Earth Engineers, Inc.

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February 10, 2024

Northwest Living, LLC
P.O. Box 68388
Portland, Oregon 97268
Attention: Mr. Andre Kuznetsov

Phone: (503) 710-2036
E-mail: info@nwlivingrentals.com

Subject: **Geologic Hazard Visual Assessment Report**
6703 NW Logan Road,
Lincoln City, Lincoln County, Oregon
EEI Report No. 24-026

Dear Mr. Kuznetsov:

Per your request, **Earth Engineers, Inc. (EEI)** has completed a visual geologic hazard assessment report for the address referenced above. You authorized our services by signing EEI Proposal Number 24-P006-A1 on January 31, 2024.

PROJECT BACKGROUND INFORMATION

Our current understanding of the project is based on information provided to us via e-mail. It included the following documents:

- **A plan set entitled "Kennedy Residence" by Watson Design Works, Inc., dated May, 2023.** The plan set includes a site plan, erosion control details, proposed exterior elevations, proposed foundation and floor plans, structural details, and other building details.

- **Structural Calculations entitled "Structural Calculations, Kennedy Residence Remodel, 6703 NW Logan Road, Lincoln City, Oregon 97367," by Matt Galvin, PE, stamped April 12, 2023, and dated January 20, 2023.** The 117-page document contains design criteria, gravity analysis, lateral analysis, and references.

Briefly, we understand that you are remodeling the existing residence. The remodel will include small additions to increase the residence's total square footage from 3,486 square feet to 3,811 square feet with 834 square feet dedicated to garage space. The remodel will add an additional garage space, a covered patio, and the removal of the existing fireplace.

Based on the property location, we understand that the property is within the Lincoln City hazard zones for coastal erosion. As such, this report will address the geologic- and geotechnical-related requirements in LCMC 17.47 Natural Hazards Beaches and Dunes, and 17.77.090 Geologic Hazard Report. If coastal-related natural hazards are present, typical recommendations to mitigate coastal erosion may include Shoreline Protection Structures, retaining structures, or deep foundations. Each of these alternatives would require geotechnical exploration for investigation and design. However, it the case of the proposed project, we understand that the project does not include substantial modification to the west (ocean bluff-facing) side of the structure, and therefore we have limited our services to visual reconnaissance to confirm that the proposed construction will not substantively increase the geo-hazard risk for the subject property or surrounding properties.

SCOPE OF SERVICES

Our scope of services was limited to addressing the minimum information required for a City of Lincoln City and Lincoln County-required geo-hazard assessment. No geotechnical engineering recommendations was included in our scope of work (i.e. the report identifies geologic hazards that could impact the property, and broadly presents mitigation options and/or recommendations for additional investigation), nor was subsurface investigation, surveying, or producing topographic site plans or erosion control drawings. Based on our understanding that the project does not include expansion of the building footprint on the west (ocean bluff-facing) side of the property, our recommended setback will be the lesser of the setback requirement as presented on the code, or the current building setback (i.e. the proposed improvements will have no additional negative impact on bluff stability or erosion, assuming that no new footings will be added on or adjacent the west side of the existing building footprint.)

SITE LOCATION

The exiting residence built in 1999 is situated on a 0.52-acre property located at 6703 NW Logan Road, Pacific City, Pacific County, Oregon. The tax lot, 06-11-34-AA-01500-00 is bounded to the north and south by existing residential properties, to the west by the Pacific Ocean, and to the east by NW Logan Road. Approximately 0.26-acre of the site is west of the vegetation line. The site has an existing shoreline protection structure (SPS; rip-rap revetment) at beach elevation and access to the beach is by an existing wooden staircase near the southern property line (Photo 1).

Based on the plans provided by Watson Design Works, Inc., the proposed property redevelopment does not include the expansion of the building footprint on the west (ocean bluff-facing) side of the property (Figure 1). Because of this, we recommend that the proposed improvements should have no negative impact on bluff stability or erosion, and stormwater management on the property will not include additional discharge onto the west side of the lot as a result of the improvements.

