Project No.
15358.000.000

September 14, 2018

Mr. and Ms. Schaper
1360 Fleming Avenue
San Jose, CA 95127

Subject: 1360 Fleming Avenue
San Jose, California

REVIEW OF GEOTECHNICAL AND GEOLOGIC HAZARDS

Dear Mr. and Ms. Schaper:

ENGEO has prepared this review of geotechnical and geologic hazards report at your request, regarding the proposed residential development located at 1360 Fleming Avenue in San Jose, California. This report is prepared as outlined in our proposal dated August 16, 2018.

This letter contains a summary of our document review, and conclusions for the geotechnical and geologic hazards related to potential development on the subject site. Based on our study, it is our opinion that development of the site is feasible from a geotechnical and geologic standpoint given that the property owners accepts the risk of seismically-induced landslides.

This letter was prepared for the exclusive use of Mr. and Ms. Schaper and their consultants for geotechnical and geologic hazards analysis related to project planning and design. In the event that any changes are made in the character, design or layout of the development, we must be contacted to review the conclusions to determine whether modifications are necessary. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without our express written consent. If the decision is made to move forward with the proposed improvements, ENGEO can certainly make further recommendations on grading and foundation design.

PROJECT DESCRIPTION

Based on the information provided, we understand that the proposed development will include a single family residence, a pool house and a tractor barn. The exact square footage of the proposed residence is unknown, while the proposed pool house and tractor barn each have estimated square footages of approximately 6,025 square feet. Preliminary plans also show an access road leading from the existing access road to the residence.

REVIEW OF EXISTING INFORMATION

We reviewed relevant information regarding geotechnical and geological aspects of the site, including:

- Aerial photographs from various years starting in 1948 (see references for details).
- Available published geologic maps and reports (see references for details).
- A previous Geologic Hazards Evaluation and Soil Engineering Report by Earth Systems Consultants, dated July 31, 2000.

Aerial Photograph Review

Review of historic aerials indicates that most of the existing buildings were built prior to 1948. The aerials also show that the site used to be surrounded by a large number of orchards, which largely remained in place until 1993. The photographs indicate that the site has largely remained the same since 1948, with only a small increase in the footprint of the farm.

GEOLOGY AND SEISMICITY

Regional Geology

The site is located within the Coast Ranges geomorphic province of California. The Coast Ranges province is typified by a system of northwest-trending, fault-bounded mountain ranges and intervening alluvial valleys. More specifically, the site is located in the foothills of the Diablo Range, a subrange of the Pacific Coast Ranges. At the foothills of these mountains, the combination of dissected hills and weak rocks has produced widespread and abundant landslides.

Bedrock in the Coast Ranges consists of igneous, metamorphic and sedimentary rocks that range in age from Jurassic to Pleistocene. The present physiography and geology of the Coast Ranges are the result of deformation and deposition along the tectonic boundary between the North American plate and the Pacific plate. Plate boundary fault movements are largely concentrated along well-known fault zones, which in the area include the San Andreas, Hayward, and Calaveras Faults, as well as other lesser-order faults.

Site Geology

Landslides

Mapping by Wiegers (2011) shows that the site is located on a dormant – mature rock slide with a landslide immediately to the north east. As such, the observed landforms related to the landslide have been smoothed and subdued by erosion and vegetation. The sliding most likely occurred at the base of a rock mass along one to several relatively thin zones of weaknesses.

Monterey Formation (Tm)

Dibblee (2005) mapped the site within the Claremont Shale Member of the Monterey Shale. The Monterey Shale is described as a siliceous shale, white-weathered, thin bedded and of late Miocene age.

Faulting and Seismicity

The California Geological Survey (CGS) indicates that the site is located within a seismic landslide zone. Similarly, Parrish (2001) maps the site in seismic hazard zone. Specifically, the site is mapped in an earthquake-induced landslide zone which indicates a potential for permanent ground displacement such that mitigation would be required.

Because of the presence of nearby active faults[1], the Bay Area Region is considered seismically active. Numerous small earthquakes occur every year in the region, and large (greater than

---

[1] An active fault is defined by the California Geological Survey as one that has had surface displacement within Holocene time (about the last 11,000 years) (SP42 CGS, 2007).

Moment Magnitude 7) earthquakes have been recorded and can be expected to occur in the future. Figure 5 shows the approximate location of active and potentially active faults and significant historic earthquake epicenters mapped within the San Francisco Bay Region. Based on the 2014 update of the national seismic hazards maps, Table 1 below shows the nearest known active faults capable of producing significant ground shaking at the site.

TABLE 1: Active Faults Capable of Producing Significant Ground Shaking at the Site

FAULT NAME	DISTANCE FROM SITE (MILES)	MAXIMUM MOMENT MAGNITUDE
Calaveras	2.8	7.0
Hayward-Rodgers Creek	6.8	7.3
Monte Vista-Shannon	11.0	6.5
Greenville Connected	16.7	7.0
San Andreas	17.3	8.0
Zayante-Vergeles	21.5	7.0

*Listed known active faults within 25 miles of the site.

The State of California Special Studies Zones map for the San Jose East Quadrangle also shows a trace of the Hayward fault running approximately 0.6 miles east of the property. This trace does not appear on the USGS Seismic Hazard Map website, which indicates that this trace of the Hayward produces a maximum moment magnitude of less than 7.0

The Uniform California Earthquake Rupture Forecast (UCERF3, 2014) evaluated the 30-year probability of a Moment Magnitude 6.7 or greater earthquake occurring on the known active fault systems in the Bay Area, including the Hayward fault. The UCERF generated an overall probability of 14.3 percent for the Hayward fault.

