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August 5, 2022

Kirk Saunders
1847 Rim Rock Canyon Road
Laguna Beach, California

Project No: 72671-00
Report No: 22-9189

Subject: **Limited Geotechnical Feasibility Investigation**
Future Residential Development
1845 Rim Rock Canyon Road
Laguna Beach, California

Dear Mr. Saunders:

In accordance with your request, this report presents our results and findings of a geotechnical investigation of the feasibility of future development of the subject vacant property pending the approval of a proposed lot split. Our investigation is based on our previous work in the area and other pertinent reports by others for the subject lot (Appendix A, References).

This report is considered preliminary as it precedes the development of architectural, foundation, and grading plans, the formulation of which are partially dependent upon the findings presented herein. Following approval of the lot split and the proposed architectural design, supplemental analyses will be required to develop updated geotechnical recommendations specific to the proposed design and consistent with the current building code.

Scope of Investigation

The investigation included the following:

1. Review of geotechnical literature including certain published regional reports and maps regarding this and nearby properties.
2. Engineering evaluation of the findings presented in local reports with regard to the geotechnical conditions underlying the subject property
3. Preparation of this feasibility report presenting the findings and conclusions of the study, offering conceptual recommendations pertinent to the design and construction of a future residential development.

Accompanying Illustrations and Appendices

Figure 1 - CDMG Geologic Location Map
Figure 2 - CDMG Seismic Hazards Map
Figure 3 - CGS Landslide Inventory Map
Appendix A - References

Site Description

Based on the tentative parcel map prepared by Rosell Surveying and Mapping, Inc., the proposed, irregularly shaped 0.71± acre vacant lot (Parcel 2) fronts 85± feet along Rim Rock Canyon Road and extends southeasterly roughly 200± feet to the rear property boundary. Topographically, the lot is generally comprised of a southerly-facing natural slope that descends at ratios generally varying between 1½:1 and 2½:1 (horizontal:vertical) with total relief estimated at 60± feet. The slope descends at similar ratios onto the adjoining developed residential lots south of the rear property boundary.

Proposed Development

Conceptual plans have not been developed and are awaiting approval of the proposed lot split. Proposed site development is otherwise anticipated to include the construction of a multi-level single-family residence notched partially into the descending onsite slope. The future residence as well as other significant exterior improvements such as a swimming pool are anticipated to be supported on a caisson foundation system, design to resist a lateral load, constructed in bedrock below the landslide deposits.

GEOTECHNICAL CONDITIONS

Geologic Setting

Rim Rock Canyon is located within a seaward slope of the San Joaquin Hills, which are underlain in the site vicinity by Miocene Age sedimentary bedrock strata. The San Joaquin Hills were formed by uplift due to regional tectonic forces acting on this region of southern California during the late Pliocene and Pleistocene. Numerous canyons, including Rim Rock Canyon and nearby Bluebird Canyons, have been deeply incised into the San Joaquin Hills by natural erosional processes during this uplift.

Earth Materials

Based on our review of regional geologic maps and previous onsite and nearby reports, the property is underlain at depth by bedrock strata of the Topanga Formation of Miocene age, which are overlain by landslide deposits, colluvium, and artificial fill.

Previous onsite and nearby explorations indicate landslide deposits, which are estimated to be up to 20± feet deep below the lot, are generally comprised of highly weathered, weakly cemented clasts of Topanga Formation sandstone and siltstone. The overlying colluvium, which is estimated to range in thicknesses between 5 and 9± feet, are generally comprised of a weathered landslide clasts in a matrix of clayey residual soil. Artificial fill soil has been mapped to underlie the upper portion of the lot near the street and is estimated to range up to

5± feet deep. Fill soil is generally comprised of locally derived colluvium and landslide deposits.

In general, the existing fill, colluvium, and landslide deposits are considered unsuitable for the support of foundations supporting significant structures. Proposed significant structures are recommended to be supported on a caisson foundation system constructed in bedrock.

In general, onsite earth materials are anticipated to excavate with conventional earth-moving and drilling equipment in good repair.