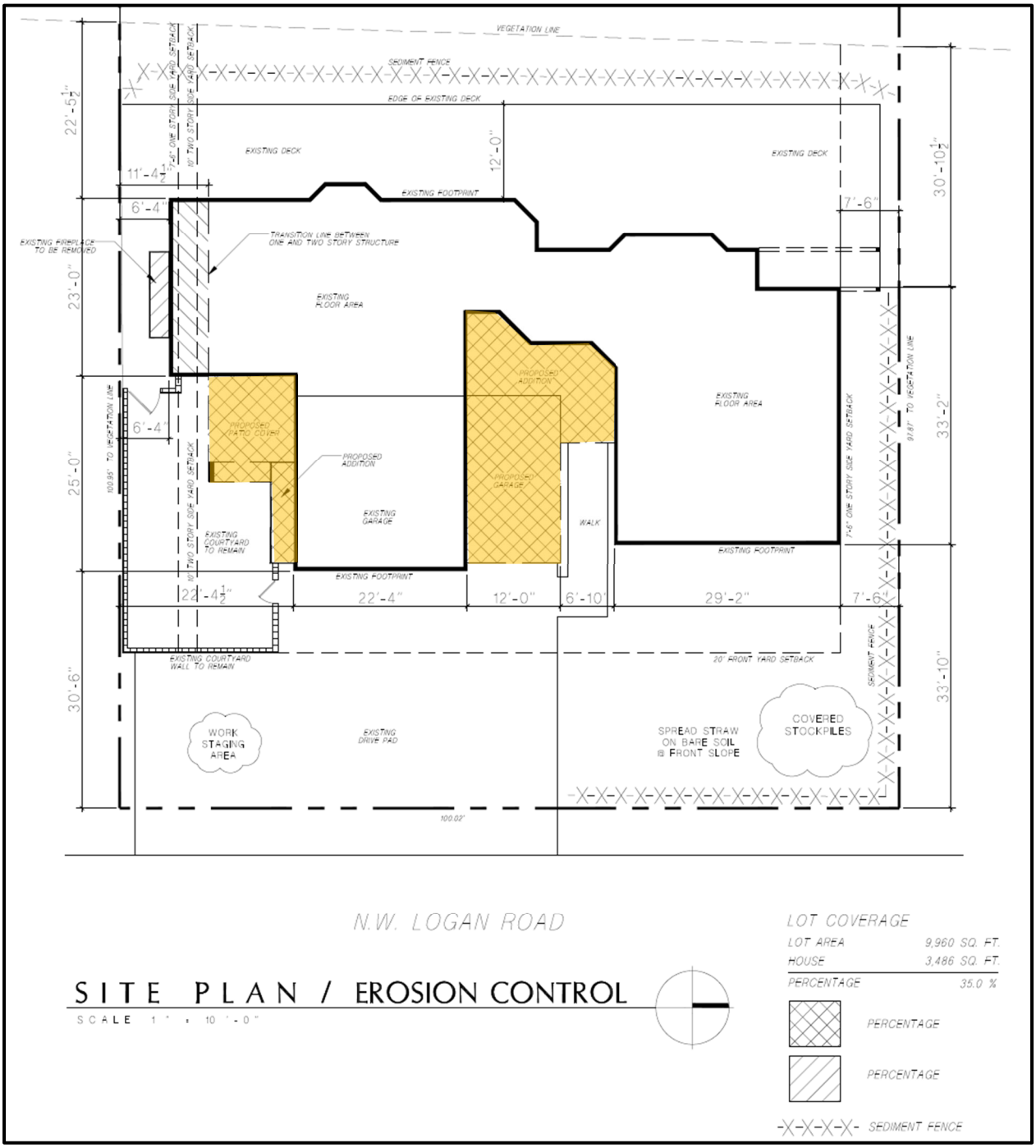


Figure 1: Site plan. Existing footprint with proposed additions (hatched and highlighted in yellow). Modified from plans provided by Watson Design Works, Inc., dated May, 2023.

