# GEOLOGIC AND GEOTECHNICAL STUDY
## PROPOSED RESIDENTIAL REDEVELOPMENT

# DE MATTEI PROPERTY
# 101 BROADWAY
# LOS GATOS, CALIFORNIA

*Prepared For:*

**Mr. Mark De Mattei**
**1794 The Alameda**
**San Jose, California**

**14 February 2020**
Document Id. 20007C-01R1

*This document is protected under Federal Copyright Laws. Unauthorized use or copying of this document by anyone other than the client(s) is strictly prohibited. If use or copying is desired by anyone other than the client, complete the "APPLICATION TO USE" attached to this document and return it to C2Earth, Inc.*

C2EARTH

14 February2020
Document Id. 20007C-01R1
Serial No. 19245

Mr. Mark De Mattei
De Mattei Construction, Inc.
1794 The Alameda
San Jose, CA 95126

SUBJECT: GEOLOGIC AND GEOTECHNICAL STUDY
PROPOSED RESIDENTIAL REDEVELOPMENT
DE MATTEI PROPERTY
101 BROADWAY
LOS GATOS, CALIFORNIA

Dear Mr. De Mattei:

As requested by your architect, Mr. Jay Plett, we have performed a geologic and geotechnical study for the proposed residential redevelopment of your property at 101 Broadway in Los Gatos, California. The accompanying report presents the results of our study and testing, and our conclusions and recommendations concerning the geologic and geotechnical engineering aspects of the project. The findings and recommendations presented in this report are contingent upon our review of the final grading, foundation, and drainage control plans; our observation of the grading; and the installation of the foundation and drainage control systems.

This report includes information that is vital to the success of your project. We strongly urge you to thoroughly read and understand its contents. Please refer to the text of the report for detailed findings and recommendations.

Sincerely,
C2Earth, Inc.

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER R. HUNDEMER
87149
CIVIL
STATE OF CALIFORNIA

Christopher R. Hundemer, Principal
Certified Engineering Geologist 2314
Certified Hydrogeologist 882
Registered Civil Engineer 87149

THIS DOCUMENT HAS
BEEN DIGITALLY SIGNED

Distribution: Addressee (2 hard copies via mail and via e-mail to markd@demattei.com)
Mr. Jay Plett (via e-mail to jay@plett-arc.com)

## TABLE OF CONTENTS

1. INTRODUCTION....2
2. SCOPE OF SERVICES....2
3. GEOLOGY AND SEISMICITY....3
   3.1. Geology....3
   3.2. Landsliding....3
   3.3. Seismicity....3
4. SITE CHARACTERIZATION....6
   4.1. Regional Setting....6
   4.2. Site Description....6
   4.3. Subsurface....7
   4.4. Groundwater....7
   4.5. Laboratory Testing....8
5. AERIAL PHOTOGRAPH REVIEW AND FIELD RECONNAISSANCE....8
6. PRIOR STUDY....8
7. LANDSLIDE SCREENING ANALYSES....9
8. FINDINGS....10
   8.1. Proposed Building Site....10
   8.2. Slope Stability....10
   8.3. Fault Hazard and Seismicity....11
9. RECOMMENDATIONS....11
   9.1. Location of Proposed Improvements....12
   9.2. Seismic Design Criteria....12
   9.3. Earthwork....12
   9.4. Foundations....15
   9.5. Drainage....21
10. PLAN REVIEW AND CONSTRUCTION OBSERVATION....22
BIBLIOGRAPHY
LIST OF AERIAL PHOTOGRAPHS
FIGURES, TABLE, AND APPENDIX
APPENDIX A: ASCE 7 HAZARDS REPORT
APPLICATION TO USE

# 1. INTRODUCTION

This report presents the results of our geologic and geotechnical study for the proposed residential redevelopment of your property at 101 Broadway in Los Gatos, California (see Figure 1, Site Location Map). The purpose of our study was to explore the geotechnical and geologic conditions on the subject property in the area of the residential redevelopment and to develop findings and recommendations for the earthwork and foundation engineering aspects of the proposed redevelopment. Our study was limited to the general vicinity of the subject residence.

We understand that you are planning to raze the existing single-family residence and construct a new, three-story residence in the same general area. The lowest level of the home will be comprised of a day lighting garage basement. We also understand that the new residence will be complimented by various landscaping improvements such as site retaining walls.

We issue this report with the understanding that it is the responsibility of the owner or the owner's representative to ensure that the information and recommendations contained in this report are brought to the attention of the project architect and engineer and are incorporated into the plans and specifications of the development. You must also ensure that the contractor and sub-contractors follow the recommendations during construction.

# 2. SCOPE OF SERVICES

We conducted this study in accordance with the scope and conditions presented in our proposal dated 9 January 2020 (Document Id. 20007-01P1). The methodology of our evaluation is discussed in the body of this report. We make no other warranty, either expressed or implied. Our scope of services for this study included:

- reviewing selected geologic literature, aerial photographs, and previous consultants' reports of the area, as available and appropriate, to evaluate the prevailing geologic and geotechnical conditions;
- performing an engineering geologic reconnaissance and mapping of the site in the area of the proposed improvements;
- preparing a site plan and a slope profile;
- conducting subsurface exploration;
- performing field and laboratory testing;
- analyzing geologic and geotechnical engineering properties from collected data; and
- preparing this report.

We have prepared this report as a product of our service for your exclusive use in designing and constructing the proposed improvements. Other parties may not use this report, nor may the report be used for other purposes, without prior written authorization from C2Earth, Inc (C2).

Because of possible future changes in site conditions or the standards of practice for geotechnical engineering and engineering geology, the findings and recommendations of this report may not be considered valid beyond three years from the report date, without review by C2. In addition, in the event that any changes in the nature or location of the proposed improvements are planned, the conclusions and recommendations of this report may not be considered valid unless we review such changes, and modify or verify in writing the conclusions and recommendations presented in this report.

