

**Appendix D –
Geology Summary Report
Prepared by American Geotechnical, Inc. dated March 12, 2014**

March 12, 2014

File No. P33366-03

Yorba Linda Estates, LLC
7114 E. Stetson, Suite 350
Scottsdale, AZ 85251

Subject: **SUMMMARY OF GEOTECHNICAL EXPLORATION AND ENGINEERING ANALYSIS –
ESPERANZA HILLS DEVELOPMENT**
Unincorporated Northeast County of Orange, California

Gentlemen:

Per your request, we have prepared this summary of completed field investigation and engineering analysis for the subject project through March 2014. To date, a majority of investigatory work has focused on the Simmons and Yorba Linda Estates parcels of the greater development area, and an alignment of access/egress connecting with San Antonio. The purpose of exploration has been to satisfy 100-scale tentative-tract-level application and approval.

Conceptual design plans for the subject parcels include construction of approximately 218 residential building lots, a buried domestic water tank and pump/booster station pads, 12-inch water main pipelines, multiple WQMB basins and 54- and 78-inch underground storm drain pipelines, parks, a small bridge, internal roadways, emergency fire access roads and large retaining walls. Development is to be accomplished through use of conventional cut and fill earthwork grading methods using heavy earthmoving equipment. Slopes are to be constructed at ratios of approximately 2:1 (horizontal:vertical).

Equipment access is so limited in certain canyon areas we propose use of hand-excavated test pits and track-mounted Bobcat trenching equipment to best explore these areas.

EXPLORATION BY OTHERS

A Geologic Constraints and Estimated Thickness of Alluvium and Landslide Debris Map specific to the property for a former development plan was prepared by Earth Consultants International in 1998 (ECI, 1998). The map is based on field mapping and a review of available geologic reports and former maps.

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The ECI work was followed in 2002, by excavation of a series of 39 backhoe pits to a maximum depth of 15 feet conducted by Allan E. Seward Engineering Geology, Inc. (Seward, 2002). No specific development plan was considered as part of this work. Seward carried forward and updated the data presented on the ECI map. The locations of Seward trenches and geologic mapping are depicted on the current American Geotechnical (AG) map.

EXPLORATION BY AG

In 2012, AG published a Fault Hazard Assessment Report for a segment of the Whittier Fault that crosses the southerly margins of the subject development (AG, 2012). The scope of work employed during that study included a comprehensive review of available geologic literature including regulatory agency files, our in-house library, on-line resources, published geologic reports, geologic and geotechnical maps, cross sections and professional consultant fault studies and mass grading reports prepared for nearby areas. Also reviewed were stereo-pairs of historical aerial photographs, geomorphic landforms related to faulting, and a LiDAR imagery flown specifically for the subject property.

The fieldwork phase of work included reconnaissance geologic mapping and preparation of a 400-scale geologic map incorporating applicable existing surface and subsurface geologic conditions by all previous investigators. Subsurface exploration included excavation and detailed logging of six fault trenches at a scale of 1-inch equals 5 feet, totaling over 2,500 feet in length and extending up to a maximum depth of 20 feet. The locations of the trenches and results of geologic logging are depicted on the attached map. Each trench was photo-documented using digital photography. Each trench was observed by professional peers including California State Certified Engineering Geologists employed with Seward Engineering Geology, Inc., California Geologic Survey, and County of Orange. The interpretations of geology exposed in the trenches, including the location of the main strand of the Whittier Fault, were discussed and found to be in agreement among the geologists who viewed them, and the fault report approved by the County of Orange. A seismic setback zone was established along the northeast of the fault ranging from 50 to 120 feet in width. The layout of residential lots for the development was based on the findings of the study and location of the setback zone.

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Prior to collection of in-situ bedrock samples, we conducted several preliminary slope stability analyses using strength data from the nearby Casino Ridge Development. The sections are noted as A-A', D-D', H-H', N-N', O-O' and K-K'. It is important to understand that these analyses were not conducted using site specific data. The purpose of these analyses was to provide the client with a general understanding of remedial grading requirements, knowing future site-specific testing would be necessary to derive more pertinent conclusions.

Additional subsurface field exploration activities were conducted by AG for the purpose of evaluating the 100-scale conceptual design for the development. These activities commenced with excavation of 112 shallow test pits which were excavated manually between May and June of 2013. The pits were followed by excavation of 51 deeper trench excavations using a mini-backhoe, accomplished during June of 2013. Subsequent to these activities, still deeper exploration was performed using a combination of 9 truck- and 11 track-mounted "LoDrill" bucket-auger drill-rigs. The track-mounted borings were drilled between July and August of 2013, and the truck-mounted borings in September of the same year. Each of these borings was down-hole logged in detail by a Certified Engineering Geologist on staff with AG. As a result of this work, the absence/presence of several suspected larger landslides were documented and where present, their dimensions constrained. Slightly undisturbed in-situ drive samples of bedrock were obtained during drilling and transported to the laboratory in our corporate office for analysis. To date, laboratory analyses to determine shear strength, consolidation and other engineering parameters have been completed.

As noted on the attached map, a series of geotechnical cross sections were constructed through major slopes proposed under existing development plans. These sections are denoted as A-A', B-B', C-C', D-D', G-G', H-H', H2-H2', N-N', O-O' and K-K', 1-1', 2-2', 3-3', 4-4', 5-5', 6-6'. These sections are nearly in draft form but nearly complete for site-specific stability analysis.

The next step in the project will be to finalize the cross sections and perform engineering analyses to determine slope stability and formulate conclusive remedial grading recommendations.

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Should you have any questions please do not hesitate to contact our office.

Respectfully submitted,

AMERICAN GEOTECHNICAL, INC.



Jeff L. Hull, PG, CEG
Chief Engineering Geologist

JLHI

Enclosures: Plate 1
Distribution: 2 – Addressee (direct delivery)

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REFERENCES

- 1) American Geotechnical, Inc., 2012, "Fault Hazard Assessment Report, Whittier Fault Zone, Addressing a Portion of the Proposed Esperanza Hills Residential Development Project in the Southeastern Puente Hills, Unincorporated Orange County, Southern California," dated November 30, 2012; prepared for Yorba Linda Estates, LLC; Project No. 33366-01; under review by County of Orange as of the time of this proposal.
- 2) Earth Consultants International, 1998, "100-scale Geologic Constraints Map and Estimated Thickness of Alluvium and Landslide Debris, Murdock Company Properties near Yorba Linda, Orange County California," dated February 10, 1998.
- 3) Seward, Allen E., 2002, "Status Report for Geologic/Geotechnical Investigation of Yorba Linda Property," dated March 27, 2002.
- 4) Seward, Allen E., 2011, "Preliminary Geologic Report, "The Preserve", Compilation of Existing Raw Field Data from 2002, Yorba Linda, California," dated October 10, 2011.