposal points by grading the ground surface to slope away a minimum of 2 percent for at least 6 feet towards a suitable gravity outlet to prevent ponding near the structures. Permanent subsurface drainage of the building perimeter using footing drains is recommended.

Footing drains should be installed adjacent to the perimeter footings and sloped a minimum of 1.0 percent to a gravity outlet. A suitable perimeter footing drain system would consist of a 4-inch diameter, perforated PVC pipe (typical) embedded below and adjacent to the bottom of footings, and backfilled with approved drain rock. The type of PVC pipe to be utilized may depend on building agency requirements and should be verified prior to construction. HGSA also recommends lining the drainage trench excavation with a non-woven geotextile filter such as Mirafi® 140N or equivalent to increase the life of the footing drain and prevent the drain from being clogged by soil. The perimeter drain excavation should be constructed in a manner that prevents undermining of foundation or slab components or any disturbance to supporting soils.

In addition to the perimeter foundation drain system, drainage of any crawlspace areas is required. Each crawlspace should be graded to a low point for installation of a crawlspace drain that is tied into the perimeter footing drain and tightlined to an approved disposal point.

All roof drains should be collected and tightlined in a separate system independent of the footing drains, or an approved backflow prevention device shall be used. All roof and footing drains should be discharged to an approved disposal point. If water will be discharged to the ground surface, we recommend that energy dissipaters, such as splash blocks or a rock apron, be utilized at all pipe outfall locations. Water collected on the site should not be concentrated and discharged to adjacent properties. We recommend that all collected water be tightlined and discharged to the local stormwater system, to splash blocks, or to the riprap revetment.

5.8 Erosion Control

As detailed above (Section 5.4), vegetation should be removed only as necessary, and exposed areas should be replanted following construction. Disturbed ground surfaces exposed during the wet season (November 1 through April 30) should be temporarily planted with grasses, or protected with erosion control blankets.

A temporary sediment fence should be installed downslope of any disturbed areas of the site until permanent vegetation cover can be established.

As recommended above, exposed sloping areas steeper than 3 horizontal to 1 vertical (3H:1V) should be protected by hydroseeding or the use of rolled erosion control products (RECP's) aka "erosion control blankets," to provide erosion protection until permanent vegetation can be established. Erosion control blankets should be installed as per the manufacturer's recommendations.

Periodic watering of exposed areas may be required during construction to control blowing sands during windy conditions and to prevent transport and deposition of disturbed or dry sands off-site.

The riprap revetment should be maintained and repaired as necessary to ensure its continued performance in reducing the potential for erosion at the site.

5.9 Flooding Considerations

Provided that all drainage recommendations detailed in this report are adhered to during design and construction, we do not anticipate localized flooding hazards at the site.

5.10 Seismic Considerations

The structure and all structural elements should be designed to meet current Oregon Residential Specialty Code (ORSC) seismic requirements. Based on our knowledge of subsurface conditions at the site, and our analysis using the guidelines recommended in the ORSC, the structure should be designed to meet the following seismic parameters:

SEISMIC DESIGN PARAMETERS	
Site Class	D
Seismic Design Category	D_2
Mapped Spectral Response Acceleration for Short Periods	S_S = 1.298 g
Site Coefficients	F_a = 1.200 F_v = 1.700
Design Spectral Response Acceleration at Short Periods	S_{DS} = 1.038 g

5.11 Plan Review and Construction Observations

Prior to construction, we should be provided the opportunity to review all site development, foundation, drainage, erosion control, and grading plans to assure conformance with the intent of our recommendations (Appendix B). All site plans, details, and specifications should clearly show that the above recommendations have been implemented into the design.

A representative of HGSA should observe all footing and slab excavations prior to placing structural fill, and/or forming and pouring concrete to assure that suitable bearing materials have been reached (Appendix B). Please provide us with at least 5 (five) days' notice prior to any needed site observations. There will be additional costs for these services.