Our study excluded an evaluation of hazardous or toxic substances, corrosion potential, chemical properties, and other environmental assessments of the soil, subsurface water, surface water, and air on or around the subject property. The lack of comments in this report regarding the above does not indicate an absence of associated hazards or risks.

## 3. GEOLOGY AND SEISMICITY

We reviewed selected geologic maps, aerial photographs, and other consultant's reports to evaluate the prevailing geologic conditions of the site and in the vicinity. The Regional Geologic Map and various local and state hazard maps are presented on Figures 2 through 7.

### 3.1. Geology

The subject property is located near the base of the central Santa Cruz Mountains, a northwest-trending range within the California Coast Ranges geomorphic province (see Figure 1). According to the Geologic Map of the Los Gatos Quadrangle (McLaughlin et al., 2001), the lower, northeastern portion of the subject site, including the area of the proposed residential redevelopment, is underlain by Pleistocene age (approximately 10,000 to 1.8 million years old) alluvial fan deposits. The alluvium is underlain at depth by upper Cretaceous age (approximately 66 to 100 million years old) Franciscan Assemblage melange, that is also mapped in the upper, southwestern portion of the property (see Figure 2, Regional Geologic Map). The alluvial fan deposits are described as unsorted boulders, gravel, sand, silt, and soil deposited in older alluvial fans. The Franciscan assemblage melange is described as pervasively sheared argillite and lithic metasandstone metamorphosed into pumpellyite assemblages and locally into lawsonite-bearing assemblages.

### 3.2. Landsliding

According to the Geologic Map, no landslides are mapped on or near the subject property. Our site reconnaissance and review of stereo-paired aerial photographs also revealed no evidence of landsliding on the subject property. You should note that the upper, southwestern portion of the subject property is mapped within the State Seismic Hazard Zone for earthquake-induced landsliding (see Figure 3, Regional Seismic Hazard Zones Map). In addition, the entire site is mapped within a Town of Los Gatos "landslide potential" hazard zone (see Figure 4, Local Landslide Hazard Areas Map). These zones were established to minimize the loss of life and property by identifying and mitigating seismic hazards related to landslides. Consequently, we have conducted a qualitative slope stability screening evaluation as presented in Section 7.

### 3.3. Seismicity

Geologists and seismologists recognize the greater San Francisco Bay Area as one of the most active seismic regions in the United States. The seismicity in the region is related to activity within the San Andreas fault system, a major rift in the earth's crust that extends for at least 700 miles along the California Coast. Faults within this system are characterized predominantly by right-lateral, strike-slip movement. The four major faults that pass through the Bay Area in a northwest direction have produced approximately 12 earthquakes per century strong enough to cause structural damage. These major faults are the San Andreas, Hayward, Calaveras, and San Gregorio faults.

*Copyright – C2Earth, Inc.*

The site can be expected to experience periodic minor earthquakes or even a major earthquake (Moment magnitude 6.7 or greater) on one of the nearby active or potentially active faults during the design life of the proposed project. The Moment magnitude scale is directly related to the amount of energy released during an earthquake and provides a physically meaningful measure of the size of an earthquake event.

The U.S. Geological Survey (2016) estimates that by 2043, the probability of a Moment magnitude 6.0 earthquake occurring on one of the active faults in the San Francisco region is 98%. The probability of a Moment magnitude 6.7 or greater earthquake occurring on one of the active faults in the San Francisco region is 72%.

The following table provides corresponding estimates for the probability of a major earthquake (Moment magnitude 6.7 or greater) for four major faults in the Bay Area.

| Fault | Probability (%) |
|---|---|
| Hayward | 33 |
| Calaveras | 26 |
| San Andreas | 22 |
| San Gregorio | 6 |

30-Year Probability of Magnitude 6.7 or Greater Earthquake

The San Andreas fault has a regional trend of approximately N34W; however, the segment of the San Andreas fault located within the central Santa Cruz Mountains southwest of the site strikes approximately N44W, forming a restraining bend. This restraining bend has created a compressional zone along the east side of the Santa Cruz Mountains, resulting in the formation of the Frontal thrust fault system. The Frontal thrust fault system is comprised of reverse and right-reverse faults, including the Berrocal-Monte Vista-Shannon faults within the eastern foothills and the alluvial plain adjacent to the foothills (Angell et al. 1997). This thrust fault system bounds the southwest margin of the Santa Clara Valley.

According to geologic mapping by McLaughlin et al. (2001), a concealed trace of the potentially active Berrocal fault is mapped beneath the alluvial fan deposits near the front (northeast) property line, and an ancient Franciscan assemblage thrust fault is mapped west of the property (see Figure 2). This trace of the Berrocal fault is shown to also be concealed beneath Pliocene-Pleistocene age Santa Clara formation materials northwest of the site, indicating that suspected movement predates these materials and this trace is therefore may be inactive. Such inactive traces typically do not represent seismic sources, however, they may be subjected to sympathetic movement during a major earthquake on one of the nearby active faults.

The following table indicates the approximate distance and direction from the site to active and potentially active faults.

*Copyright – C2Earth, Inc.*

| Fault | Approx. Distance To Fault | Direction From Site |
|---|---|---|
| Berrocal (nearest trace) | Along Broadway | Northeast property boundary |
| Berrocal (nearest pot. active trace) | 3000 ft | Northeast |
| San Andreas | 2½ miles | Southwest |
| Butano | 4¼ miles | Southwest |
| Hayward | 13¼ miles | Northeast |
| Calaveras | 15½ miles | Northeast |
| San Gregorio | 18¼ miles | Southwest |

Regional Fault Distances and Directions

Because the subject property is located within close proximity to potentially active traces of the Berrocal fault, the site is mapped within a Town of Los Gatos moderate fault rupture potential hazard zone (see Figure 5, Local Fault Rupture Potential Map). According to the California State Special Studies Zones Map by the California Division of Mines and Geology, the site is mapped outside of current Alquist-Priolo Earthquake Fault Zone for areas prone to earthquake ground rupture. The site is within a Santa Clara County geologic hazard zone corresponding to potential for fault rupture.

