

Gary B. Griggs
Registered Geologist No. 3277
Certified Engineering Geologist No. 1282
321 Alta Avenue - Santa Cruz, CA 95060
(831) 332-9318 - griggs@ucsc.edu

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Mary Anderson
1223 Wilshire Blvd #748
Santa Monica, CA 90403

RE: EVALUATION OF POTENTIAL IMPACT OF EXCAVATION ON THE 190 WEST CLIFF DRIVE PROJECT SITE ON COASTAL BLUFF STABILITY

The 190 West Cliff Drive project site lies at the corner of Bay Street and West Cliff Drive and is underlain by the siltstone and sandstone of the Purisima Formation, which is capped by 13 to 14 feet of unconsolidated sandy marine terrace deposits. These same two geologic units make up the coastal bluffs along West Cliff Drive from Almar Avenue east to the Santa Cruz Municipal Wharf, and then extend eastward to form the bluffs along East Cliff Drive from the San Lorenzo River mouth to Capitola and beyond to Rio Del Mar.

Five borings across the site from geotechnical investigations in 2004 and in 2017 extended to depths of 19.5 to 29.5 below grade and penetrated six to sixteen feet of the Purisima bedrock (Figure 1). As a standard measure in soil engineering of the hardness and density of subsurface materials a 140 pound sampling device is dropped repeatedly from a height of 30 inches in order to determine how many of these "blows" are required to drive the soil sampler 12 inches. Twelve of these measurements were obtained during boring within the overlying terrace deposits, with values ranging from 10-29. This material is thus categorized as *loose to medium dense*. A total of thirteen of these tests were performed within the Purisima Formation. One value was in the *dense* category (Dense = 30-50 blows to drive the sampler 12 inches) and all of the rest were in the *very dense* category (Very Dense > 50 blows to penetrate 12 inches). In contrast to the overlying sandy terrace deposits, the Purisima is dense bedrock. This can easily be observed along the lower bedrock portions of the bluff along West Cliff Drive, immediately up coast from the Dream Inn and beneath the pool area of the Dream Inn.

Where exposed directly to wave attack, the Purisima Formation does erode along joints or other zones of weakness, which is why protective rip-rap has been placed along the area immediately upcoast from the Dream Inn and in the vicinity of Steamer Lane and Lighthouse Point. Areas where the rip-rap has been placed historically are locations where no permanent beach was present so wave attack was persistent and bluff erosion

was occurring. However, because of the shoreline orientation along Cowell's Beach from just upcoast of the Dream Inn and extending to the Santa Cruz Small Craft Harbor and beyond to Soquel Point, sand has accumulated to form a wide protective beach such that waves rarely reach the base of the bluff (Figure 2). Waves have washed completely across the beach during severe El Niño years, when elevated water levels coincide with high tides and storm waves (e.g. the 1983 and 1997-98 winters, for example).

The bedrock making up the bluff fronting the Dream Inn (across West Cliff Drive from the proposed project site) has experienced only minimal erosion in the 90 years since the time the first vertical aerial photographs were taken in 1928 (Treadwell and Rollo, 2004). This lack of erosion is in large part due to the presence of the wide protective beach, which keeps wave activity well away from the bluff except during relatively infrequent very severe storms coincident with very high tides and/or strong El Niño events.

In addition (from Haro, Kasunich & Associates, 2004):

"The existing hotel has foundation elements that armor the bluff and prevent it from eroding... These include: concrete piers and grade beams seaward of the pool and at the restaurant, as well as a continuous concrete wall across the front of the ten-story section."(Figures 3 and 4). These foundations and coastal protection structure elements have historically retarded coastal erosion seaward of and underneath the hotel." The upcoast area (actually the bluff at the south corner of the Dream Inn) has also been armored with rip-rap, further strengthening the bluff.

Evidence of the strength and support of the coastal bluff fronting the Dream Inn is also provided by the lack of any slope failure observed at the site during the strong 1989 6.9 magnitude Loma Prieta earthquake (Treadwell, 2004). A measure of the severity of the shaking observed in Santa Cruz during the event is provided by horizontal and vertical accelerations approaching 0.5 g (g= gravity; Plant and Griggs, 1990) and the destruction of much of downtown Santa Cruz.

The plans for the site involve excavation to about 24 feet from ground surface to top of foundation in order to provide for two levels of parking for the existing Dream Inn as well as the residents and visitors to the new mixed-use development. The upper thirteen feet of the excavation involves removal of the loose, unconsolidated, sandy terrace deposits, which is a straightforward operation. The next nine feet will require ripping the sandstone and siltstone of the Purisima, which is not deemed to be a significant issue (HKA, 2017):

"According to our local experience, the Purisima Formation at the project site and within the planned depth of the parking garage is rippable and/or can be drilled using conventional construction equipment such as an excavator and backhoe."