5.12 Worker Safety

All construction activities should be completed in accordance with OSHA standards, and all State and local laws, rules, regulations, and codes.

6.0 Summary Findings and Conclusions

HGSA certifies that all applicable content requirements of Tillamook County Land Use Ordinance Section 3.570(5) have been addressed above, and it is the undersigned engineering geologist's professional opinion that the proposed development will be within the acceptable level of risk established by the community, considering the site conditions and the above recommendations.

Our summary findings and conclusions are presented below:

6.1 Proposed Use

The proposed project consists of constructing a single-family home on the site. No additional roads are anticipated other than a driveway. No adverse impacts are anticipated to occur on adjacent lots as a result of the development of this site, provided that the recommendations detailed in this report are adhered to.

6.2 Hazards to Life, Property, and the Environment

Geologic hazards to life, property, and the environment associated with this proposed use include stormwater erosion, ocean wave erosion, and seismic hazards. Recommendations for mitigation of erosion and seismic hazards have been incorporated into this report. Please note that the risk of these hazards is inherent with development and construction in this part of Neskowin and must be assumed by the owner, future owners, developers, and residents.

6.3 Off-Site Protection

Adverse effects of this development on surrounding areas will be minimized when all the stormwater, foundation, vegetation, and erosion control recommendations detailed in this report are adhered to.

6.4 Stabilization Programs

Stabilization programs for this site include vegetation and erosion stabilization as addressed in Sections 5.4 and 5.8 of this report, surface water collection as addressed in Section 5.7 of this report, and maintenance of the riprap revetment as addressed in Section 5.8 of this report.

6.5 Conclusions Regarding Hazards and Adverse Environmental Effects

Adverse environmental effects will be minimized by following the recommendations detailed in this report during the design and construction of the proposed project.

6.6 Recommendations for Further Work

Assuming all the recommendations above are adhered to, no additional investigation or analysis is required by our firm other than review of site development plans, and observation of foundation excavations as detailed in Section 5.11 and Appendix B of this report.

7.0 Additional Services

Design Review

This report pertains to a specific site and development. It is not applicable to adjacent sites, nor is it valid for types of development other than that to which it refers. Any variation from the site or development plans necessitates a geotechnical review in order to determine the validity of the design concepts evolved herein.

HGSA's review of final plans and specifications is necessary to determine whether the recommendations detailed in this report for the site have been properly interpreted and incorporated in the design and construction documents. At the completion of our review, we will issue a letter of conformance to the client for the plans and specifications.

Construction Monitoring

Because of the judgmental character of geotechnics, as well as the potential for adverse circumstances arising from construction activity, observations during site preparation, excavation, and construction will need to be carried out by a representative of HGSA or our designate. These observations may then serve as a basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein to the benefit of the project. Field observations become increasingly important should earthwork proceed during adverse weather conditions.

8.0 Limitations

The Oregon Coast is a dynamic environment with inherent unavoidable risks to development. Landsliding, erosion, tsunamis, storms, earthquakes, and other natural events can cause severe impacts to structures built within this environment and can be detrimental to the health and welfare of those who choose to place themselves within this environment. The client is warned that, although this report is intended to identify the geologic hazards causing these risks, the scientific and engineering communities' knowledge and understanding of geologic hazards processes are not complete.

Our investigation was based on engineering geological reconnaissance, limited review of published information, and our subsurface exploration and analyses. The data presented in this report are believed to be representative of the site. The conclusions herein are professional opinions derived in accordance with current standards of professional practice and budget constraints. No warranty is expressed or implied. The performance of the site during a seismic event has not been evaluated. If you would like us to do so, please contact us.

The boring logs and related information depict generalized subsurface conditions only at these specific locations, and at the particular time the subsurface exploration was completed. Soil, rock, and groundwater conditions at other locations may differ from the conditions at these boring locations. Also, the passage of time may result in a change in the soil and groundwater conditions at the site.