The Town of Los Gatos fault rupture hazard zones were partly based upon the Fault, Lineament, and Coseismic Deformation Map by Nolan Associates, 1999 (see Figure 6, Fault, Lineament, and Cosmetic Deformation Map). Nolan Associates mapped linear depressions north of the subject parcel. The nearest linear depression is mapped approximately 1000 feet northeast of the site. This mapped lineament trends in a northwest-southeast orientation about 50 degrees clockwise from the general trend of the mapped trace of the Berrocal fault in the site vicinity. Figure 6 also shows that the subject property is mapped approximately 800 feet southwest of areas of concentrated coseismic ground deformation.

Coseismic damage associated with the 1989 Loma Prieta Earthquake, which consisted of pavement and pipe buckles and breaks, was inventoried by Schmidt et al. (1995). The nearest distress mapped by Schmidt is northeast of the site, across the street on the other side of Broadway, and consists of two mapped concrete pavement breaks with an unspecified sense of deformation (see Figure 7, Observed Distress from the 1989 Loma Prieta Earthquake Map). Concentrated areas of damage mapped by Schmidt further away from the site generally correspond with areas of concentrated coseismic ground deformation mapped by Nolan Associates (see Figure 6).

Because of the site's proximity to the San Andreas fault and the site's geology, maximum anticipated ground shaking intensities for the area are characterized as very strong and equal to a Modified Mercalli (MM) intensity of VIII (Borcherdt, et. al., 1975). An earthquake having a MM intensity of VIII generally causes considerable damage to well-built ordinary buildings and partial collapse in poorly built or designed buildings (Yanev, 1974) (see Table I, Modified Mercalli Scale of Earthquake Intensities).

*Copyright – C2Earth, Inc.*

The intensity of an earthquake differs from the Moment magnitude, in that intensity is a measure of the effects of an earthquake, rather than a measure of the energy released. These effects can vary considerably based on the earthquake magnitude, distance from the earthquake's epicenter, and site geology.

Since 1800, four major earthquakes have been recorded on the San Andreas fault. In 1836, an earthquake with an estimated maximum intensity of VII on the MM scale occurred east of the Monterey Bay on the San Andreas fault (Toppozada and Borcherdt, 1998). The estimated Moment magnitude ($M_w$) for this earthquake is about 6.25. In 1838, an earthquake occurred with an estimated intensity of about VIII-IX (MM), corresponding to a $M_w$ of about 7.5. The San Francisco Earthquake of 1906 caused the most significant damage in the history of the Bay Area in terms of lives lost and cost of property damage. This earthquake created a surface rupture along the San Andreas fault from Shelter Cove to San Juan Bautista, about 290 miles in length. It had a maximum intensity of XI (MM), a $M_w$ of about 7.9, and was felt as far away as Oregon, Nevada, and Los Angeles. The most recent earthquake to affect the Bay Area was the Loma Prieta earthquake of 17 October 1989, occurring in the Santa Cruz Mountains, which had a $M_w$ of about 6.9. Ground shaking equal to an MM intensity of VII was felt at the site during the Loma Prieta Earthquake (Stover, et al., 1990).

In 1868, an earthquake with an estimated maximum MM intensity of X and $M_w$ of about 7.0 occurred on the southern segment of the Hayward fault, between San Leandro and Fremont. In 1861, an earthquake of unknown magnitude (likely having an $M_w$ of about 6.5) was reported on the Calaveras fault. The most recent significant earthquake on this fault was the 1984 Morgan Hill Earthquake, that had an $M_w$ of about 6.2.

# 4. SITE CHARACTERIZATION

## 4.1. Regional Setting

We reviewed the aerial photographs and topographic maps for the site and vicinity. The rectangular shaped, approximately ¼-acre site is situated within hilly, alluvial terrain near the eastern base of the central Santa Cruz Mountains. The site is elongated with its long axis oriented in the northeast-southwest direction. The subject property is bounded to the northwest, southeast, and southwest by developed private properties. The property is bound by Broadway to the northeast.

## 4.2. Site Description

On 14 January 2020, our principal geologist performed an initial site reconnaissance and marked three proposed boring locations for utility clearance. On 21 January 2020, our project geologist visited the site to conduct our subsurface exploration program and perform site mapping mapping. The site plan and slope profile we developed is based upon an Existing Conditions Plan developed by TS Civil Engineering, Inc., dated 21 December 2019 supplemented by tape and compass mapping techniques (see Figures 8 and 9, Site Plan and Engineering Geologic Map and Geologic Cross-Section A-A', respectively). The site plan and profile are only as accurate as implied by the mapping techniques used. The following is a summary of the surficial site characteristics.

*Copyright – C2Earth, Inc.*

The topography across the site can generally be characterized as moderately sloping downward toward the northeast. An existing, wood-framed single-family residence is situated in the northeast portion of the property. The residential building pad was constructed into the hillside by using cut and fill grading techniques. A short, slab-on-grade driveway leads from Broadway to an attached garage beneath the northeast portion of the residence. From the driveway, a path leads around the southeast side of the residence, ascending into the backyard area. A tiered brick-paver patio exists along the rear of the home. The two tiers are separated by an approximate two foot tall brick retaining wall. The upper patio limits are defined by an approximately 3-foot tall rock retaining wall. The brick retaining wall continues into a set of stairs that leads to the slope up to a garden area on the hillside behind the home, in the central portion of the property.

The slopes in the central and southwest portion in the property can be characterized as moderate with overall slope gradients ranging from 4:1 to 3:1 (horizontal to vertical). The site is landscaped with various trees and sparse grass. Drainage across the site can be generally characterized as uncontrolled sheet flow to the northeast.