MAPPED SOILS, GEOLOGY AND GEOLOGICAL HAZARDS

In the vicinity of the subject property, the underlying geology is mapped as Qmt - Quaternary marine terrace deposits composed of semi-consolidated beach sand overlain with fine-grain dune deposits.

The United States Department of Agriculture (USDA) Soil Survey provides geographical information of the soils in Lincoln County as well as summarizing various properties of the soils. Within the planned building addition areas on the property, the soil is mapped as Gleneden silty clay loan (on 2 to 12 percent slopes). The soil is derived from clayey alluvium and is classified as somewhat poorly drained.

According to the USGS Quaternary Fault and Fold Database (http://earthquake.usgs.gov/hazards/faults/), there are no known faults located underneath the property or adjacent properties. The nearest mapped fault that has been active during the Quaternary is the Cascadia fault zone, located approximately 5 miles to northwest. As such, we consider the fault rupture hazard for the site to be low. Note that it is possible for faults to be present at or near the property that are not currently mapped.

The Oregon Department of Geology and Mineral Industries (DOGAMI) Statewide Geohazards Viewer, HazVu (https://gis.dogami.oregon.gov/maps/hazvu/) produces geological hazard maps for the state. Given the mapped and observed soil and rock units on the property, it is our professional opinion that there is a significant ground shaking amplification hazard at this particular site. Any ground shaking amplification would be similar to other properties in the area. DOGAMI maps the expected shaking due to a Cascadia earthquake to be violent. As part of our seismic evaluation of the site, we also reviewed the tsunami evacuation mapping, which is an indicator of areas expected to be inundated by tsunamis. The residence is located within the tsunami evacuation zone for local tsumanis produced by a large Cascadia subduction zone event.

According to HazVu, the property is not mapped within an area that includes any mapped landslides. However, two landslides have been mapped to the east of the site. The slides are mapped approximately 500 to 600 feet to the east of the site and originated in the hills east of NE Neptune Drive (Figure 2).

HazVu indicates that the property is within the Coastal Erosion Hazard zone. The erosion hazard ranges from very high (active) on the western side of the lot, to low hazard on the eastern side nearest to NW Logan Road (Figure 3). The very high (active) zone is defined as being actively eroded by waves and mass movement caused by wave energy. Allan and Priest (2001) define this area as potentially being affected by active erosion within the next 60 to 100 years.

