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September 11, 2020

Martin Casado / Leilei Shei
8 Ocean Avenue
Bollinas CA, 94924

RE: Geotechnical Observations and Recommendations, 8 Ocean Avenue, Bollinas, Coastal Permit and Design Review; Assessor's Parcel 193-172-17

Martin,

Please consider this geotechnical evaluation report prepared for your property at 8 Ocean Avenue (APN: 193-162-22) in Bollinas, California. Consistent with the previously proposed project (Marin County file: ID P2376), this report includes after the fact permitting of existing pier and tieback systems on the northwest and southeast side of the property along the bluff face. In addition, this report recommends for a proposed small addition to the 2007 wall (perpendicular to the bluff face) along the southeastern property boundary. The purpose of this report and recommendations is to facilitate permitting for work needed to protect the property and existing improvements from degradation due to surface and subsurface drainage conditions and potential future bluff erosion.

We have conducted multiple site visits, collected topographic data, reviewed current and historical aerials, and have provided preliminary opinions regarding site. This report/plan include uses consistent with the California Coastal Act, the Marin Countywide Plan, the Local Coastal Plan Unit I, and Marin County Implementation Plan (Interim Development Code).

The existing and proposed improvements, including the 2019 emergency repair, are required to prevent continued erosion caused by neighboring activities along the bluff edge and thus jeopardizing the main residence as well as the neighboring residence to the west (105 Terrace Ave). Using the guidelines and the policies of the Bollinas Community Plan (1975), specifically the Bollinas Peninsula Slope Policy (on page 31 of the BCP) the proposed improvements (existing and proposed) are consistent with the recommendations for bluff retreat, setbacks, and site-specific solutions.

BACKGROUND

The existing residential structures/improvements were constructed in 1957 prior to the formation of the California Coastal Act of 1976. The property is located on an elevated terrace approximately 160 feet above the beach, at approximately elevation 164 feet msl. The subject property is located on an elevated terrace mapped on regional geologic maps as Quaternary Terrace (Qt) deposits. Santa Margarita Sandstone (Msm) and Santa Cruz Mudstone (Msc) are mapped in the vicinity. The Qt deposits, which consist of clay, silt, and gravel, form the bulk of the bluff down to the beach. Surface drainage

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and unmitigated neighboring ground disturbance appears to accelerate the raveling of the bluff. The Qt deposits overlie what appears to be either Msc and/or Msm along a subhorizontal contact approximately 10 feet above the beach. Field observations and review of historical aerial images by others (Settgast, 2005) for the area have suggested that the area has endured episodic retreat and/or landsliding in addition to general localized bluff erosion to the south, east, and west of the subject property.

Our firm had submitted a geotechnical evaluation report for the existing stabilization structure in an 8/27/07 report, which included our design, our criteria and our calculations. We also monitored drilling and tieback testing in respective 8/7/07 & 11/29/07 reports. Copies of these three reports are attached. The original 2007 stabilization structure has functioned well even through unseasonable rains despite earth slippage downslope from this structure. Without its support, a substantial segment of the sea-cliff and much of the level terrace above would have been lost. A segment of the bluff just east of the 2007 upgrade, which had not been upgraded, had moved during these storms.

PRELIMINARY OPINION

The property is being undermined by encroaching geologic events from neighboring properties. Based upon our field observations and our understanding of similar phenomena, it is our opinion that the progressive failures along the eastern property boundary is driven by long-term surficial runoff and problematic site disturbance associated with improper usage of the neighboring property. In addition, the western bluff portion of the subject property has been adversely impacted by unintentional consequences of the permitted wall located on the 105 Terrace property to the west. In its current state, the bluff would experience significant landsliding if untended. It is also our opinion that subsurface drainage at the top of the bluff is contributing to the degradation of the hillside. Natural erosion coupled with weather- and wave-driven erosion at the base of the bluff are also occurring near the project site. The impacts to existing structures due to the above can be mitigated with appropriate structural solutions.

Three California registered Geotechnical Engineers participated in the formulation of appropriate urgent measures. The three are William W. Moore, Robert H. Settgast & Paul Torikian. All three are senior very experienced geotechnical engineer with extensive Marin County experience. It is our opinion that a do-nothing option (no construction) would put the primary structure at 8 Ocean (as well as the residence at 105 Terrace) and associated infrastructure (including foundations, onsite septic systems, and other physical improvements) at risk. We have evaluated other options for prevention of further drainage erosion and determined that retention of the immediate slope utilizing buried piers is the only practical, feasible, and thus least impactful solution. Other options, including site drainage alone, above-ground retaining walls or other multi-tiered

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walls would not extend far enough to bedrock to arrest ongoing surface or subsurface conditions or cause significantly more ground disturbance.