### 4.3. Subsurface

On 21 January 2020, our project geologist visited the site to observe the subsurface conditions at discrete locations in the general vicinity of the proposed residential redevelopment. Our geologist logged three test borings, drilled to depths of approximately 11 to 15 feet below ground surface using portable Minuteman drilling and sampling equipment and a truck-mounted Mobile B-24 drillrig. The approximate locations of the borings are shown on Figure 8. We determined these locations by measuring distance and bearing from known points on the supplied site plan; these locations are only as accurate as implied by the mapping technique used.

We logged the borings in general accordance with the Unified Soil Classification System described on Figure 10, Key to Logs. A Summary of Field Sampling Procedures is presented on Figure 11. The boring logs are presented on Figures 12 through 14, Logs of Borings 1 through 3. The logs show our interpretation of the subsurface conditions at the locations and on the date indicated and we do not warrant that they are representative of the subsurface conditions at other locations and times.

In general, the borings encountered a similar sequence of subsurface materials, including colluvium (a soil material that is deposited on or at the base of a slope from sheet flow runoff) underlain by alluvial fan deposits. The colluvium consists of dark brown to very dark brown, firm to stiff sandy silt and silty clay that is less than about 5 feet thick. The alluvial fan deposits encountered in Borings 1 and 2 are comprised of dark brown to dark reddish brown, stiff to hard sandy silt, and in Boring 3 consist of dark yellowish brown, medium dense to dense silty sand. Our interpretations of subsurface conditions across the proposed residence site are depicted on Figure 9.

### 4.4. Groundwater

We did not encounter groundwater in any of the borings. Fluctuations in the level of subsurface water could occur due to variations in rainfall, temperature, and other factors not evident at the time our observations were made.

*Copyright – C2Earth, Inc.*

### 4.5. Laboratory Testing

We developed our laboratory testing program to supplement our evaluation of the geotechnical engineering properties of the subsurface materials at the site. We retained soil samples from the borings for laboratory classification and testing. The results of moisture content, dry density, and shear strength tests are presented on the boring logs. We performed an Atterberg limits plasticity index test on a sample of the colluvium retained from Boring 2. The test results indicate that this material is moderately expansive, with a Plasticity Index of 24 (see Figure 15, Plasticity Chart).

## 5. AERIAL PHOTOGRAPH REVIEW AND FIELD RECONNAISSANCE

We reviewed 1965 stereo-paired historical aerial photographs to observe geomorphic evidence of earth processes in the site vicinity. The photographs show that the site and surrounding vicinity were developed in a manner similar to the current site conditions. We did not observe evidence of the linear depressions noted by Nolan and Associates northeast of the site. Evidence of the depressions may have been obscured during the development of businesses and residences within the Downtown Los Gatos area. On 14 January 2020, our principal geologist/engineer performed a field reconnaissance of the neighborhood to look for evidence of distress to curbs, sidewalks, streets, and other infrastructure around the vicinity of the mapped fault orientation northeast of the site. We did not observe evidence of fault related distress on the site or area of mapped prior distress.

## 6. PRIOR STUDY

While employed with Treadwell and Rollo (T&R) in 2008, our principal geologist/engineer performed a fault hazard investigation for the construction of a skilled nursing facility at 50 Los Gatos-Saratoga Road. During that study, T&R drilled and logged six borings to depths between 69½ and 84 feet deep. The borings encountered alluvium to depths of between 62 and 78 feet below the ground surface. The alluvium was underlain by Monterey formation bedrock. T&R observed a six-foot vertical offset of the bedrock surface horizon between two of the borings and interpreted the offset as a thrust fault. In order to evaluate if the offset observed in the bedrock horizon extended into recent deposits, T&R excavated a 100-foot long by 12-foot deep fault exploration trench. According to T&R, *"the contacts between alluvial layers were distinct, and were not offset by faulting."* In addition, T&R obtained two samples of carbon (charcoal/wood fragments) from two layers of alluvium in the trench for age dating. The results of the carbon dating revealed one sample to be approximately 11,000 years old and the other to be older than 11,000 years.

T&R concluded, *"the upper 12 feet of alluvium at the site has not experienced active faulting. Considering the thickness of the alluvium, and the results of the age dating from the carbon samples obtained from the trench, we conclude there is no evidence that this splay of the Shannon fault has been active during Holocene time (the past 11,000 years). Furthermore, there is no evidence that the fault has broken the ground surface. Therefore, we conclude that the potential from fault offset through the property is negligible, and a setback from this fault should not be required."* T&R determined that if the fault splay were to move as sympathetic (coseismic) movement during a large earthquake on the San Andreas fault, the movement would

*Copyright – C2Earth, Inc.*

dissipate through the alluvial materials would result in maximum differential settlement of the alluvium on either side of the fault ¾-inch, per event. Throughout the study, T&R communicated with representatives from the California Geological Survey (CGS) who came to the site and observed exposures within the trench. The project was reviewed and accepted by CGS; however, construction on the project has yet to commence.