This report pertains to the subject site only and is not applicable to adjacent sites, nor is it valid for types of development other than that to which it refers. Geologic conditions, including materials, processes, and rates, can change with time, and therefore, a review of the site and/or this report may be necessary as time passes to assure its accuracy and adequacy. This report may only be copied in its entirety.

9.0 Disclosure

H.G. Schlicker & Associates, Inc. and the undersigned Certified Engineering Geologist have no financial interest in the subject site, the project, or the Client's organization.

10.0 References Cited

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It has been our pleasure to serve you. If you have any questions concerning this report or the site, please contact us.

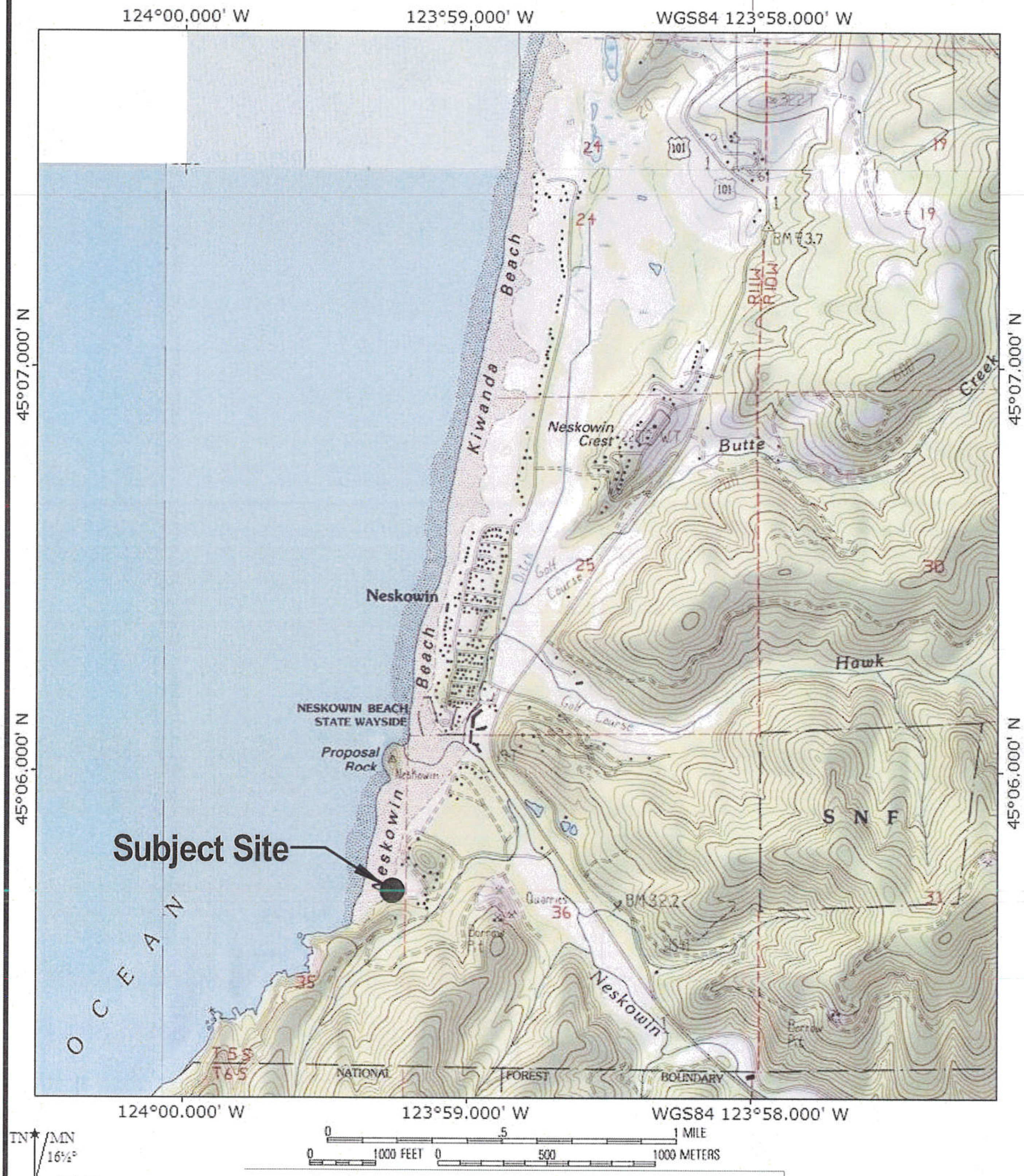
Respectfully submitted,

H.G. SCHLICKER AND ASSOCIATES, INC.