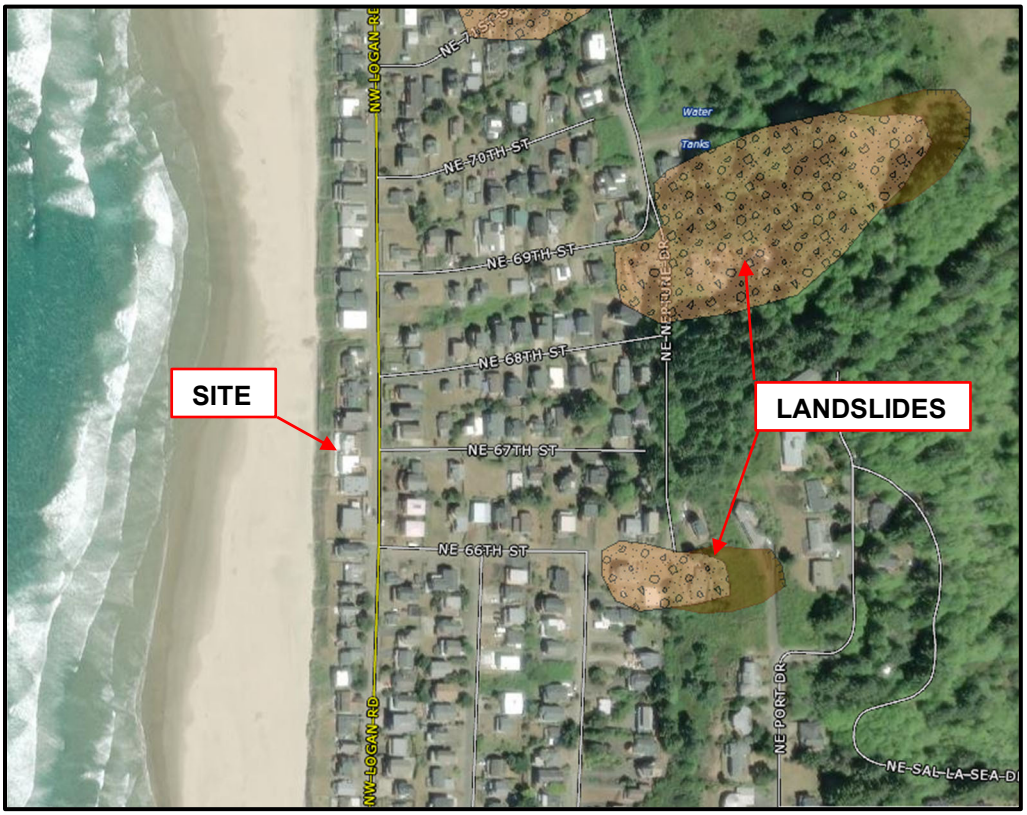


Figure 2: Location of nearest mapped landslides.

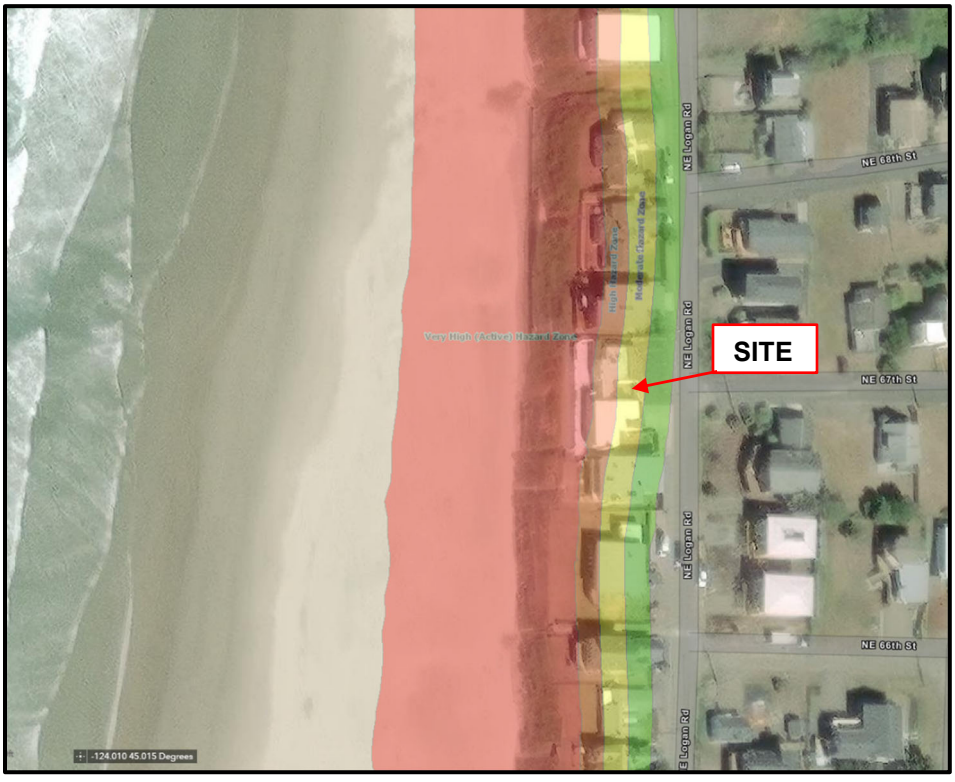


Figure 3: Site location within the Coastal Erosion Hazard Zone.