## 7. LANDSLIDE SCREENING ANALYSES

As noted above, the subject site is partially mapped within a State Seismic Hazard zone for earthquake-induced landsliding (see Figure 3), and the entire site is within a Town of Los Gatos landslide potential hazard zone (see Figure 4). The purpose of this qualitative screening analysis is to evaluate the severity of the earthquake-induced landsliding hazard on the subject site and to determine if further analysis is warranted (CDMG, 1996). In accordance with Special Publication 117A by the California Geological Survey (2008) our screening analysis includes an evaluation of the following questions:

- ***Are existing landslides, active or inactive, present on, or adjacent (either uphill or downhill) to the project site?*** Our study did not reveal evidence of active or inactive landslides on or in the immediate vicinity of the subject property.
- ***Are there geologic formations or other earth materials located on or adjacent to the site that are known to be susceptible to landslides?*** According to the geologic map, the hillside uphill of the proposed home-site is underlain by Franciscan assemblage melange, and the lower portions of the property, including the area of the proposed residence, are underlain by alluvial fan deposits. These formations are not known to be susceptible to landsliding in the general site area. An insignificant thickness of colluvium mantles these materials in the area of the residence.
- ***Do slope areas show surface manifestations of the presence of subsurface water (springs and seeps), or can potential pathways or sources of concentrated water infiltration be identified on or upslope of the site?*** Slope areas on the site are uniform and drainage courses are not disturbed. We did not observe any evidence of springs or seeps in areas that could affect the proposed development.
- ***Are susceptible landforms and vulnerable locations present? These include steep slopes, colluvium-filled swales, cliffs or banks being undercut by stream or wave action, areas that have recently slid.*** Our study did not reveal evidence of such susceptible landforms on the property.
- ***Given the proposed development, could anticipated changes in the surface and subsurface hydrology (due to watering of lawns, on-site sewage disposal, concentrated runoff from impervious surfaces, etc.) increase the potential for future landsliding in some areas?*** In our opinion, the current redevelopment concept will not increase the potential for landsliding on the subject site.

*Copyright – C2Earth, Inc.*

# 8. FINDINGS

Based upon the results of our study, it is our opinion that, from geologic and geotechnical engineering perspectives, the subject property may be re-developed as planned, provided that the recommendations presented in this report are incorporated into the design and construction of the proposed improvements. In our opinion, the primary constraints to the proposed development include:

- The moderately steep slope ascending behind the rear of the proposed residence;
- the presence of non-supportive soil and colluvium mantling the supportive alluvial deposits; and
- the site's seismic setting.

## 8.1. Proposed Building Site

Our subsurface study revealed that the site is underlain at depths of approximately 3 feet or less by alluvial deposits. The soil overlying the alluvial deposits should be considered non-supportive. The alluvial deposits consist of medium dense to dense silty sand and stiff to hard sandy silt that, in our opinion, should provide adequate support for the foundations of the proposed residence and associated improvements.

Standard penetration test results suggest that the alluvial deposits at the site have variable consistency and can be very hard locally. We recommend that high-powered, well-maintained equipment be used to excavate the basement and foundation elements. The contractor should plan for this condition in choosing the appropriate means and methods of excavating.

## 8.2. Slope Stability

Our study showed no evidence of recent landsliding on the property in the vicinity of the proposed residence. Because of the presence of non-supportive soil and colluvium mantling the alluvial fan deposits on the slopes behind the proposed homesite, the occurrence of a new shallow landslide within or adjacent to the subject property cannot be excluded. A new shallow landslide (approximately less than 5 feet deep) in this area could be triggered by excessive precipitation or strong ground shaking associated with an earthquake. In our opinion, a landslide of this nature should not constitute an immediate threat to the integrity of the proposed residence and associated improvements, provided that they are designed and constructed in accordance with the recommendations of this report.

Based upon our observations of the subsurface conditions and geologic setting of the site vicinity, it is our opinion that the potential for deep-seated landsliding to affect the proposed residence is negligible.

The long-term stability of many hillside areas is difficult to predict. A hillside will remain stable only as long as the existing slope equilibrium is not disturbed by natural processes or by the acts of Man. Landslides can be activated by a number of natural processes, such as the loss of support at the bottom of a slope by stream erosion or the reduction of soil strength by an increase in

*Copyright – C2Earth, Inc.*

groundwater level from excessive precipitation. Artificial processes caused by Man include improper grading activities, the introduction of excess water through excessive irrigation, improperly designed or constructed leachfields, and poorly controlled surface runoff.

Although our knowledge of the causes and mechanisms of landslides has greatly increased in recent years, it is not yet possible to predict with certainty exactly when and where all landslides will occur. At some time over the span of thousands of years, most hillsides will experience landslide movement as mountains are reduced to plains. Therefore, a small but unknown level of risk is always present to structures located in hilly terrain. Owners of property located in these areas must be aware of, and willing to accept, this unknown level of risk.

### 8.3. Fault Hazard and Seismicity

Our subsurface exploration revealed uniform alluvial deposits across the site in the area of the proposed new residence. Our reconnaissance and review of aerial photographs and prior site-specific consultant reports did not reveal any evidence that would substantiate a fault trace crossing the homesite, although a potentially inactive, concealed trace of the Berrocal fault is mapped beneath the alluvial fan deposits along the northeastern property boundary. Based upon our reconnaissance, our review of published geologic maps, literature, aerial photographs, and our experience with other studies in the site area, we conclude that even if a trace of the Berrocal fault exists beneath subject property, there is no evidence that surface fault rupture has occurred at the site within the last 11,000 years.

The site vicinity is underlain by a thick section of alluvial deposits. Based upon our review of prior reports in the area and the site's regional setting, we anticipate the alluvial deposits to be several tens of feet thick below the subject site. Should fault rupture occur, we conclude that fault movement resulting in displacements within the bedrock beneath the alluvial deposits would propagate upward through uncemented alluvium in a flower pattern. The uncemented alluvial materials would shift and realign, dispersing the amount of deformation at the ground surface.

It is reasonable to assume that the site will be subjected to very strong ground shaking from a major earthquake on at least one of the nearby active faults during the design life of future improvements (Borcherdt, et. al., 1975). During such an earthquake, it is our opinion that the danger from surface fault rupture through the site is low. Ground deformation may occur as the alluvial materials shift and realign, yet we anticipate total deformations of less than 6 inches across a horizontal distance of several hundred feet. This amount of potential deformation should not pose a safety risk to ordinary structures designed and constructed in accordance with current standards. It should be noted that following a large seismic event, cosmetic damage or sympathetic movement caused by ground shaking may occur and may have to be repaired.