PROPOSED PROJECT

The bluff on the ocean front of 8 Ocean Ave has been identified as an active slide area part of the receding coastline. Two retaining walls have been constructed on an emergency basis; first a 64 ft. pier and tie-back system constructed in 2007; the second, a 140-foot long pier and tie-back system completed in the fall of 2019. Each pier system included steel, reinforced concrete beams, and a tieback cable system to mitigate emergency landslide situations consisting of 18" concrete piers connected with an 18"x30" grade beam and tie backs from 30 to 55 feet long installed back into the natural soils and bedrock. The southeast wall is in response to a 2006 event and the southwest wall was an emergency response developed in the spring of 2019 when a portion of the rear yard (facing the ocean) moved during a high intensity rain event. As described below, improvements from neighboring properties encroached onto the subject property causing unintentional erosion and land sliding. The 2007 wall was constructed in response to increase erosion events due to the eastern adjacent property that threatened the existing residence. The 2019 wall was constructed due to an unexpected event due to high rains in the 2018-2019 winter/spring. Had the walls not been located where constructed, it is likely that the property would have experienced significant erosion that could quickly compromise the integrity of the main residence within one storm season.

We also recommend including an additional portion of the wall to provide stabilization for the recent slippage by extending the existing system eastward about 9 ft along the property boundary of 20 Ocean Avenue. The same criteria, used for the existing system, will be continued for the new extension. This entails an approximate 9 ft extension of the existing deepened grade beam with two drilled piers and a single tieback.

Because the 2007 improvement has performed well for 13 years, the design was quickly adopted for the new 2019 project and is expected to perform effectively. While connecting pier systems on both east and west sides of the subject property was a consideration, we elected to focus first on curtailing further deterioration of the failing slope. There is a land area between the two improvements that protrudes south towards the ocean. Visual observation indicates that erosion is occurring to the west and east of this area, thus necessitating the emergency work in the areas as proposed/constructed. It is our professional opinion, that connecting these two areas is not needed to ensure protection of the residential structure for 40-years plus. However, without the construction of the two pier systems where located, the site conditions and erosion patterns would be quickly exacerbated, and accelerated erosion would be likely.

All improvements or construction would occur within the 8 Ocean Avenue property boundary. Spoils from the grade beam and drilled pier construction will be placed as

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engineered fill /upslope from new improvements as shown on the site and drainage plan. The disturbed areas would then be restored with native vegetation when construction is complete. Other controls for surface drainage and roof downspouts will be implemented and routed to areas north and northeast of the site to reduce the amount of surface erosion and site infiltration. The rear yard of 8 Ocean Avenue slopes away from the bluff face, so natural drainage will direct stormwater flows away from existing and proposed improvements.

With respect to mitigation of erosion and its effect on sediment supply, the construction of the buried retaining soldier pier and tieback system will not cause adverse impacts to the shoreline sand supply. The soldier pier system itself is buried, will not be exposed to wave action, and is intended to protect the top of the bluff; it is not an armoring of the shoreline. Furthermore, the beach below is an emergent shoreline where wave action is directly in contact with bedrock, which contributes to the narrowness of the beach. The sand that exists is a thin veneer that mantles resistant bedrock; bedrock is visible in aerial photographs along the shoreline throughout the area. The base of the bluff on the subject property is in close proximity to Canyon creek which runs to the east of Canyon Road. The creek provides a sustained source of sediment that will continue to sustain the beach and will not be impacted by the improvements.

Conventional track mounted LoDrills or Limited Access Rigs access the site and can drill piers at the subject property via access through a small dirt driveway off Ocean. Staging and material and equipment storage would occur via an existing unpaved equipment access path (see Sheet C1). Soil stockpile and laydown areas for excavation materials would occur in areas away from sensitive bluff areas. A construction management plan has been provided as sheet CMP-1.

Per civil engineer Paul Krohn, P.E., the visual appearance of the 2007 improvement is due to bags of cement which with exposure to the elements has hardened similar to concrete. These types of "sack" walls have been used extensively to stabilize road cuts/embankments in Marin County and have excellent longevity). The area covered by the "bags" is approximately 20' x 30' or 600 square feet.

Please see the attached Plan Sketch (by William Moore, G.E.) and reference drawing by Paul Krohn, P.E. The sketch shows the approximate location of the scarp created by the march 2019 landslide /abrupt drop, as well as approximate distances to the residences, 45 & 50 feet. The new system is shown with the existing system on the Fig 1 from the 2007 report (see Attached Plans: Sheet C-1).

CONSIDERATIONS FOR PERMITTING AND CONSTRUCTION

Pursuant to Marin County Development Code (MCMC) Interim § 22.57.130i(k) Shoreline Protection, we have evaluated potential shoreline protective works for code consistency. Based on observations of geologic site conditions, analysis of historical aerial photos, and review of prior studies in the area, the natural rate of bluff retreat near the project

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site has been receding at a steady rate estimated to be 1 to 2 feet per year (see Salem-Howes report).