Groundwater

There was no publicly available groundwater data for the site. In general, the topography of the site suggests that groundwater would exist at significant depths greater than 30 feet.

USDA Soil Survey

According to the United States Department of Agriculture (USDA) Soil Survey the site is potentially underlain by two soil types: Diablo clay, and Alo-Altamont complex. It should be noted that all of the data compiled by the USDA are estimates and approximations and actual values should be obtained with site-specific exploration.

Diablo clay (15 to 30 percent slopes)

This soil unit underlies approximately 85 percent of the property and is categorized as a fat clay (CH) with a Group C rating. Typically, Diablo soils have a dark gray, neutral and mildly alkaline silty clay upper A horizons, gray and olive gray, calcareous, silty clay lower A horizons, and light olive gray, silty clay AC and C horizons. It is noted to have a low corrosion rating for concrete and a high corrosion rate for steel. It is rated as very limited suitability for shallow excavations. The Plasticity Index (PI) is estimated at 38, indicating a high susceptibility to shrink and swell due to variation in moisture content.

Alo-Altamont complex (30 to 50 percent slopes)

This soil unit underlies approximately 15 percent of the property and is categorized as a lean clay (CL) with a Group C rating. It is noted to have a moderate corrosion rating for concrete and a high corrosion rate for steel. It is rated as very limited suitability for shallow excavations. The Plasticity Index (PI) is estimated at 32, indicating a high susceptibility to shrink and swell due to variation in moisture content.

2016 CBC Seismic Design Parameters

We are providing preliminary estimates for 2016 California Building Code (CBC) seismic parameters. The 2016 CBC utilizes design criteria set forth in the 2010 ASCE 7 Standard. Based on the subsurface conditions assumed, we characterized the site as Site Class C in accordance with the 2016 CBC. We provide the 2016 CBC seismic design parameters in Table 2 below, which include design spectral response acceleration parameters based on the mapped Risk-Targeted Maximum Considered Earthquake (MCE_R) spectral response acceleration parameters.

TABLE 2: 2016 CBC Seismic Design Parameters
Latitude: 37.36587 **Longitude:** -122.79619

PARAMETER	VALUE
Site Class	D
Mapped MCE_R Spectral Response Acceleration at Short Periods, S_S (g)	1.762
Mapped MCE_R Spectral Response Acceleration at 1-second Period, S_1 (g)	0.653
Site Coefficient, F_A	1.00
Site Coefficient, F_V	1.50
MCE_R Spectral Response Acceleration at Short Periods, S_{MS} (g)	1.762
MCE_R Spectral Response Acceleration at 1-second Period, S_{M1} (g)	0.979
Design Spectral Response Acceleration at Short Periods, S_{DS} (g)	1.175
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	0.653
Mapped MCE Geometric Mean (MCE_G) Peak Ground Acceleration, PGA (g)	0.674
Site Coefficient, F_{PGA}	1.00
MCE_G Peak Ground Acceleration adjusted for Site Class effects, PGA_M (g)	0.674
Long period transition-period, T_L	12 sec

CONCLUSIONS

From a preliminary geologic and geotechnical standpoint, the study area is generally suitable for potential development, provided that sound engineering practices are incorporated in the design and construction of the project. In addition, the risk of landsliding would need to be acceptable as discussed below. If and when proposed improvements move forward into a design phase, geotechnical recommendations will have to be made, and ENGEO would be happy to perform a design-level study and make site recommendations. The primary geologic and geotechnical considerations for this project are:

- Location of the proposed development within a mapped landslide and a designated State of California Landslide Zone.

- Considerable ground shaking from an earthquake of moderate to high magnitude generated within the San Francisco Bay Region.
- Shrinking and swelling of surficial soils due to high Plasticity Indexes.

Seismic Hazards

Ground Rupture

The site is not located within a State of California Earthquake Fault Hazard Zone. This does not preclude the site from ever experiencing ground rupture, and special considerations might be needed where planned improvements cross the contact.

Ground Shaking

An earthquake of moderate to high magnitude generated within the San Francisco Bay Region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, all structures should be designed using sound engineering judgment and the latest California Building Code (CBC) requirements, as a minimum.

Liquefaction and Lateral Spreading

The site is not located in a mapped liquefaction zone. Based on the map and available soil data from the USDA Soil Survey, the risk of liquefaction and lateral spreading at the site are low.

Earthquake-Induced Landslides

Ground shaking associated with earthquake events can trigger landslides in weak geologic materials, caused by a wide range of mechanisms. The site is mapped on an existing landslide and is designated on the State of California Seismic Hazard Zones Map as susceptible to earthquake-induced landslides and its close proximity to the Hayward Fault increases this risk. It is our opinion that the site is suitable for the proposed development given that the property owner is aware and accepts the risk posed by seismically-induced landslides.

Expansive Soils

Expansive soils shrink and swell as a result of moisture changes. This can cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Structures can be supported on structural reinforced mat foundations that are designed to accommodate shrinking and swelling subgrade soils.

Successful construction on expansive soils requires special attention during grading. It is imperative to keep exposed soils moist by occasional sprinkling. If the soils dry, it is extremely difficult to remoisturize the soils (because of their clayey nature) without excavation, moisture conditioning, and recompaction.