EXPIRES: 10/31/2020

J. Douglas Gless, MSc, RG, CEG, LHG
President/Principal Engineering Geologist

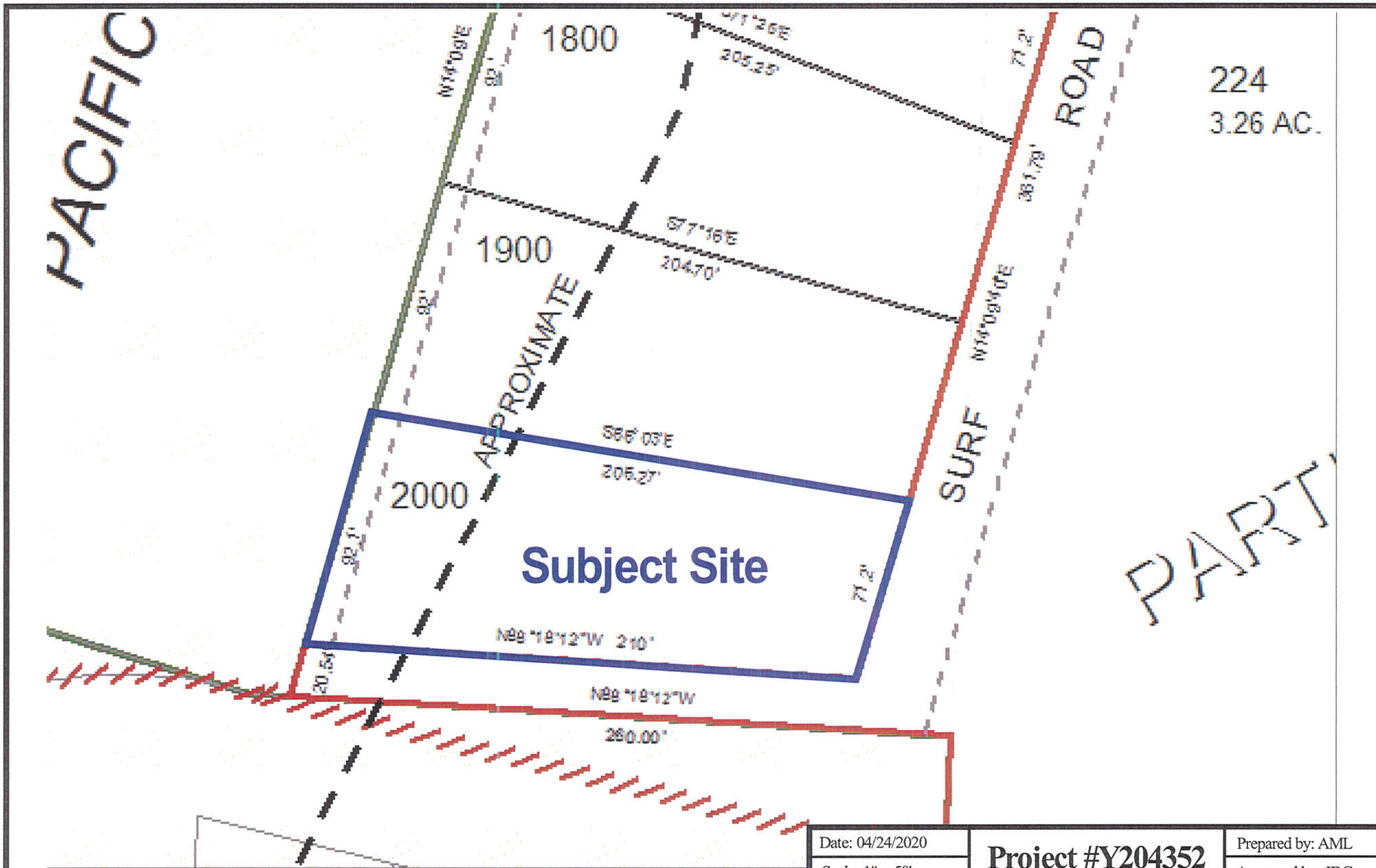
JDG:aml



Date: 04/24/2020	**Project #Y204352**	Prepared by: AML
Scale: 1" = 2,000'		Approved by: JDG

Location Map