Slope Stability

Based on a review of published maps, the property is located within a mapped landslide by the CGS and is located within a CDMG seismic hazard study zone for possible landsliding. Previous investigations for the site and nearby areas support the interpretation that the site and downslope properties are underlain at depth by ancient landslide(s). Existing data also suggest the subject site is underlain by other geologic conditions promoting shallow slope instability and erosion.

Previous slope stability analyses indicate the property does not currently possess adequate factors of safety for new residential construction. However, development is considered feasible provided a caisson foundation system constructed in bedrock below the landslide and designed to resist a lateral load to achieve adequate factors of safety in accordance with the CBC and SP117A is utilized.

Groundwater

Groundwater was not encountered during previous onsite and nearby subsurface explorations and is not considered a constraint affecting the design or construction of proposed site improvements.

Surficial Runoff

Existing surface runoff is generally uncontrolled. Site development is anticipated to include improved site drainage designed by a licensed civil engineer in accordance with California Building Code.

Seismic Considerations

Published Studies

One of the principals of seismic analyses and prediction is the premise that earthquakes are more likely to occur on geologically younger faults, and less likely to occur on older faults. For many

years studies have described faults with Holocene movement (within the last 11,000 years) as "Active", and faults with documented Pleistocene movement (within the last 1.6 million years) and with undetermined Holocene movement as "Potentially Active". Informally, many studies have described faults documented to have no Holocene movement as "Inactive". Recent geologic and seismic publications are attempting to clarify the nomenclature describing faults to more accurately represent the potential affects from earthquakes.

Reports by the California Division of Mines and Geology indicate faults with documented Holocene or Historic (within the last 200 years) movement should be considered Active. However, Potentially Active faults are more appropriately characterized in terms of the last period of documented movement. The Fault Activity Map of California (Jennings, C.W.; 1994) defines four categories for onshore Potentially Active faults. The categories are associated with the time of the last displacement evidenced on a given fault and are summarized in Table 1.

Table 1, Definitions of Fault Activity in California

Activity	Category	Recency of Movement
Active	Historic	Within the last 200 years
	Holocene	Within the last 11,000 years
Potentially Active	Late Quaternary	Within the last 700,000 years
	Quaternary	Within the last 1.6 million years
	Late Cenozoic	Possibly within the last 1.6 million years
	Pre-Quaternary	Before the last 1.6 million years

It is important to note these categories embrace all Pre-Holocene faults as Potentially Active, and provide no methodology to designate a given fault as "Inactive". Although the likelihood of an earthquake or movement to occur on a given fault significantly decreases with inactivity over geologic time, the potential for such events to occur on any fault cannot be completely eliminated within the current level of understanding.

Local and Regional Faults

The closest published active fault to the site is the offshore extension of the Newport-Inglewood Fault Zone, approximately 3.0 miles west, (Blake, T.F., 2000, CGS/2004). Other active faults in the vicinity include the San Joaquin Hills Fault, approximately 3.9 miles from the site, the Palos Verdes Fault, approximately 17.8 miles to the northwest, the Coronado Bank Fault, approximately 20.6 miles to the south, and the San Andreas Fault, approximately 52.6 miles to the northeast.

The Newport-Inglewood Fault zone is indicated in published reports as being a Potentially Active and Quaternary fault, (Jennings, C.W.; 1994). This interpretation is not universally shared, as portions of the Newport-Inglewood Fault are included as a potential seismic source in

the computer programs utilized to model ground motions for this study, (Blake, T.F.; 2000). With the fault's location approximately 3.0 miles to the west, it is, in our opinion, appropriate to include this portion of the fault as a causative seismic feature.

The California Geological Survey updated the Fault Parameters and Earthquake Catalog for the probabilistic Seismic Hazards Maps, (Cao, T., et. al., 2002). This update included the addition of the "San Joaquin Hills" blind thrust fault, theorized to exist from Newport Beach to Dana Point, and ramping up inland to the Irvine area, immediately underlying the site. Earthquakes of significant magnitude (M6.6) are presently postulated for this structure and, based on seismological computer data files, it is calculated as the most significant seismic source to affect this site.