It is our professional opinion that non-engineered construction activities on the bluff face area of the adjoining property as well as a neighboring permitted wall encroaching onto the western rear yard have created unnecessary and excessive drainage conditions resulting in escalated erosion in the area. Given the existing conditions adjacent to the subject property, and pursuant to MCMC § 22.57.130i(k)(2), shoreline protective works are allowable based on the following criteria:

2. *Standards and requirements for shoreline protective works. Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline process shall be permitted only when:*
 - a. *Required to serve coastal-dependent uses or to protect existing structures (constructed before adoption of the LCP).*
 - b. *No other nonstructural alternative is practical or preferable.*
 - c. *The condition causing the problem is site specific and not attributable to a general erosion trend, or the project reduces the need for a number of individual projects and solves a regional erosion problem.*
 - d. *The structure will not be located in wetlands or other significant resource or habitat area, and will not cause significant adverse impacts to fish or wildlife.*
 - e. *There will be no reduction in public access, use and enjoyment of the natural shoreline environment, and construction of a structure will preserve or provide access to related public recreational lands or facilities.*
 - f. *The structure will not restrict navigation, mariculture or other coastal use and will not create a hazard in the area in which it is built.*

Per the Marin County Assessor's records, and stated above, the existing residence at 8 Ocean Avenue was constructed in 1957, prior to the drafting of the California Coastal Act. It is our professional opinion that no other alternative is feasible or practical and that site observations indicate the major contributor to erosion is site specific due to surface and sub-surface drainage complications from adjacent sources, including non-engineered construction activities. As determined through historical aerial investigation, site visits, and visual observations of unmitigated site disturbance, it is clear that the activities at the neighboring property (20 Ocean Avenue) were the primary cause of landsliding and erosion activity on the subject property. In order to arrest the dangerous conditions adjacent to the site, the 2007 pier system was constructed in its present location specific to stopping further issues. Pursuant to the geotechnical reports prepared by Sett gast (1/31/19) and Moore (5/14/19), the 1-2 foot per year retreat rate

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was determined through historical aerial evaluation and site observations. Given the 40-year life span of the main residence, this retreat rate couples with unmitigated off-site ground disturbance, would complicate the integrity of the residence which could eventually succumb to bluff erosion if not arrested through development of the pier system. Background information is also provided which includes bluff observation information from Salem Howes in 2006.

The construction of the underground piers will prevent near-term erosion issues for this portion of Ocean Avenue and would potentially eliminate the need for multiple individual projects. No wetlands or sensitive plant or animal species are located in the area of potential disturbance. No tree removal is required for construction of the proposed piers and grade beam extension

Furthermore, there is no public access to the shoreline below where proposed improvements would be constructed, and the proposed improvement would not result in impacts to navigation, maricultural or any other coastal use. Finally, construction is expected to only occur from the elevated portions of the properties, and no construction impacts would be required on the bluff face or at beach level. The buried piers will help protect the slope from future failure for both properties (105 Terrace and 8 Ocean) and reinforce an area of slope that is susceptible to subsurface water seepage in an area where man-made drainage complications and sub-standard site disturbance (20 Ocean) have sped up the natural erosion process.

Summary

The 2007 pier system was constructed to shore up movement spurred by the non-engineered construction activities and excessive drainage on the adjacent property (20 Ocean Avenue). At the time, earth movement activities on that parcel were contributing to excessive movement on the 8 Ocean Avenue property. Due to the topography of the subject property, and the activities located on the adjacent parcel, the 2007 improvement was specifically located in order to arrest erosion that would compromise the main residence at 8 Ocean Avenue. The accelerated erosion caused by 20 Ocean Avenue is evident based on historical aerial evaluations, site observations, and lack of planning or building permit compliance. In addition, a proposed nine-foot extension (perpendicular to the bluff face) will minimize site disturbance at 20 Ocean Avenue. Furthermore, the permitted improvement on 105 Terrace has encroached onto the western rear yard without an engineered termination point. As such, a significant land movement that occurred on the subject property jeopardizes both the subject property and the 105 Terrace residence. The 2019 improvement provided a proper resolution and created one site-specific system for both properties. Bluff recession and the associated landslides do not occur on a regular predictable schedule. Recession may be zero for a number of years and may be 15 or 20 feet during one or two harsh weather years. Useable life of structures may be significantly extended by construction of pier systems and improving drainage. No other possible improvement would arrest erosion in these locations.

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existing slope conditions for the rear yard area, such that surface drainage is directed away from the bluff thus reducing the overall surface and subsurface drainage conditions contributing to bluff erosion. Finally, it has been noted that site disturbance continues at 20 Ocean Avenue, including significant vegetation removal along the bluff face (see photo attached).

After review and consideration of these concepts, please do not hesitate to call me at (707) 373-5438 or contact me via email at wwm110@sbcglobal.net if you have questions or comments regarding the proposal suggested above.

Sincerely,



The seal is circular with the text "REGISTERED PROFESSIONAL ENGINEER" around the top edge and "STATE OF CALIFORNIA" around the bottom edge. Inside the seal, it reads "WILLIAM WEBBER MOORE", "No. GE-615", and "Exp. 06-30-21".

William W. Moore

Robert H. Settgast

CC: Sean Kennings, LAK Associates
Martin Casado / Leilei Shei, owners



The seal is circular with the text "REGISTERED PROFESSIONAL ENGINEER" around the top edge and "STATE OF CALIFORNIA" around the bottom edge. Inside the seal, it reads "ROBERT SETTGAST", "No. GE000764", and "Exp. 6/30/19".

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