



Geotechnical • Geologic • Coastal • Environmental



5741 Palmer Way • Carlsbad, California 92010 • (760) 438-3155 • FAX (760) 931-0915 • www.geosoilsinc.com

July 20, 2019

Ms. Patricia Radi
772 Neptune
Encinitas, Ca. 92024

SUBJECT: Discussion of Bluff Stability at 772 Neptune Avenue, Encinitas, CA

Dear Ms. Radi:

At your request, GeoSoils, Inc. (GSI) is pleased to provide the following discussion of the stability of the bluff fronting the subject site. Our professional opinion is based upon our inspections of the property and adjacent properties over the last 30 years, our knowledge and experience with the coastal bluffs in Encinitas, and our review of technical reports. This discussion of the site, bluff stability and soils strengths is not based upon an analysis of site specific drilled soils samples and as such is subject to both revision & error but it is our professional opinion that the conclusions herein are valid and applicable to the site. This type of more extensive sampling and analysis would be required by a regulatory agency for a permit to do work at the site.

The subject site is a bluff top parcel in the Leucadia community of Encinitas. The property extends from Neptune Avenue to the Mean High Tide Line, an ambulatory property line, which at the time of the subdivision was ± 280 feet from the Neptune Avenue right of way (ROW). The site is fronted by an historic landslide, which occurred before the subdivision of the area was recorded. Figure 1 shows the landslide in 1932 before there was development along Neptune Avenue (the dirt road). Figure 2 shows the same section of shoreline 85 years later. There are two geologic units that make up the bluff. The older, lower unit, is the Santiago Formation, which is relatively resistant to marine erosion. The upper unit is "coastal terrace deposits" that are composed of silty fine sands. The landslide extends from below the bluff top patio to the toe of the slide at the beach, a distance of about 150 feet. The toe of the landslide is composed of the erosion resistant Santiago Formation. There is groundwater seeping onto the beach coming from the contact between the Santiago Formation and the terrace deposit, or cracks within the Santiago Formation as a result of the landslide. The upper portion of the bluff, just below the patio, is the coastal terrace deposits and is about 30 feet high.



Figure 1. Subject site with landslide fronting the bluff in 1932.



Figure 2. Site and landslide in December 2017 from Google Earth.

A bluff, regardless of its location (on the ocean or inland), is formed primarily by the process of erosion. Bluffs should be expected to erode or fail over time regardless of the geologic setting. The primary erosion/failure agent is water, with a secondary failure agent due to seismic activity. Seismic bluff failure has not been a documented contributor to bluff failure along the Encinitas shoreline. There are three sources of water at the subject site. The first source is surface drainage which is typically controlled by the site drainage plan. The second source is groundwater, and the third source is the ocean waves and tides. The impacts of these three sources on the over stability of the bluff are discussed below.

Water from rain hitting the residence and other site improvements is controlled by surface drainage. The subject site has a hardscape bluff top patio and side yard walkways, which direct water back into a drainage system. The roof has gutters, which also convey water into the drainage system. The proper functioning of the system is import to the stability of the bluff at the site. Uncontrolled surface water over the bluff soils will exacerbate erosion. The upper portion of the bluff is also protected with a timber cladding. The timber cladding is not a bluff retaining structure but rather prevents rain and wind from eroding the upper bluff terrace deposit soils. Groundwater cannot be controlled at the site and is a regional feature. However, groundwater does not appear to be impacting the stability of the upper portion of the bluff at the site. The impact of ocean waves on the stability of the bluff is mitigated by the erosion resistant Santiago Formation at the landside toe.

In other sections of bluff in Encinitas, where there is no landslide at the bluff toe, the typical failure mechanism is for the lower geologic unit to fail in a block that triggers the failure of the upper terrace deposits. At this site that process will not occur until the toe of the landslide approaches the upper portion of the bluff below the patio. This is a distance of about 150 feet. The US Army Corps of Engineers has documented a historical retreat rate in the site area (not at the subject site in particular) of 0.4 feet per year. At this rate, for the landslide toe to reach the site it would take about 375 years. Comparing Figure 1 and Figure 2, photographs taken about 85 years apart, it is difficult to see any movement of the toe of the landslide. Using the 0.4 ft per year rate you would expect to see perhaps 34 feet of erosion. It is also interesting to note on the Assessor Parcel Map (APN) the top of the upper bluff is denoted and shows that the distance from the north property line to Neptune Avenue ROW is about 93 feet. That distance measured today is almost the same (about 91 feet), which shows that the retreat of the upper bluff has been very small.

CONCLUSION

The bluff fronting the subject site is particularly unique and stable. The past erosion of the upper bluff has been perhaps a few feet and was a result of past subaerial erosion. The recently added timber cladding essentially mitigates this erosion mechanism. This section of the bluff is not subject to marine erosion and will likely not be subject to marine for a few centuries, even in consideration of an increased erosion rate due to future sea level rise. The erosion rate of the Santiago Formation may increase perhaps by 20% or more after the year 2040 due sea level rise. The impact of groundwater on this upper bluff was not noted at the site or at any of the adjacent properties. The continued stability of the bluff

relies on the maintenance of the drainage system, and inspection and maintenance of the timber cladding.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact me.

Respectfully submitted,



GeoSoils, Inc.
David W. Skelly MS, PE
RCE#47857