Recent construction of the Twin Lakes coastal protection project involved deep

excavation into the Purisima Formation with no vibration effects to the adjacent road and homes across East Cliff Drive (which were less than 150 feet from the excavation; John Kasunich, HKA, personal communication).

CONCLUSIONS

Based on the: 1] strength of the Purisima Formation from site borings as well as its stability along the nearby coastal bluffs; 2] the lack of bluff failure in this location during the severe 1989 Loma Prieta Earthquake; 3] the protection of the bluff fronting the Dream Inn and to either side by a combination of concrete walls and concrete piers; 4] the distance from the bluff edge (much of which is armored with concrete) to the area of excavation for the proposed project (150 feet inland at its closest point), and 5] similar excavation in the Purisima Formation, there should be no impact of the excavation proposed for the project on the nearby coastal bluff.

Sincerely,



Gary Griggs

Registered Geologist No. 3277

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REFERENCES

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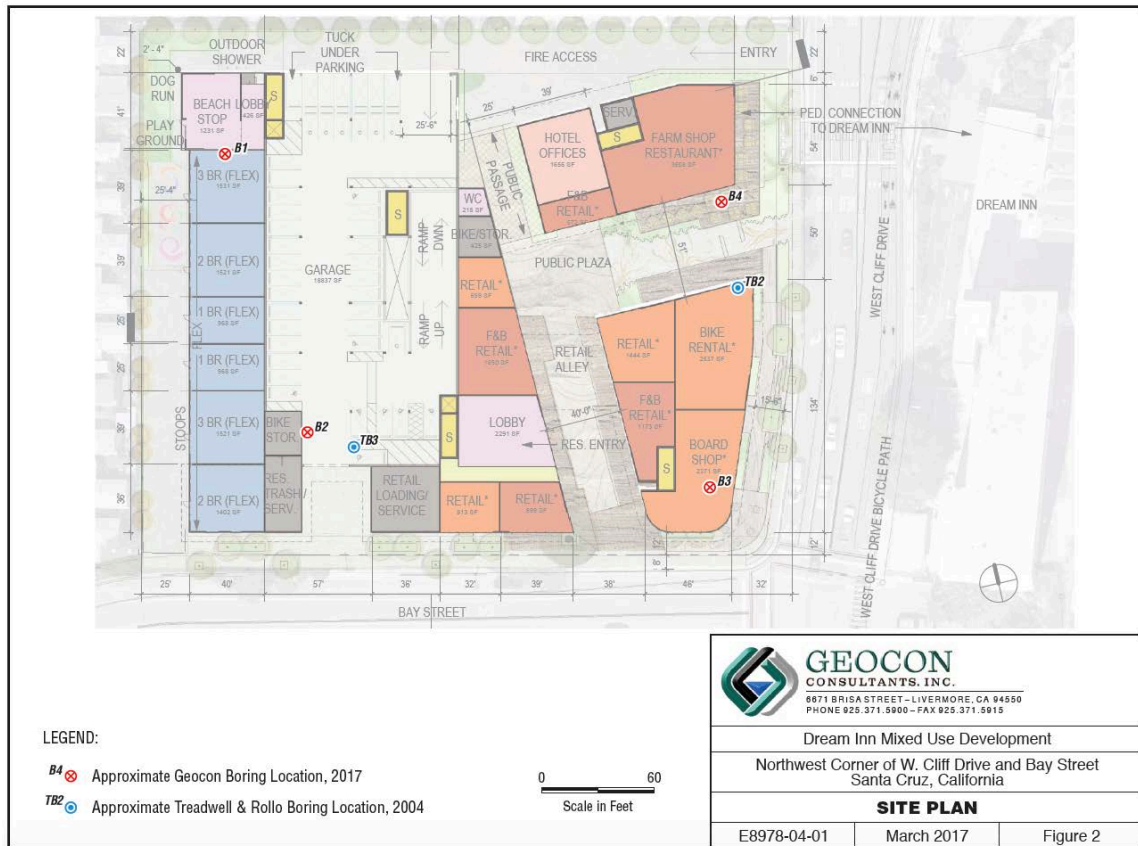


Figure 1. Site plan and locations of soil borings from both Treadwell and Rollo (2004) and GEOCON (2017).



Figure 2. Wide sandy beach fronting Dream Inn. Note rip-rap and lack of beach immediately to the left (upcoast). (2015 photo from California Coastal Records Project)



Figure 3. Protection of the bluff fronting the Dream Inn. The concrete wall on the left beneath the 10-story hotel portion spans 140 feet of hotel frontage. The restaurant on the far right is

protected by 150 feet of concrete wall. In the middle beneath the pool, 235 feet of the bluff is partially protected by a series of concrete caissons and also by a chain link fence, which helps to dissipate any wave energy that might reach this far inland during extreme storms and also prevents logs and debris from impacting the Purisima bedrock.



Figure 4. Area beneath the Dream Inn pool where Purisima Formation bedrock is exposed behind the row of concrete caissons and fencing.