Historic Ground Motion Analyses

Utilizing attenuation relationships (Bozorgnia, et al.; 1999, unconstrained/soft rock), one can estimate the ground motion history of the site. The study indicates the maximum site acceleration from 1800 to 1999 was approximately 0.15g and occurred during a magnitude 6.3 Long Beach Earthquake 12.8 miles from the site on March 11, 1933.

It is noted that the estimation of peak ground acceleration presented above is provided for the interest of the client and is required by local (City or County) review agencies. The value derived is not directly utilized in structural design of residential structures. Seismic parameters for use by the structural engineer will be provided a future geotechnical specific to the design of the approved architectural plans.

Secondary Seismic Hazards

The Seismic Hazards Zones Map (CDMG, 1998) for the Laguna Beach Quadrangle, Figure 2, indicates this lot is not located within a "zone of required investigation" for earthquake induced liquefaction, but is within a zone mapped for landsliding. Please refer to the Slope Stability section above for a discussion of slope instability.

Other secondary seismic hazards can include deep rupture and shallow ground cracking. With the absence of active faulting onsite, the potential for deep fault rupture is not present. The potential for shallow ground cracking to occur during an earthquake is a possibility at any site, but does not pose a significant hazard to site development.

CONCLUSIONS

1. Development of the subject lot is considered geotechnically feasible provided the recommendations of a supplemental geotechnical report are followed during the design, construction, and long-term maintenance of the subject property. Proposed construction

should not adversely affect or be affected by adjacent properties provided appropriate methods and care are utilized by the builder.

2. The property is underlain at depth by bedrock strata of the Topanga Formation, which is successively overlain by landslide deposits, colluvium, and local artificial fill.

3. The site is located within an ancient landslide based on regional landslide inventory map published by the California Geological Survey. Previous onsite and nearby geotechnical investigations support this interpretation.

4. The lot does not currently possess adequate factors of safety against slope instability based on previous analyses. Slope instability, however, is not anticipated to negatively affect the proposed development supported on a caisson foundation system designed in accordance with our pending geotechnical recommendations.

5. Groundwater was not encountered during our subsurface investigation and is not considered a constraint affecting the design or construction of repairs or improvements.

6. Surface runoff is generally uncontrolled and may contribute to shallow slope instability during or following periods of heavy rain. Site development is anticipated to include improved drainage as designed by a licensed civil engineer.

7. No potentially active faults are known to transect the site and therefore the site is not expected to be adversely affected by surface rupturing. It will however, be affected by earthquake ground motions during the design life of the residence.

8. In general, onsite earth materials may be excavated with conventional earth moving equipment in good repair.

9. The proposed development may be supported on a caisson foundation system constructed in bedrock below the landslide and designed to resist a calculated lateral load. Tieback reinforcement may be necessary pending supplemental evaluation by a structural engineer.

10. Following approval of the proposed lot split and the preparation of conceptual architectural plans, a supplemental investigation will be required to development geotechnical recommendations specific to the proposed design.

RECOMMENDATIONS

Following approval of the proposed lot split and the preparation of conceptual architectural plans, a supplemental geotechnical investigation will be required. The supplemental investigation is anticipated to include updated analyses to provide lateral loading as well as other

geotechnical parameters necessary for the appropriate civil and structural engineering of the residential development.

LIMITATIONS

This investigation has been conducted in accordance with generally accepted practice in the engineering geologic and soils engineering field. No further warranty is offered or implied. Conclusions and recommendations presented are based on subsurface conditions encountered and are not meant to imply a control of nature. As site geotechnical conditions may alter with time, the recommendations presented herein are considered valid for a time period of one year from the report date. The recommendations are also specific to the current proposed development. Changes in proposed land use or development may require supplemental investigation or recommendations. Also, independent use of this report in any form cannot be approved unless specific written verification of the applicability of the recommendations is obtained from this firm.

Thank you for this opportunity to be of service. If you have any questions, please contact this office.