Conventional grading operations, incorporating fill placement specifications tailored to the expansive characteristics of the soil, and use of a mat foundation (either post-tensioned or conventionally reinforced) are common, generally cost-effective measures to address the expansive potential of the foundation soils. Based upon our initial findings, the effects of expansive soils are expected to pose a low impact if properly mitigated.

If you have any questions or comments regarding this letter, please call and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

Jonas F. Bauer

Robert H. Boeche, CEG

CERTIFIED ENGINEERING GEOLOGIST
ROBERT BOECHE
No. 2318
STATE OF CALIFORNIA

Attachments: Selected References
Figures 1-5

SELECTED REFERENCES

California Geological Survey Special Publication 117A (2008). Guidelines for Evaluation and Mitigating Seismic Hazards in California.

Davis, James; Department of Conservation – California Geological Survey (2000). Seismic Hazard Zone Report for the San Jose East 7.5-Minute Quadrangle, Santa Clara County, California. Seismic Hazard Zone Report.

Dibblee JR., Thomas, (2005) Geologic Map of the San Jose East Quadrangle.

Earth System Consultants, Geologic Hazards Evaluation and Soil Engineering Report, July 31, 2000.

GeoTracker. http://geotracker.waterboards.ca.gov/

Historic Aerials, http://www.historicaerials.com/

Jennings, C.W., (2010) Fault Activity Map of California, California Geologic Survey, Map No. 6.

Parrish, John; California Geological Survey (2001). Earthquake Zones of Required Investigation, San Jose East Quadrangle.

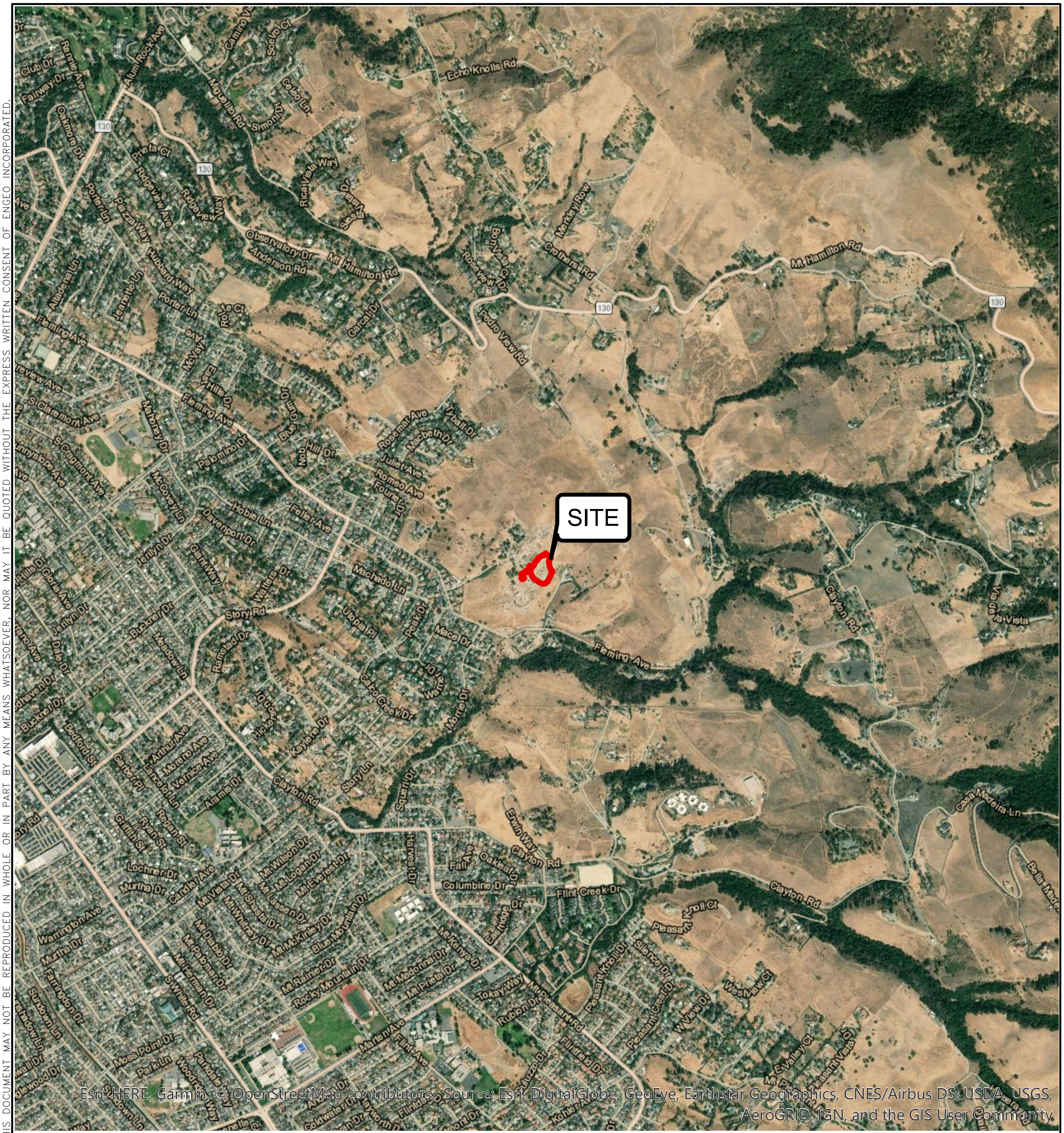
State of California, (1982) Special Studies Zone, San Jose East Quadrangle.