## 9. RECOMMENDATIONS

Because the proposed project is still in a relatively early phase of development, it is conceivable that changes and additions will be made to the proposed improvement/development concept following submission of this report. We recommend that as various changes and additions are made, you contact us to evaluate the geotechnical aspects of these modifications.

*Copyright – C2Earth, Inc.*

As currently planned, the existing structures on the property will be razed. A new, single-family residence with a partial daylighting garage basement is planned in approximately the same location as the existing residence. We also anticipate that several site retaining walls will be constructed for landscaping purposes. In addition, new concrete slabs-on-grade, pavers, or asphalt pavement will be used to construct the new driveway, patios, and walkways.

The following recommendations must be incorporated into all aspects of future development.

## 9.1. Location of Proposed Improvements

The proposed improvements must be confined to the approximate building area shown on Figure 8. Do not construct improvements outside of this generalized area without written approval from C2. If other structures are planned in the future, we must evaluate their location to provide appropriate geotechnical engineering design criteria.

## 9.2. Seismic Design Criteria

We recommend that the project structural design engineer provide appropriate seismic design criteria for proposed foundations and associated improvements. The following information is intended to aid the project structural design engineer to this end and is based on criteria set forth in the 2019 California Building Code (CBC). The structural design engineer must confirm the Seismic Risk Category and make revisions as they deem appropriate. The mapped spectral accelerations and site coefficients must be computed using the ASCE/SEI 7-16 design standard based upon USGS Seismic Design Maps. ASCE 7 Hazards Reports are presented in Appendix A.

Experience has shown that earthquake-related distress to structures can be substantially mitigated by quality construction. We recommend that a qualified and reputable contractor and skilled craftsmen build the associated improvements. We also recommend that the project structural design engineer and project architect monitor the construction to make sure that their designs and recommendations are properly interpreted and constructed.

## 9.3. Earthwork

At the time of this study, the full extent of any proposed earthwork had not been finalized. We anticipate that a moderate to significant amount of grading will be required to construct the proposed improvements. Any proposed earthwork should be performed in accordance with the recommendations provided below.

### 9.3.1. Clearing and Site Preparation

- Clear all obstructions, including brush, trees not designated to remain, and debris on any areas to be graded.
- Clear and backfill any holes or depressions resulting from the removal of underground obstructions below proposed finished subgrade levels with suitable material compacted to the requirements for engineered fill given below.

*Copyright – C2Earth, Inc.*

- After clearing, strip the site to a sufficient depth to remove all surface vegetation and organic-laden topsoil. At the time of our field study, we estimated that a stripping depth of approximately 3 inches would be required on natural slope areas. This material must not be used as engineered fill; however, it may be used for landscaping purposes.

### 9.3.2. Fill Material

- Based on our study, it is our opinion that the materials encountered in the borings should be suitable for use as fill. On-site or imported materials must meet the requirements specified below to be used as engineered fill:
- Materials used for engineered fill must meet the following requirements:
  1) Have an organic content less than 3% by volume;
  2) no rocks or lumps greater than 6 inches in maximum dimension, and
  3) no more than 15% of the fill may be greater than 2½ inches in maximum dimension.
- If on-site materials do not meet the requirements given above, they may be off-hauled or used for landscaping purposes only.
- In addition to the requirements above, any import fill must have a plasticity index (PI) of 15 or less.
- **Contact C2 with samples of proposed fill materials at least four days prior to fill placement for laboratory testing and evaluation.**

### 9.3.3. Keyways and Benches

- Non-retained fill placed on slopes in excess of 5:1 must be keyed and benched into the underlying supportive alluvium to provide a firm, stable surface for support of the fill.
- A keyway, located at the toe of proposed fill, must be excavated a minimum of 3 feet into the supportive alluvium, as measured on the downhill side of the keyway.
- Keyways and benches generally must be a minimum of 5 feet wide and must be excavated entirely into the supportive material.
- Temporary back slopes may be vertically excavated provided they are constructed in the dry season and meet Cal OSHA requirements.
- Both the keyway and any required benches must be excavated near level in the direction parallel to the natural slope and must be provided with an approximately 2% gradient sloping into the hillside to provide resistance to lateral movement and to facilitate proper subdrainage.
- **Contact C2 to evaluate the actual location, size, and depth of the required keyway and benches at the time of construction**.

*Copyright – C2Earth, Inc.*

### 9.3.4. Subdrains

- C2 must determine the need for subdrains at the time of construction.
- In general, fill exceeding 5 feet deep should be provided with subdrains.
- Subdrains must consist of a 4-inch diameter, rigid, heavy-duty, perforated pipe (Schedule 40, SDR 17, or equivalent), approved by C2, embedded in drainrock (crushed rock or gravel).
- Flexible corrugated pipe must not be used.
- The pipe must be placed with the perforations down on a 2- to 3-inch bed of drainrock. The drainrock must be separated from the fill and the native material by a geotextile filter fabric, approved by C2.
- Subdrain pipes must be provided with clean-out risers at their up-gradient ends and at all sharp changes in direction.
- Changes in pipe direction must be made with "sweep" elbows to facilitate future inspection and clean-out.
- Subdrain systems must be provided with a minimum 1% gradient and must discharge onto an energy dissipater at an appropriate downhill location approved by C2.

### 9.3.5. Compaction Procedures

- Prior to fill placement, scarify the surface to receive the fill to a depth of 6 inches.
- Moisture condition the imported fill to the materials' approximate optimum moisture content.
- Spread and compact the fill in lifts not exceeding 8 inches in loose thickness.
- Compact the fill to at least 90% relative compaction by the Modified Proctor Test method, in general accordance with the ASTM Test Designation D1557 (latest revision).
- **Contact C2 to observe the placement and test the compaction of engineered fill.** Provide at least two working days notice prior to placing fill.