Tax Lot 4601, Map 5S-11W-36BC
Neskowin, Tillamook County, Oregon

H.G. Schlicker & Associates, Inc. — **Figure 1**



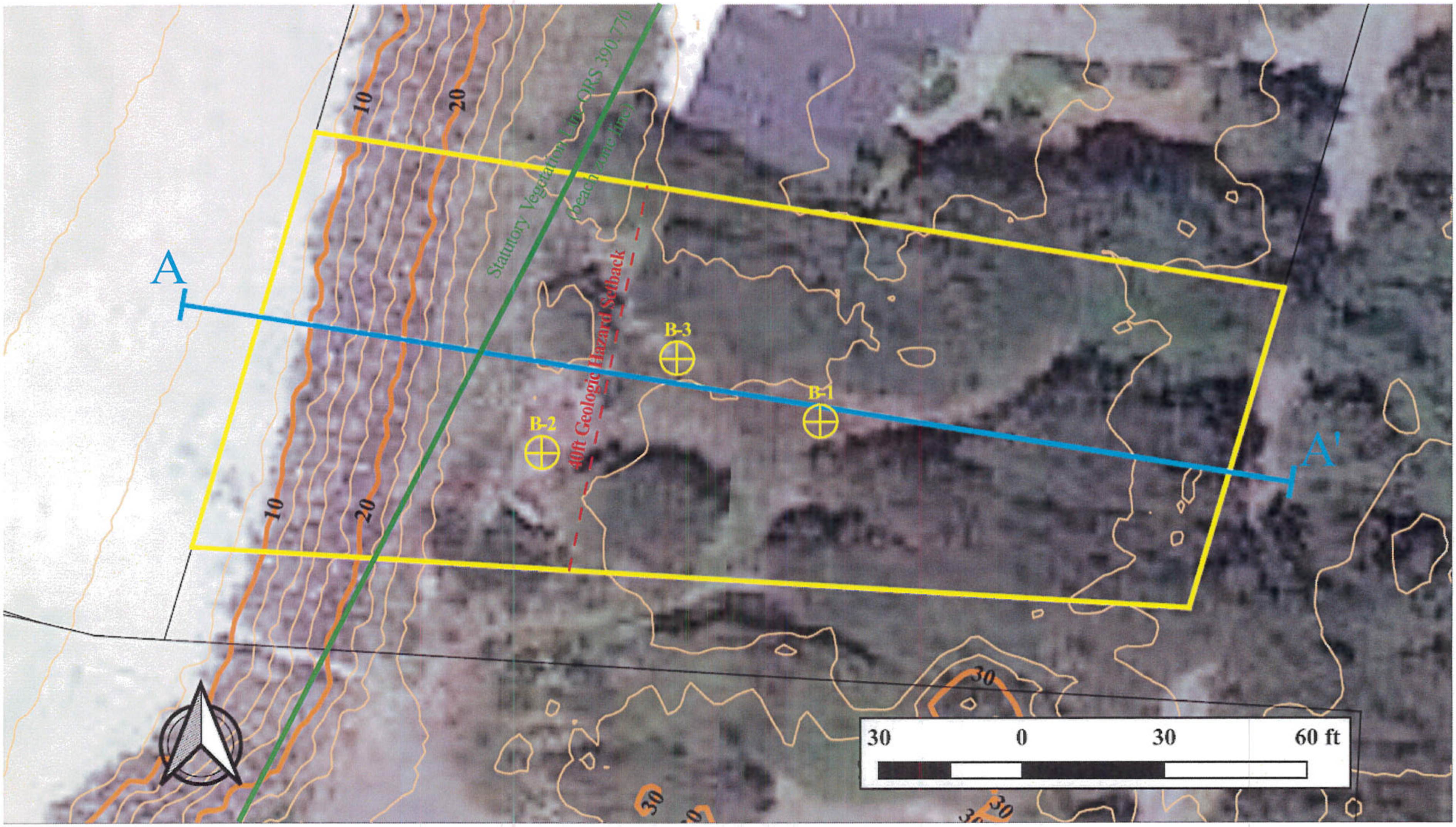
Modified from the Tillamook County assessor's plat 5S-11W-36BC
All locations and dimensions are approximate.