United States Department of Agriculture (USDA) (2016). Web Soil Survey. http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Natural Resources Conservation Service.

U.S. Geological Survey and California Geological Survey (2006). Quaternary fault and fold database for the United States, accessed August 28, 2018, from USGS web site: http//earthquake.usgs.gov/hazards/qfaults/.

Wiegers, Mark, (2011) Landslide Inventory Map of the San Jose East Quadrangle.

FIGURES



N

0 1,000 2,000 FEET

0 500 1,000 METERS

ENGEO Expect Excellence	VICINITY MAP 1360 FLEMING AVENUE SAN JOSE, CALIFORNIA	PROJECT NO.: 15358.000.000 SCALE: AS SHOWN DRAWN BY: QRL CHECKED BY: RHB	FIGURE NO. 1

LOCATION: 121°47'44"W 37°21'57"N

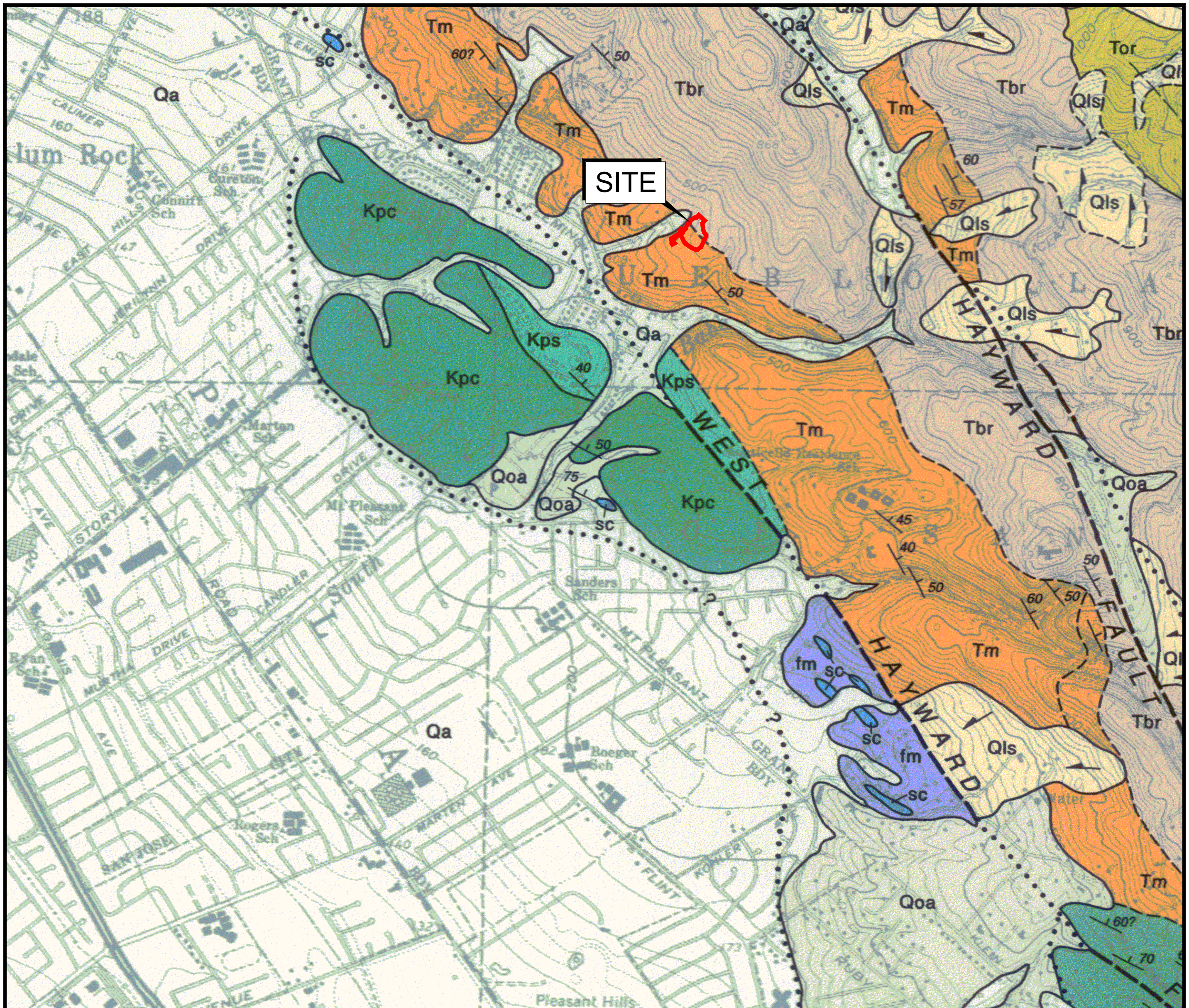
ORIGINAL FIGURE PRINTED IN COLOR

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE AND HMH, 2018

ENGEO Expect Excellence	SITE PLAN 1360 FLEMING AVENUE SAN JOSE, CALIFORNIA	PROJECT NO.: 15358.000.000 SCALE: AS SHOWN DRAWN BY: LL · CHECKED BY: RHB	FIGURE NO. 2

G:\Drafting\DRAFTING2_Dwg_13000 Plus\15358\000\GEX\15358000000-GEX-2-SITEPLAN-0918.dwg Plot Date: 9-10-18 llee

ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

GEOLOGIC CONTACT-DASHED WHERE GRADATIONAL OR APPROXIMATELY LOCATED

FAULT-DASHED WHERE INFERRED, DOTTED WHERE CONCEALED, QUERIED WHERE EXISTENCE IS DOUBTFUL. SAWTEETH ARE ON UPPER PLATE OF LOW ANGLE THRUST FAULT

DIRECTION OF LANDSLIDE MOVEMENT

AXIS OF FOLD

ANTICLINE SYNCLINE

STRIKE AND DIP OF STRATA

INCLINED VERTICAL OVERTURNED

Qls	LANDSLIDE DEBRIS OLDER
Qoa	OLDER SURFICIAL SEDIMENTS
Tbr	BRIONES FORMATION
Tm	MONTEREY FORMATION
Kps	PANOCHE FORMATION,SANDSTONE
Kpc	PANOCHE FORMATION, CONGLOMERATE
sc	SERPENTINITE
fm	MELANGE

N

0 FEET 2000
0 METERS 1000

BASE MAP SOURCE: DIBBLEE, 2005

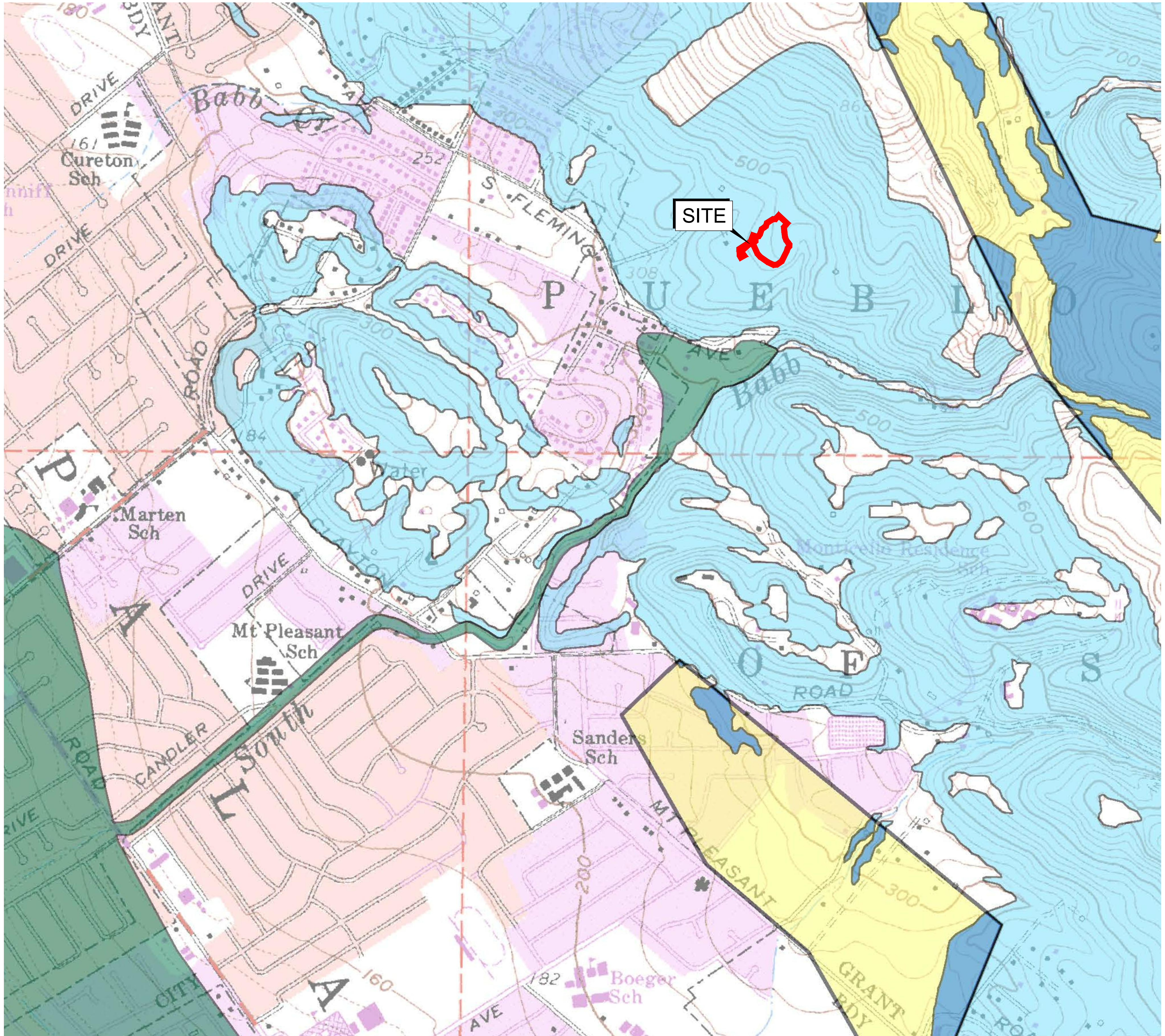
ENGEO
Expect Excellence

REGIONAL GEOLOGIC MAP
1360 FLEMING AVENUE
SAN JOSE, CALIFORNIA

PROJECT NO.: 15358.000.000
SCALE: AS SHOWN
DRAWN BY: LL CHECKED BY: RHB
FIGURE NO. 3

C:\Users\llee\appdata\local\temp\AcPublish_11440\15358000000-GEX-3-GEOMAP-0918.dwg Plot Date: 9-10-18 llee