SITE OBSERVATIONS

The following is a summary of our visual reconnaissance performed by staff from our firm on January 11, 2024. Approximately 1 hour was spent walking the residential lot, the beach and the surrounding slopes on the parcel. The following is a summary of our observations:

General Site Observations:

1. The majority of the parcel generally consists of flat topography, with the eastern half of the parcel upslope of the existing SPS being generally flat. Elevations provided by DOGAMI LiDAR (https://pubs.oregon.gov/dogami/ldq/LDQ-45124A1.zip) of the site range between 8 to 44 feet (NAVD 88). The beach portion of the property ranges between 8 and 18 feet in elevation. The SPS and bluff ranges from 18 to 38 feet in elevation, and the developed portion of the property ranges from 38 to 44 feet in elevation. The developed portion of the lot slopes gradually towards the ocean at 5 to 7 percent grade.

2. The steepest portion of the lot slopes seaward (west), and consists of a SPS (rip-rap revetment) down to beach elevation. The SPS is approximately 20 feet high, 20 to 30 feet wide, and slopes at approximately 45 degrees towards the beach. The SPS runs the entire beachfront length of the property (approximately 100 feet). The SPS (where not covered in vegetation) appeared to be in good condition and functioning properly, and continues southward abutting the adjacent property to the south (Photo 1). The SPS for the lot to the north was observed to be composed of a concrete block wall. We did not observe any active seeps, streams, or springs at the time of our site reconnaissance. Three drift logs were observed on the beach near the base of the SPS.

Photo 1: Adjacent beach, looking east toward the existing residence and revetment.

3. The beach was composed of typical beach sand. A review of geological data from Peterson and Kingen, 2021 indicate the mean grain size of 0.183-mm for Road's End (closest to the site) and ranged between 0.23 to 0.36-mm nearby at Pacific City (https://pdxscholar.library.pdx.edu/geology_data/1/).

4. As previously stated, the proposed redevelopment plans include modifications to the existing structures only on the appear to be east of the existing SPS and the western wall of the residence (Figure 1). Because of this, we do not expect the redevelopment activities will affect the existing site vegetation, the stability of existing slopes, site erosion, or geologic hazards to surrounding properties. The existing SPS provides substantial protection for the upland portion of this property to coastal erosion, and increases the resistance of the property to wave attack.

GEOLOGIC HAZARD SUMMARY FINDINGS

Because the site is located within the coast erosion hazard zone defined by Priest and Allan, 2004, we are providing this section of our report to facilitate the review of the anticipated building permit of the site. The following section of Lincoln City Code, Chapter 17.47 (Natural Hazards, Beaches, and Dunes) and Section 17.47.020 are addressed below. Note that all of the Site Description items (1.a. through 1.k.) have been previously addressed in the report text, or (if not previously addressed) are not applicable or pertinent to this property or review. Items 2 through 5 are discussed below.

17.47.020 Development in Identified Hazard Areas

2. Description of the Fronting Beach

a. Average Summer and Winter Beach Widths
Based on aerial photos between 1985 and 2019 provided on Google Earth, the beach adjacent the subject property site varies in width from approximately 275 to 630 feet wide in the summer, and approximately 480 to 590 feet wide in the winter.

b. Median Beach Sediment Grain Size
The median beach sediment grain size is fine- to medium-grained sand. As previously stated, Peterson and Kingen (2021) indicate a mean grain size of 0.183-mm for the Road's End area.

c. Summer and Winter Beach Elevations and Average Slopes
The typical beach slopes at this location vary from approximately 2 to 3 degrees westward based on elevations (NAV 88) derived from DOGAMI LiDAR. As typical of the Oregon Coast, the conditions are dynamic and can change substantially is a relatively short period of time, particularly during El Nino and La Nina events.