### 9.3.6. Permanent Slopes

- Construct the gradients of permanent cut or fill slopes no steeper than 2:1.
- Re-vegetate all graded surfaces or areas of disturbed ground prior to the onset of the rainy season following construction to control soil erosion.
- Install other erosion control provisions if vegetation is not established by the rainy season.
- Maintain ground cover vegetation once it is established to provide long-term erosion control.

*Copyright – C2Earth, Inc.*

#### 9.3.7. Trench Backfill

- Backfill all utility trenches with compacted engineered fill.
- Place suitable on-site soil into the trenches in lifts not exceeding 8 inches in uncompacted thickness, and compact it to at least 90% relative compaction by mechanical means only.
- If imported sand is used, compact it to at least 90% relative compaction. Do not use water jetting to obtain the minimum degree of compaction in imported sand backfill. If the trench is greater than 50 feet long, located on sloping ground greater than 5:1 (horizontal to vertical), and is backfilled with sand, check dams should be installed to reduce the potential of the sand washing out.
- Compact the upper 6 inches of trench backfill to at least 95% relative compaction in all pavement areas.
- **Contact C2 to observe and test compaction of the fill.**

#### 9.3.8. Basement Excavations

- Excavate for the proposed basement areas using an OSHA approved benching or sloping cut configuration selected by an OSHA "Competent Person". The Competent Person must be capable of identifying hazards during construction, such as slope instability, and take prompt corrective measures to mitigate any potential hazard.
- To aid the Competent Person in their selection of construction means and methods, consider the on-site engineered fill to be an OSHA Soil Type B. The Competent Person must evaluate the excavation during construction and confirm the suggested OSHA soil classification type.
- As an alternative to benching and sloping, shoring may be used to support the temporary cut along the southwest side of the road. Consult with a shoring specialist for the design and installation of temporary shoring.
- The contractor is solely responsible for means and methods of construction and should designate appropriate personnel to act as the Competent Person.
- **Contact C2 to observe the subsurface conditions** exposed within the excavations to assess whether they are consistent with expected subsurface conditions.

### 9.4. Foundations

Because of the presence of shallow supportive alluvial fan deposits in the area of the proposed residence, we recommend that the residence and associated structures be supported on a mat-slab or conventional spread footing foundations, gaining support in the underlying alluvial fan deposits. In our opinion, a foundation comprised of a mat-slab or grid of interconnected footings designed and constructed in accordance with the following recommendations will reduce the risk of differential movement and distress affecting the residence as a result of earthquake-induced ground deformation.

*Copyright – C2Earth, Inc.*

We recommend that your engineer design and your contractor construct the proposed foundation and retaining wall elements in accordance with the following recommendations.

### 9.4.1. Spread Footings / Mat-Slabs

- Spread footings or mat-slabs must bear on the underlying, native undisturbed alluvial deposits.
- Design the spread footings or mat-slabs supported in the undisturbed alluvial deposits for an allowable bearing pressure of 2,000 psf for dead plus live loads, with a 1/3 increase for transient loads, including wind and seismic.
- If the designer elects to utilize a design methodology based upon a modulus of subgrade reaction, the designer must recognize that this parameter cannot be determined without full scale load testing. Based upon the site soil conditions, an approximated modulus of subgrade reaction could vary between 40 and 150 pci. The designer should conduct a sensitivity analysis and must utilize a value they deem acceptable.
- All footings adjacent to utility trenches or basement retaining wall excavations must have their bearing surface below an imaginary 1:1 (horizontal to vertical) plane projected upward from the bottom edge of the trench / basement retaining wall excavation (see Figure 16, Conceptual Basement Retaining Wall Pressure Diagram).
- As an alternative, foundation elements located above a 1:1 plane projected upward from the bottom edge of the basement retaining wall excavation must be designed to structurally span the area above this plane (the zone of influence on the retaining wall).
- For the basement areas, lateral loads may be resisted by using passive pressure equal to an equivalent fluid weight of 400 pcf for mat-slab elements poured neat in excavations into the undisturbed alluvial fan deposits. Lateral loads may also be resisted by a friction coefficient of 0.25, which has been reduced to account for a waterproofing membrane. The passive pressure and friction may be used in combination without reduction.
- For the non-basement foundations, lateral loads may be resisted by friction between the foundation bottoms and the supporting subgrade using a friction coefficient of 0.35.
- The structural design engineer must determine concrete reinforcing to provide structural continuity and to permit the spanning of any local irregularities.
- Design for differential and total settlement for footings or mat-slabs founded in supportive material of less than 1 inch.
- Concrete reinforcing must be provided in accordance with the recommendations of the structural design engineer.

*Copyright – C2Earth, Inc.*

- Provide the basement foundation elements with appropriate waterproofing. Waterproof the concrete slab-on-grade or mat-slab and maintain waterproofing continuity with the cellar retaining wall waterproofing.
- Clear the bottoms of the footing or mat-slab excavations of loose cuttings and soil fall-in prior to the placement of concrete.
- **Contact C2 to observe the footing / mat-slab excavations prior to placing reinforcing steel** to evaluate depth into supportive material.

### 9.4.2. Retaining Walls

We anticipate that both basement and site retaining walls will be used on the site. The following recommendations are for cantilever type walls. Contact us to provide appropriate recommendations if you consider other types of walls.

- Support residential and site retaining walls on mat-slab or spread footing foundations designed in accordance with the recommendations given above.
- Design retaining walls to resist both lateral earth pressures and any additional lateral loads caused by surcharge loads on the adjoining ground surface.
- Deflection of cantilever retaining walls will occur in response to lateral loading. Anticipate horizontal deflections at the top of the wall to be 2% of the wall height or less.
- Design unrestrained (active condition) walls to resist an equivalent fluid pressure of 50 pcf. Design walls that are restrained from movement at the top or sides (at-rest condition) to resist an equivalent fluid pressure of 70 pcf (see Figure 16, Conceptual Basement Retaining Wall Pressure Diagram and Figure 17, Conceptual Site Retaining Wall Pressure Diagram).
- Add an additional equivalent fluid pressure increment to the active and at-rest condition for backfill steeper than 4:1 (horizontal to vertical), in accordance with the following:

  + 8 pcf for slopes between 3:1 and 4:1

  + 12 pcf for slopes between 2:1 and 3:1

  - + Contact us for slopes steeper than 2:1

- Design for seismic-loading as the structural engineer deems appropriate. In our opinion, the requirements for seismic design of retaining walls are not clearly defined. If the structural engineer considers seismic loading, based upon the procedures presented by Sitar, et. al. (2012), design unrestrained (active condition) residential retaining walls to resist an additional earthquake equivalent fluid pressure (seismic increment) of 49 pcf.