ORIGINAL FIGURE PRINTED IN COLOR



N

EXPLANATION

EARTHQUAKE FAULT ZONES

ZONE BOUNDARIES ARE DELINEATED BY STRAIGHT SEGMENTS; THE BOUNDARIES DEFINE THE ZONE ENCOMPASSING ACTIVE FAULTS THAT CONSTITUTE A POTENTIAL HAZARD TO STRUCTURES FROM SURFACE FAULTING OR FAULT CREEP SUCH THAT AVOIDANCE AS DESCRIBED IN PUBLIC RESOURCES CODE SECTION 2621.5(a) WOULD BE REQUIRED

1906 C ? ?

ACTIVE FAULT TRACES

FAULTS CONSIDERED TO HAVE BEEN ACTIVE DURING HOLOCENE TIME AND TO HAVE POTENTIAL FOR SURFACE RUPTURE: SOLID LINE IN BLACK OR RED WHERE ACCURATELY LOCATED; LONG DASH IN BLACK SOLID LINE IN PURPLE WHERE APPROXIMATELY LOCATED; SHORT DASH IN BLACK OR SOLID LINE IN ORANGE WHERE INFERRED; DOTTED LINE IN BLACK OR SOLID LINE IN ROSE WHERE CONCEALED; QUERY (?) INDICATED ADDITIONAL UNCERTAINTY. EVIDENCE OF HISTORIC OFFSET INDICATED BY YEAR OF EARTHQUAKE- ASSOCIATED EVENT OR C FOR DISPLACEMENT CAUSED BY FAULT CREEP

OVERLAP OF EARTHQUAKE FAULT ZONE AND EARTHQUAKE-INDUCED LANDSLIDE ZONE

AREAS THAT ARE COVERED BY BOTH EARTHQUAKE FAULT ZONE AND EARTHQUAKE-INDUCED LANDSLIDE ZONE

LIQUEFACTION

AREAS WHERE HISTORIC OCCURRENCE OF LIQUEFACTION, OR LOCAL GEOLOGICAL, GEOTECHNICAL AND GROUNDWATER CONDITIONS INDICATE A POTENTIAL FOR PERMANENT GROUND DISPLACEMENTS SUCH THAT MITIGATION AS DEFINED IN PUBLIC RESOURCES CODE SECTION 2693(c) WOULD BE REQUIRED

EARTHQUAKE-INDUCED LANDSLIDES

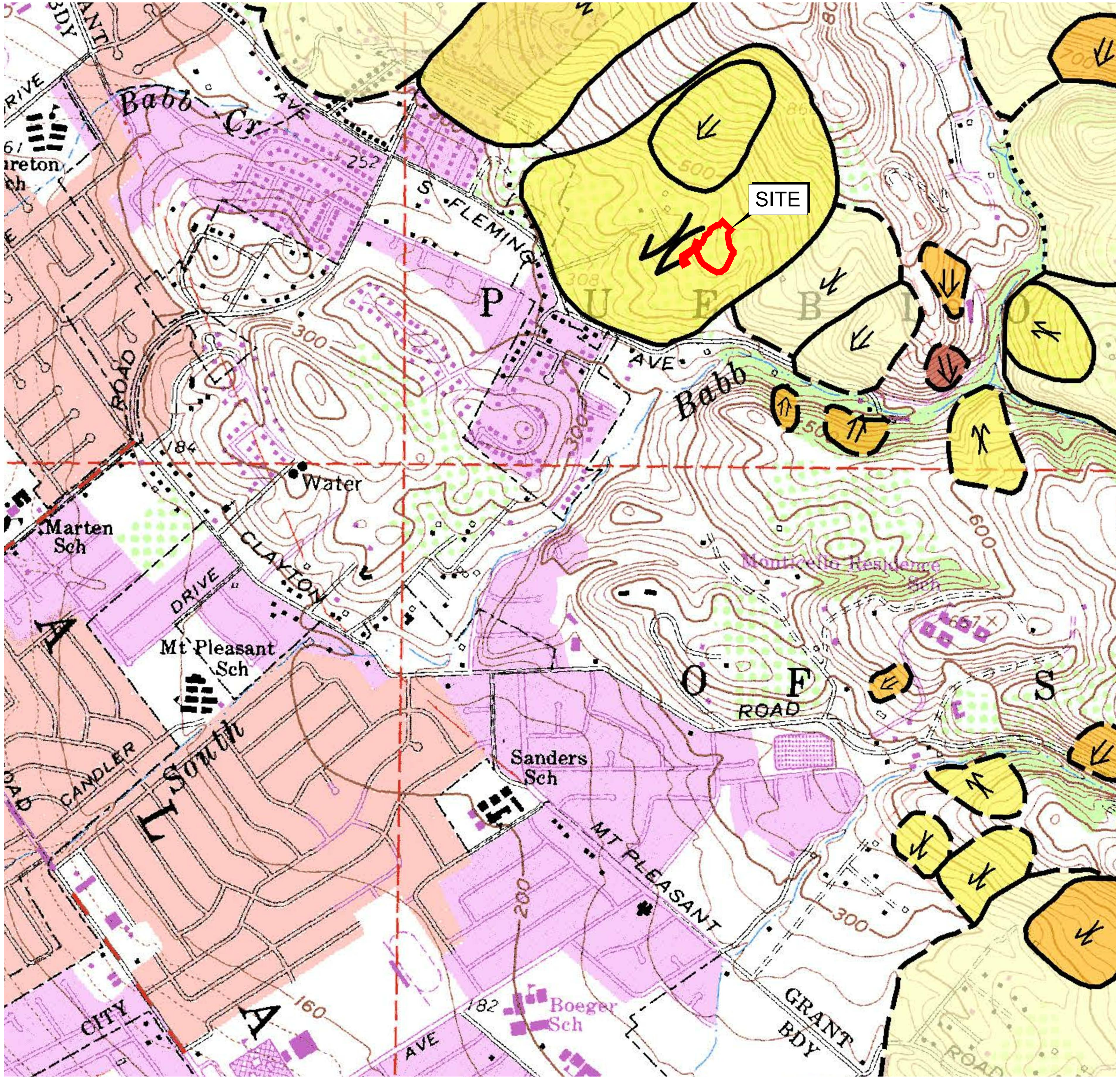
AREAS WHERE PREVIOUS OCCURRENCE OF LANDSLIDE MOVEMENT, OR LOCAL TOPOGRAPHIC, GEOLOGICAL, GEOTECHNICAL AND SUBSURFACE WATER CONDITIONS INDICATE A POTENTIAL FOR PERMANENT GROUND DISPLACEMENTS SUCH THAT MITIGATION AS DEFINED IN PUBLIC RESOURCES CODE SECTION 2693(c) WOULD BE REQUIRED