Date: 04/24/2020 Scale: 1" = 50'	**Project #Y204352**	Prepared by: AML Approved by: JDG

Plat Map
Tax Lot 2000, Map 5S-11W-36BC
Neskowin, Tillamook County, Oregon

H.G. Schlicker & Associates, Inc.

Figure 2

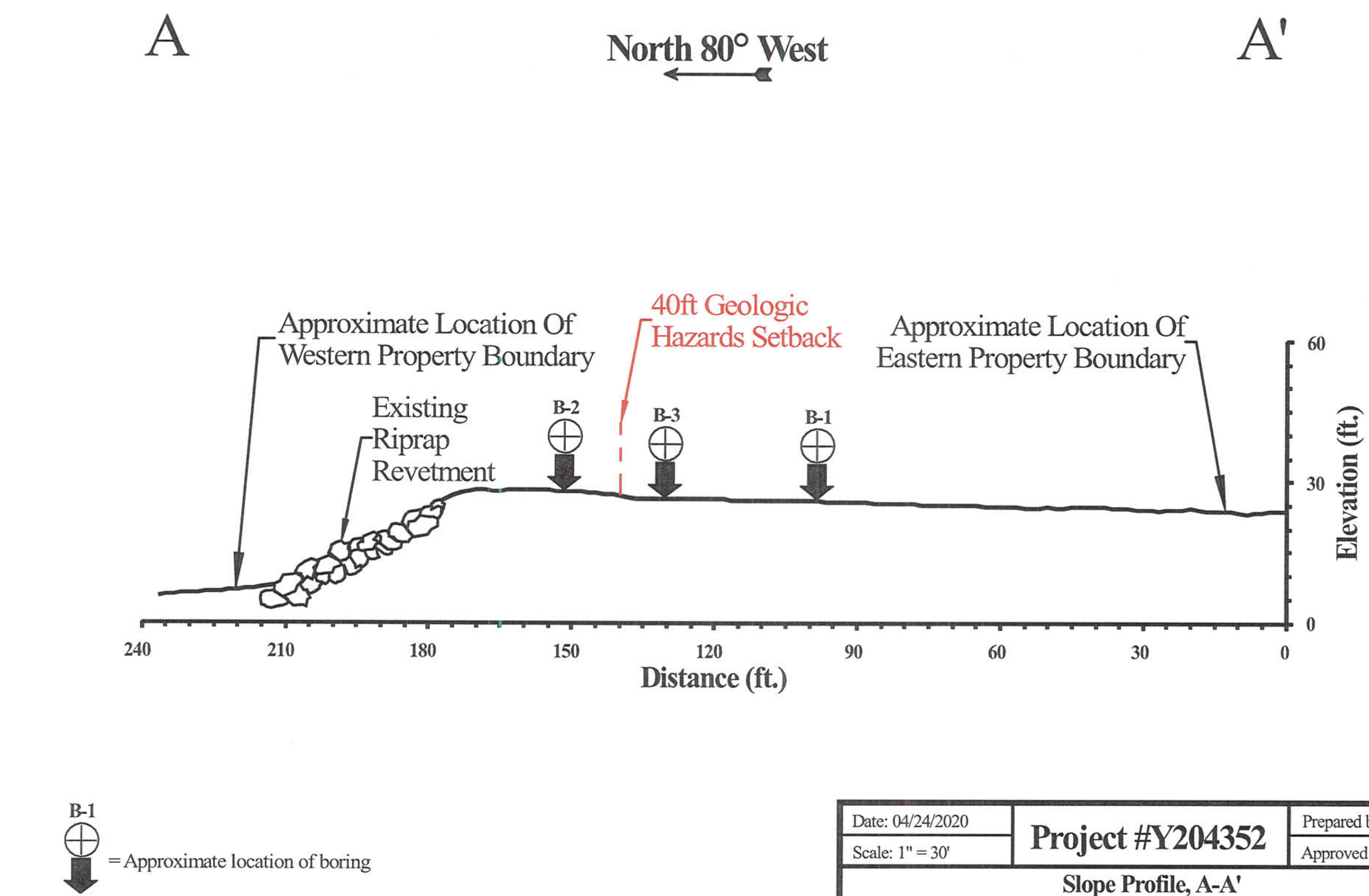


A —— A' = Approximate trend of profile line

B-1 ⊕ = Approximate location of boring

Imagery provided Google.
Topographic data derived from West_Coast_2016_El_Nino Lidar data from NOAA.
All locations and dimensions are approximate.

Date: 04/24/2020 Scale: 1" = 30'	**Project #Y204352**	Prepared by: AML Approved by: JDG	**Site Topographic Map** Tax Lot 2000, Map 5S-11W-36BC Neskowin, Tillamook County, Oregon	H.G. Schlicker & Associates, Inc.	**Figure 3**



All dimensions, elevations and locations are approximate.
Slope profile derived from West_Coast_2016_El_Nino
Lidar data from NOAA.

Date: 04/24/2020 Scale: 1" = 30'	**Project #Y204352**	Prepared by: AML Approved by: JDG
Slope Profile, A-A' Tax Lot 2000, Map 5S-11W-36BC Neskowin, Tillamook County, Oregon		
H.G. Schlicker & Associates, Inc.		**Figure 4**

Project #Y204352

Appendix A
- Site Photographs –

Photo 1 – Westerly view of the site from near the northeast property corner.

Photo 2 – Westerly view of the site from near the southeast property corner. Note the beach access path along the southern side of the site.

Photo 3 – Easterly view of the site from near the top of the riprap revetment.

Photo 4 – Southerly view of the beach and bluff from the site. Note the stumps exposed on the beach.

Photo 5 – Northerly view of the revetment, beach access stairs, and Neskowin Beach from just south of the site. Note the continuous riprap revetment along the dune slope.

Photo 6 – View of the riprap revetment at the base of the slope immediately west of the site. Yellow arrow indicates where larger armor stone has become displaced and the revetment is damaged.

Photo 7 – View of the dune sand encountered in boring B-2 to a depth of approximately 13 feet below the ground surface.

Project #Y204352

Appendix B

- Checklist of Recommended Additional Work, Plan Reviews and Site Observations -

H.G. Schlicker & Associates, Inc.

Project #Y204352

APPENDIX B
Checklist of Recommended Additional Work, Plan Reviews and Site Observations To Be Completed by a Representative of H.G. Schlicker & Associates, Inc.