d. Elevations Above Mean Sea Level of the Beach at the Seaward Edge of the Property During Summer and Winter
Elevations provided by DOGAMI LiDAR show the contact between the beach and SPS between 17 and 18 feet elevation (NAVD 88).

e. Rip currents and Embayments
Rip currents are common on this part of the Oregon Coast, and rip embayments regularly set up and form in the Lincoln City area. The effects of rip embayments have been particularly severe in areas south of Lincoln City, with historical impacts of property and structural loss the Salishan Spit. Based on our review of available GoogleEarth satellite imagery (period ranging from 1985 and 2019), we did not observe a prevalence of rip embayments in the vicinity of the subject site on the images from this period.

f. Rock Outcrops and Sea Stacks
No rock outcrops or sea stacks were observed offshore and within the beach zone.

g. Depth of Beach Sand to Bedrock
Bedrock was not observed at the time our visual reconnaissance. Based on our experience in the vicinity of the subject property, it is anticipated that depth to bedrock could be from approximately 5 to 12 feet below observed beach level.

3. Analyses of Erosion and Flooding Potential

a. DOGAMI Beach Monitoring Data
We reviewed available DOGAMI beach monitoring data (Allan and Hart, 2005) pertinent to this location. In the vicinity of the subject property, there was relative consistency in beach elevation for the years monitored (1997, 1998, and 2002).

b. Human Activities Affecting Shoreline Erosion
The installation of rip-rap revetment has decreased shoreline erosion of the bluff by wave action to essentially zero, provided the SPS is maintained and repaired as necessary.

c. Mass Wasting, Weathering, Landsliding, and Slumping
As previously discussed in this report, the site is not mapped on a known landslide and the site is not oversteepened and is essentially flat.

d. Wave Runup Beyond Mean Water Elevation
The installation of rip-rap revetment has decreased shoreline erosion of the bluff by wave action to essentially zero, provided the SPS is maintained and repaired as necessary. Furthermore, a wave runup beyond mean water elevation should only lead to minor erosion (that can be address on the upland portion of the property with limited, infrequent maintenance), provided the runup events are not continuous in nature.

e. Frequency of Erosion-Inducing Processes
The average erosion rate is for Lincoln City ranges between 0.30 and 0.31 feet/year with uncertainties between 0.19 and 0.37 feet/year (Priest, 2004). With the installation of rip-rap revetment on the bluff, the erosion rate has essentially been reduced to zero.

f. Dune-Backed Shoreline Erosion
The installation of rip-rap revetment has essentially decreased shoreline erosion of the upland subject property area by wave action to essentially zero, provided the SPS is maintained and repaired as necessary.

g. Bluff-Backed Shoreline Erosion
Not applicable for this site.

h. Potential of Sea Level Rise
A review of NOAA data for South Beach and Garibaldi monitoring stations in Oregon (https://tidesandcurrents.noaa.gov/) show sea-level rise between 1.71 and 2.44 mm per year for data collected between 1967 through 2022. This rise translates to 0.56 to 0.8 feet of sea level rise per 100 years.

i. Estimation of Annual Erosion Rate
Because the bluff is protected by existing SPS, the estimated annual erosion rate is essentially zero, provided the revetment is maintained and repaired as needed. Erosion rates previously discussed above.