BASE MAP SOURCE: CALIFORNIA DEPARTMENT OF CONSERVATION, CALIFORNIA GEOLOGICAL SURVEY, 2006

ENGEO — Expect Excellence —	SEISMIC HAZARD ZONES MAP 1360 FLEMING AVENUE SAN JOSE, CALIFORNIA	PROJECT NO.: 15358.000.000 SCALE: AS SHOWN DRAWN BY: LL / CHECKED BY: RHB	FIGURE NO. 4

ORIGINAL FIGURE PRINTED IN COLOR

G:\Drafting\DRAFTING2_Dwg_13000 Plus\15358\000\GEX\15358000000-GEX-4-HAZMAP-0918.dwg



BASE MAP SOURCE: CALIFORNIA DEPARTMENT OF CONSERVATION, CALIFORNIA GEOLOGICAL SURVEY, 2011

EXPLANATION

LANDSLIDE ACTIVITY: Each landslide has been classified according to how recently the landslide last moved. Because evidence of active or historic landslide movement is difficult to obtain from air photo interpretation, the primary tool employed in making this map, classification typically is inferred from the youthfulness of observed landslide geomorphic characteristics (see "Limitations" below). The classification of landslide activity is based on the system described by Keaton and DeGraff (1996; Table 9-1). This map display uses color to show the activity.

ACTIVE or HISTORIC:
The landslide appears to be currently moving (at the time the aerial photograph was taken or field observation occurred) or to have moved within historic time.

DORMANT - YOUNG:
The observed landforms related to the landslide are fresh or un-eroded, but there is no evidence of historic movement.

DORMANT - MATURE:
The observed landforms related to the landslide have been smoothed and subdued by erosion and vegetation.

DORMANT - OLD:
The observed landforms related to the landslide have been greatly eroded, including significant gullies or canyons cut into the landslide mass and/or main scarp by small streams.

LANDSLIDE MATERIALS TYPES AND MOVEMENT: A two-part classification that records type of landslide material and type of landslide movement is displayed by arrow style. Material types recorded are either rock or soil, and soil is further subdivided into "earth" or "debris" on the basis of predominant particle grain size. There are five categories of landslide movement types: **slide, flow, fall, topple and spread**. These movement types are combined with material type to form the landslide classification. Not all combinations are common in nature, and only those that are recognized in the San Jose East Quadrangle are included here.

ROCK SLIDE:
A landslide involving bedrock in which the rock that moves remains largely intact for at least a portion of the movement. Rock slides can range in size from small and thin to very large and thick, and are subject to a wide range of triggering mechanisms. The sliding occurs at the base of the rock mass along one to several relatively thin zones of weakness, which are variably referred to in engineering geology reports and literature as "slide planes," "shear surfaces," "slip surfaces," "rupture surfaces," or "failure surfaces." The sliding surface may be curved or planar in shape. Rock slides with curved sliding surfaces are commonly called "slumps" or "rotational slides," while those with planar failure surfaces are commonly called "translational slides," "block slides," or "block glides." Rock slides that occur on intersecting planar surfaces are commonly called "wedge failures."

SOIL SLIDE:
A landslide generally composed of combinations of soil, surficial deposits, rock fragments and vegetation, including both natural deposits and fills created by the activities of man. Soil slides are called Earth Slides if composed of predominantly fine-grained materials (silts and clays), or Debris Slides if composed of predominantly coarse-grained materials (fine sand to boulders). Sliding typically occurs along a basal low-strength zone at the soil-rock interface, at the base of a fill, in highly weathered rock, at the base of the vegetation root zone, or in some other weak zone in the soil mass. Soil slides typically move as shallow intact slabs of soil and vegetation, but may break up and flow after short distances.