Item No.	Date Done	Procedure	Timing
1*		Review site development, foundation, drainage, grading, and erosion control plans.	Prior to construction.
2*		Observe foundation excavations and setbacks.	Following excavation of foundations, and prior to placing fill, and forming and pouring concrete.**
3*		Review Proctor (ASTM D1557) and density test results for all fills placed at the site.	Following compaction, and prior to forming and pouring.

* There will be additional charges for these services.
** Please provide us with at least 5 days' notice prior to all site observations.

capriarchitecture

747 SW 13th Street Newport, OR 97365 | p.541.961.0503 | p.503.349.6246 | dustin@capriarchitecture.com | amanda@capriarchitecture.com

SAFEST SITE LETTER

McMillan Residence

H.G. Schlicker & Associates, Inc.

607 Main Street, Suite 200 · Oregon City, Oregon 97045
(503) 655-8113 · FAX (503) 655-8173

Project #Y204352 July 13, 2020

To: **Christina and Dan McMillan**
12050 NE Kuehne Road
Carlton, Oregon 97111

Subject: **Safest Site Requirement**
Tax Lot 2000, Map 5S-11W-36BC
Neskowin, Tillamook County, Oregon

Dear Christina and Dan McMillan:

H.G. Schlicker and Associates, Inc. (HGSA) is providing this letter to address the requirements set forth in Tillamook County Land Use Ordinance (TCLUO) Section 3.570(6)(b), the "safest site requirement".

Our April 24, 2020, Geologic Hazards and Geotechnical Investigation report (HGSA #Y204352) addresses the geologic hazards at the subject site in accordance with the geologic report standards outlined in TCLUO Section 3.570(5). In our report, we recommend a geologic hazards setback of 40 feet from the top of the riprap revetment located on the western portion of the property. The geologic hazard setback provided in our report establishes the area of the site with the least exposure to risk from coastal hazards and most suitable for development.

If you have any questions concerning this letter or the site, please contact us.

Respectfully submitted,

H.G. SCHLICKER AND ASSOCIATES, INC.

CERTIFIED OREGON J. DOUGLAS GLESS E-902 ENGINEERING GEOLOGIST
EXPIRES: 10/31/2020

J. Douglas Gless, MSc, RG, CEG, LHG
President/Principal Engineering Geologist
JDG:aml

capriarchitecture

747 SW 13th Street Newport, OR 97365 | p.541.961.0503 | p.503.349.6246 | dustin@capriarchitecture.com | amanda@capriarchitecture.com

HAZARD DISCLOSURE STATEMENT

McMillan Residence

June 30, 2021

Daniel J. and Christina L. McMillan
12050 NE Kuehne Road
Carlton, Oregon 97111

Re: Hazard Disclosure Statement
For Tax Lot 2000, Map5S-11W-36BC
Neskowin, Tillamook County, Oregon

To whom it may concern,

The following is a Hazard Disclosure Statement for the above-mentioned property, executed by Daniel J. and Christina L. McMillan. This property was purchased by us on April 24, 2000, and is still currently owned by us.

As the current owners:

1. We understand that above-mentioned property is subject to potential chronic natural hazards and the development thereon is subject to risk of damage from such hazards.
2. We have commissioned a geologic report for the property. This report was completed on April 24, 2020, by H.G. Schlicker and Associates. The geologic report was submitted to Tillamook County on June 30, 2021. This report has been very thoroughly reviewed by us through consultation with H.G. Schlicker and Associates. As we have moved through the process of developing plans to build on the property, H.G. Schlicker has been consulted many times as to the best placement of our property taking into consideration the type and extent of hazards present and the risks associated with development on above mentioned property.
3. We accept and assume all risks of damage from natural hazards associated with the development of the above-mentioned property.

Daniel J. McMillan

Christina L. McMillan