4. Assessment of Potential Reactions to Erosion Episodes

a. Legal Restrictions of Shoreline Protective Structures
As described above the subject property is protected by a SPS (rip-rap revetment). According to the online Oregon Coast Atlas, the subject property is Goal 18 eligible (i.e. the property was developed before January 1, 1977). Therefore, subject to permit rules of the municipality and the Oregon Parks and Recreation Department (OPRD) Ocean Shores program, the existing SPS can be maintained or replaced in the future as needed.

b. Potential Reactions to Erosion Events and Future Erosion Control
Based on the geologic hazard conditions at the subject property, potential reactions to erosion events and future erosion control may include vegetation maintenance/management, and maintenance, enhancement, or replacement of the existing SPS. Additional measures could include retrofit of the existing foundations with deep foundation elements, and/or construction of retaining walls or a seawall.

c. Annual Erosion Rate
As previously noted, the average erosion rate is for Lincoln City ranges between 0.30 and 0.31 feet/year with uncertainties between 0.19 and 0.37 feet/year (Priest, 2004). With the installation of rip-rap revetment on the bluff, the erosion rate has been essentially lowered to zero.

5. Recommendations

a. Safety and Compliance of all Local Requirements
In general, based on our reconnaissance, review of geologic hazard conditions associated with the subject property, and our understanding of the project, we recommend that the proposed project can be performed at an acceptable level of safety and in compliance with local requirements. As noted previously, the proposed project does not include a reduction in the existing setback of structures, and the property is protected from coastal erosion by an existing SPS.

b. Preservation of Vegetation and Within Setback Area
We understand that the project includes no changes to the existing grade on or adjacent the subject site, and that vegetation will not be impacted (and further, will be preserved and protected during project implementation).

c. Consideration of Local Variance Process to Reduce Building Setback
As noted previously, the proposed property improvements do not include changes to the existing setback, and therefore we recommend that consideration of a setback variance is not applicable to this project.

d. Control and Direction of Stormwater Drainage Away From the Ocean
We understand that the project includes the addition of impermeable surface area (roofline), as shown on Figure 1. In addition, we understand that the project will include modifications to existing foundations/footings. We recommend that surface water is collected from the roofline area and diverted from building foundations and walls, to approved disposal points on the eastern portion of the property, or discharged to a municipal storm sewer (if present). Regardless, the water should be diverted in such a way so as to not cause erosion or visual impacts. For new perimeter footings, subsurface drainage of the building perimeter using footing drains is recommended and the water should be discharged in the same manner as the surface water described above.

LIMITATIONS

Geologic hazard evaluations can take the form of simplistic visual observations, or they can involve detailed investigations with borings, inclinometer installations, laboratory testing, and slope stability modeling. Visual observation evaluations tend to translate to more risk and less cost for the client than a detailed investigation. However, no matter what method of landslide

hazard evaluation is selected, there is always some risk to the client that coastal erosion or a landslide could occur in the future. Our evaluation is not a guarantee that some form of coastal erosion or landsliding will never occur on this property in the future. It is merely an evaluation of the risk based on our observations.

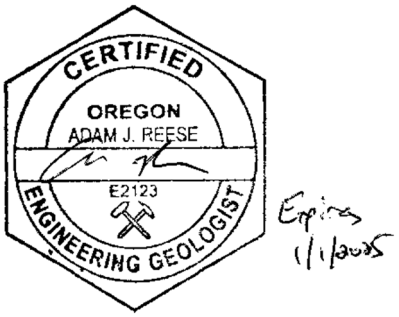
The geologic hazard recommendations presented in this report are based on the available project information described in this report. If any of the noted information is incorrect, please inform EEI in writing so that we may amend the recommendations presented in this report if appropriate and if desired by the client. EEI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

This report has been prepared for the exclusive use Andre Kuznetsov of Northwest Living, LLC, for the specific application to the proposed development of a property at 6703 NW Logan Road, Lincoln City, Lincoln County, Oregon. EEI does not authorize the use of the advice herein nor the reliance upon the report by third parties without prior written authorization by EEI.

We appreciate the opportunity to perform this geologic hazard assessment. If you have any questions pertaining to this report, or if we may be of further service, please contact Adam Reese at 360-567-1806 (office) or 503-502-2726 (cell).

Sincerely,

Earth Engineers, Inc.



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