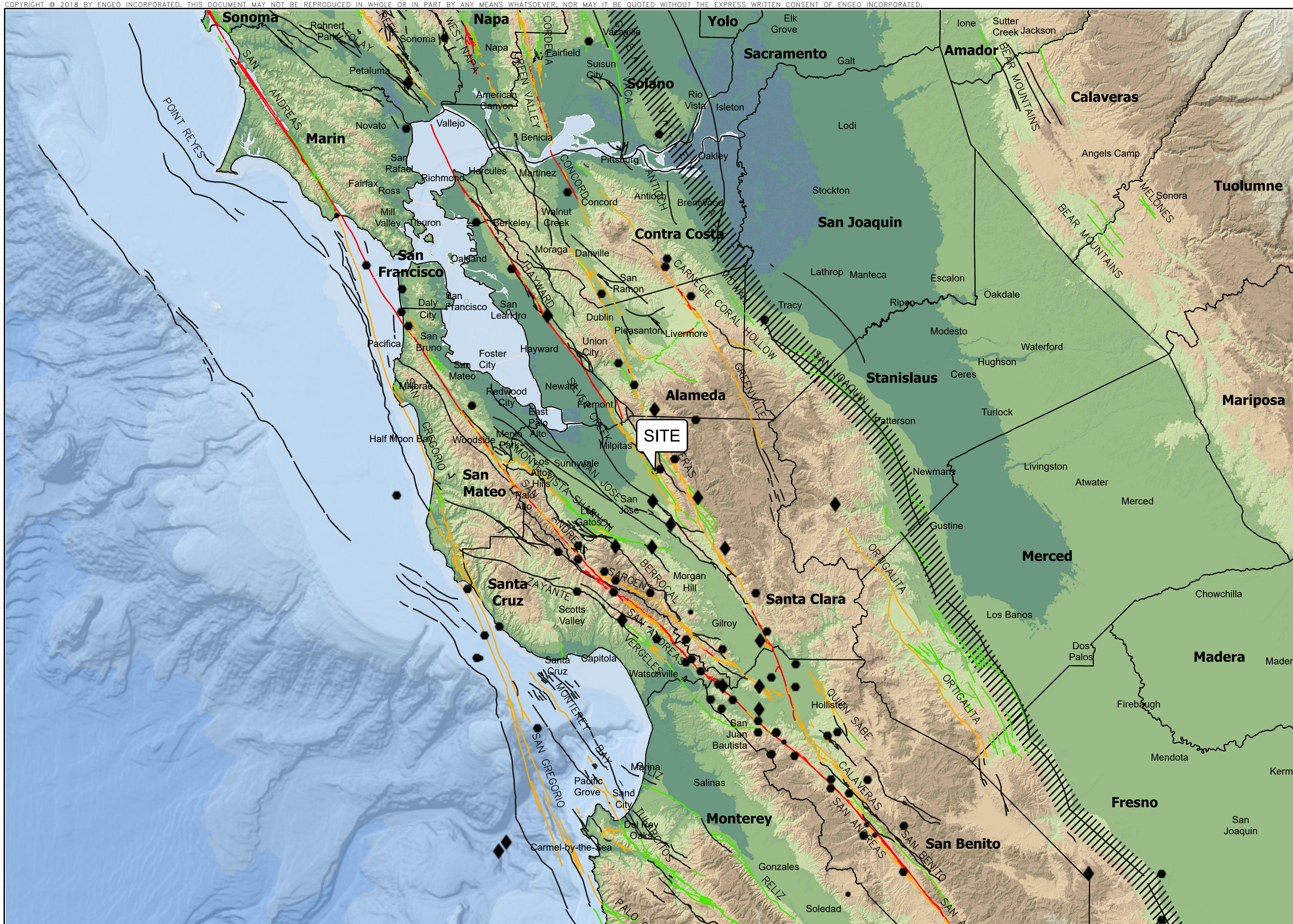
N

0 FEET 1000
0 METERS 500

ENGEO Expect Excellence	LANDSLIDE INVENTORY MAP 1360 FLEMING AVENUE SAN JOSE, CALIFORNIA	PROJECT NO.: 15358.000.000 SCALE: AS SHOWN DRAWN BY: LL CHECKED BY: RHB	FIGURE NO. 5

G:\Drafting\DRAFTING2_Dwg_13000 Plus\15358\000\GEX\15358000000-GEX-5-LANDSLIDE-0918.dwg

ORIGINAL FIGURE PRINTED IN COLOR



N

0 7.5 15 Miles

0 15 30 Kilometers

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

EARTHQUAKE

- ◆ MAGNITUDE 7+
- ● MAGNITUDE 6-7
- • MAGNITUDE 5-6

USGS QUATERNARY FAULTS

- HISTORICAL
- LATEST QUATERNARY
- LATE QUATERNARY
- UNDIFFERENTIATED QUATERNARY
- HISTORIC BLIND THRUST FAULT ZONE

BASE MAP SOURCE

ESRI, GARMIN, GEBCO, NOAA NGDC, AND OTHER CONTRIBUTORS
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATA SET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, 2018
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800-PRESENT)

ENGEO
Expect Excellence

REGIONAL FAULTING AND SEISMICITY
1360 FLEMING AVENUE
SAN JOSE, CALIFORNIA

PROJECT NO. : 15358.000.000	FIGURE NO. 6
SCALE: AS SHOWN	
DRAWN BY: QRL	CHECKED BY: RHB

LOCATION: 121°47'44"W 37°21'57"N

ORIGINAL FIGURE PRINTED IN COLOR