Respectfully submitted,

GEOFIRM

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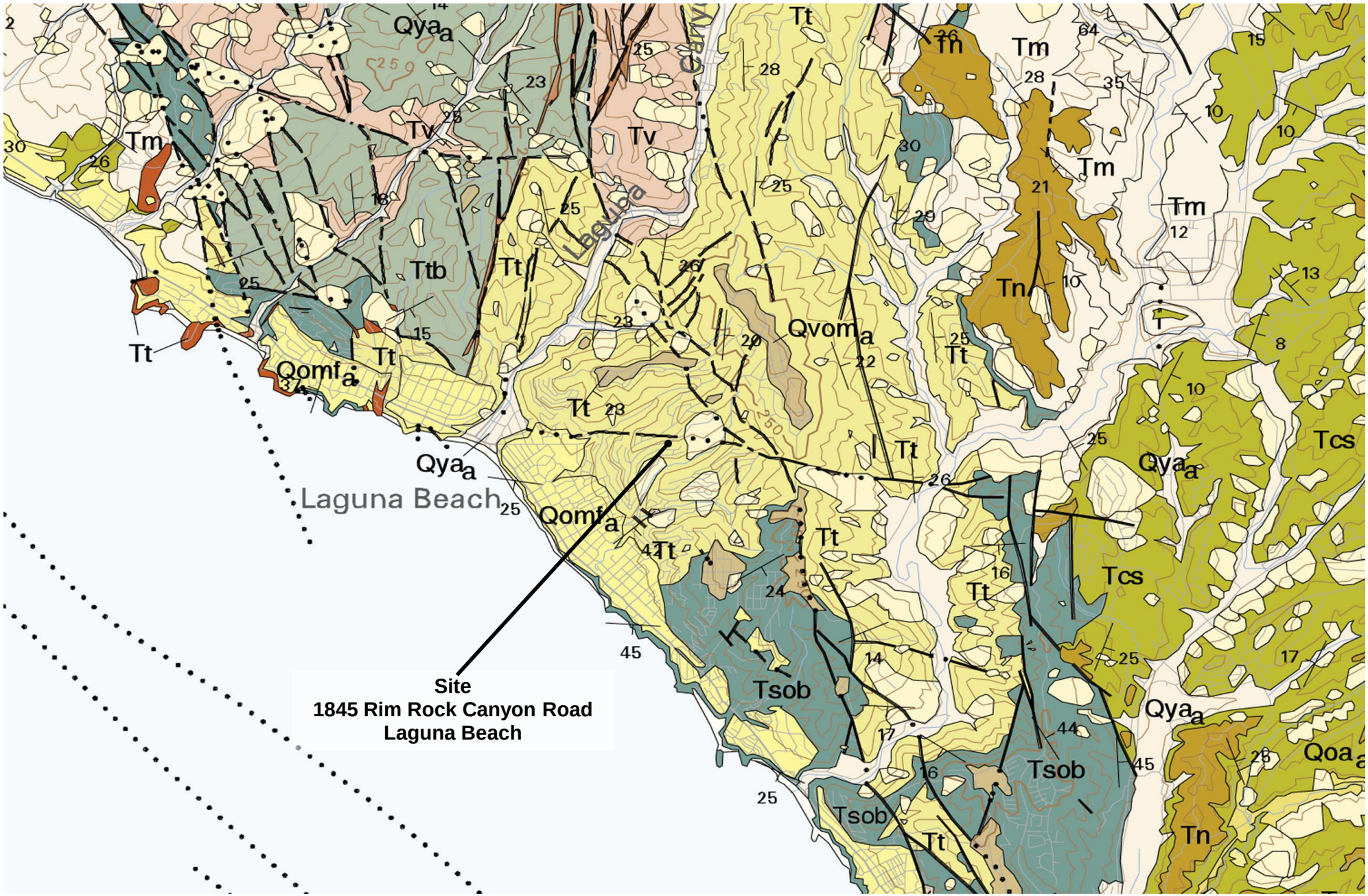
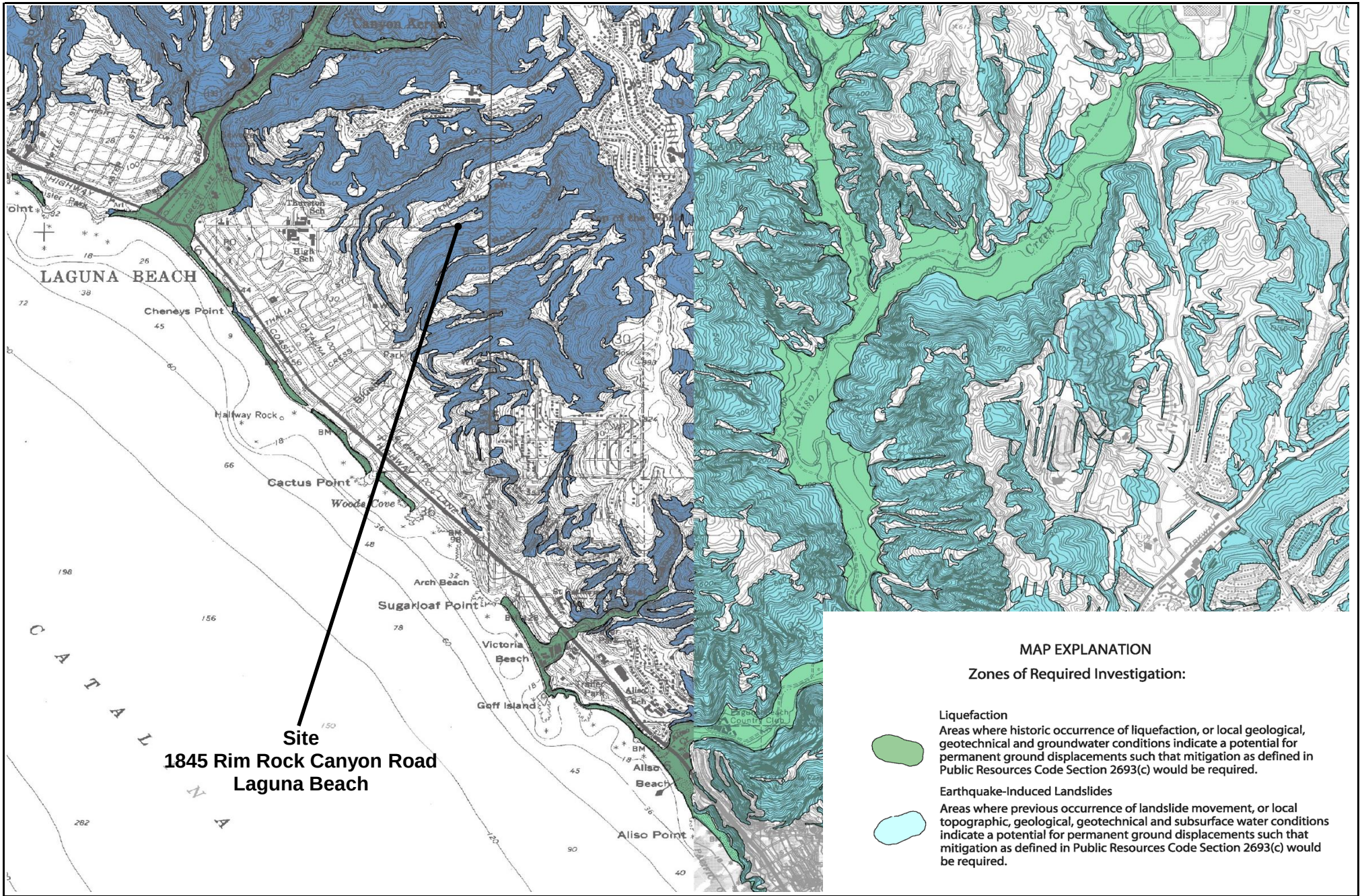
ERH/mr

Distribution: Addressee via email



Geofirm	**USGS Geologic Location Map, Santa Ana 30' x 60' Quadrangle**		
JOB NO.: **72671-00**	DATE: **August 2022**	FIGURE: **1**	



CDMG Seismic Hazards Map, San Juan Capistrano and Laguna Beach Quadrangle

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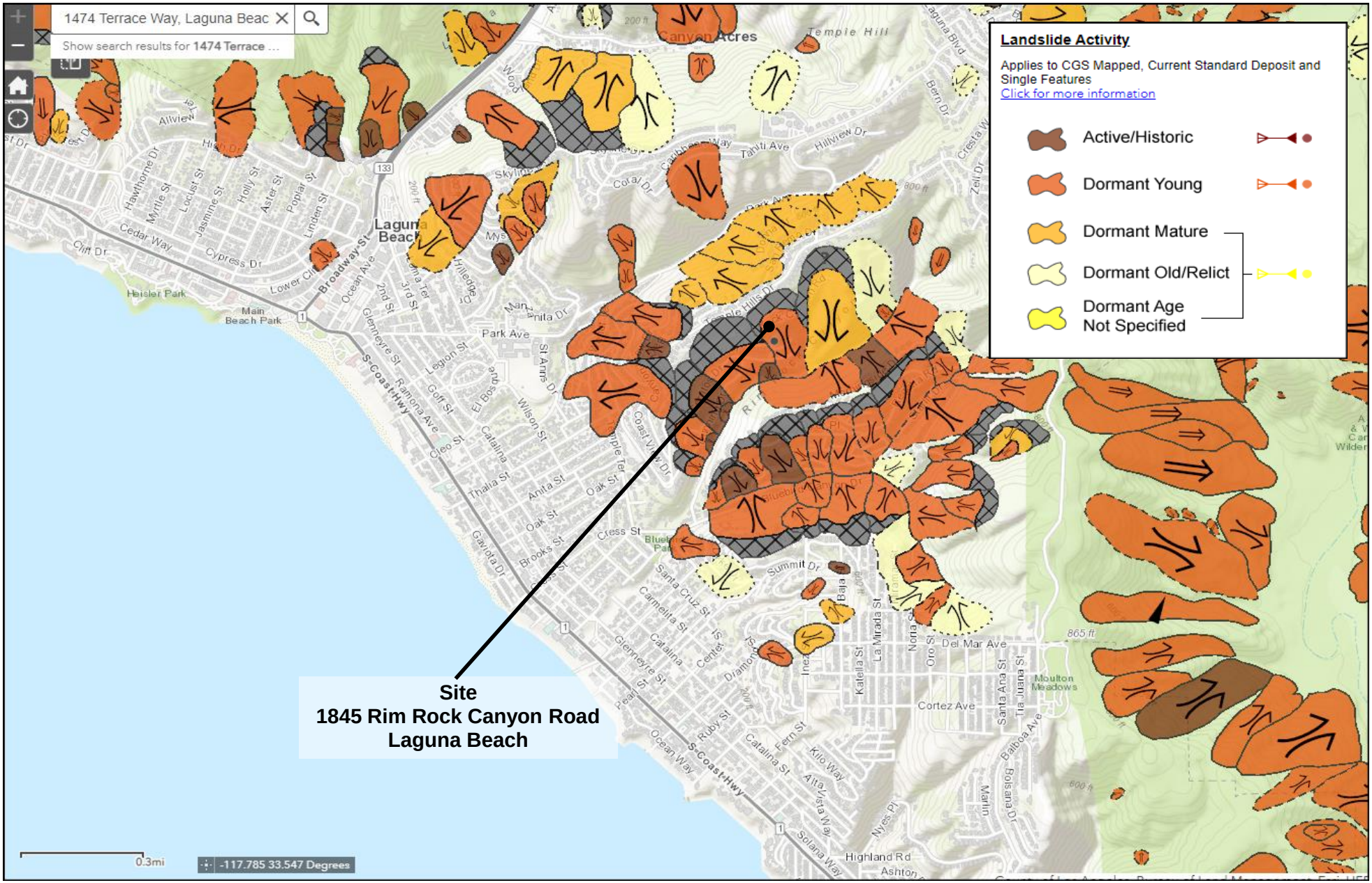

CGS Landslide Inventory Map, 2015

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APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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