*Copyright – C2Earth, Inc.*

- If seismic loading is considered, design building retaining walls to resist the appropriate loading condition: either the at-rest condition if the walls are restrained, or the active condition plus the seismic increment if the walls are unrestrained.
- Site walls retaining less than 6 tall are not typically subject to additional earthquake loading requirements.
- Wherever the walls will be subjected to surcharge loads, they must be designed for an additional uniform lateral pressure equal to 1/2 or 1/3 the anticipated surcharge load for restrained or unrestrained walls, respectively.
- The preceding pressures require that sufficient drainage be provided behind the walls to prevent the buildup of hydrostatic pressures from surface or subsurface water infiltration.
- Provide a backdrain system consisting of an approximately 1 foot thick curtain of drainrock (crushed rock or gravel) behind the wall.
- Separate the drainrock from the backfill by a geotextile filter fabric, such as Mirafi 140 or an alternative, approved by C2. A 4-inch diameter heavy-duty rigid perforated subdrain pipe (Schedule 40, SDR 21 or equivalent), approved by C2, must be placed with the perforations down on a 2- to 3-inch layer of drainrock at the base of the drain. Where subdrain pipes will be buried deeper than 10 feet, Schedule 80 or equivalent pipe should be used. **Do not use flexible corrugated pipe.**
- As an alternative, back drainage may consist of an approved drainage mat placed directly against the wall. The bottom of the drainage mat must be in contact with the rigid 4-inch perforated drainpipe embedded in gravel. The gravel must be fully encased in filter fabric.
- The backdrains should extend up the height of the back of the retaining walls to within 1 foot of the height of the retained soil, and then be covered with a compacted clay soil cap.
- Details of backdrain options are presented on Figure 18, Conceptual Retaining Wall Backdrain Diagram.
- Perforated retaining wall subdrain pipes must be dedicated pipes and must not connect to the surface drain system. Install the subdrain pipes with a positive gradient of at least 1% and provide them with clean-out risers at their up-gradient ends and at all sharp changes in direction. Changes in pipe direction must be made with "sweep" elbows to facilitate future inspection and clean-out. The perforated pipes must be connected to buried solid pipes to convey collected runoff to discharge onto an energy dissipater at an appropriate downhill location, approved by C2.

*Copyright – C2Earth, Inc.*

- Compact the backfill placed behind the walls to at least 90% relative compaction, using light compaction equipment, in accordance with the compaction procedures given above. If heavy compaction equipment is used, the walls should be appropriately temporarily braced, as the situation requires. If backfill consists entirely of drainrock, it should be placed in approximately 2-foot lifts and must be compacted with several passes of a vibratory plate compactor.
- Perform annual maintenance of retaining wall backdrain systems, which must include inspection and flushing to make sure that subdrain pipes are free of debris and are in good working order. This maintenance must also include inspection of subdrain outfall locations to verify that introduced water flows freely through the discharge pipes and that no excessive erosion has occurred.
- If erosion is detected, C2 must be contacted to evaluate its extent and to provide mitigation recommendations, if needed.
- Damp proof or waterproof retaining walls that are adjacent to living spaces and/or site walls with decorative facing. We are not qualified to recommend specific damp proofing or waterproofing materials or their applications. Any damp proofing or waterproofing product must be applied in **strict** compliance with the manufacturer's and/or architect's specifications.
- If you select an alternative retaining wall type, you should contact C2 to provide additional recommendations.

### 9.4.3. Segmental Block Retaining Walls

We anticipate that segmental block retaining walls (SRWs) may also be used on the site. The following recommendations are for typical SRWs. Contact us to provide appropriate recommendations if you consider other types of walls.

- We recommend that the SRWs be designed and constructed in general accordance with the manufacturer's recommendations, including being provided with geogrid reinforcement, if necessary.
- The following material parameters may be used for the SRW design. For the underlying alluvial fan deposits (foundation materials) and for engineered backfill derived from on-site materials, use a unit weight of 125 pcf, an internal angle of friction of 26 degrees, and negligible cohesion with an allowable bearing capacity of 2,000 psf. Site walls are not subject to additional earthquake loading requirements.
- Construct the SRWs so that a minimum of one layer of blocks is keyed into the displaced colluvium/old landslide deposits below any topsoil (remove any topsoil in the vicinity of the wall and backfill area).
- Calculate the wall height from the bottom of the lowest block to the top of the upper block.

*Copyright – C2Earth, Inc.*

- Apply appropriate surcharge loading for sloping ground at the top of the retaining wall in accordance with the manufacturer's recommendations.
- **Contact C2 to observe the excavation prior to placement of the SRW blocks** to evaluate if the blocks are founded in material of sufficient supporting capacity.
- **Contact C2 to observe the placement of geogrid and test the compaction of backfill.**
- Provide drainage provisions to prevent the build up of hydrostatic pressure in accordance with the manufacturer's recommendations and the recommendations presented in the preceding section for basement retaining walls

#### 9.4.4. Flatwork

We anticipate that flexible pavement or concrete slabs-on-grade may be used for a new driveway onto the site, and concrete slab-on-grade or pavers may be used for patios and walkways. Where located on soil or colluvium, the overlaying flatwork will be subject to downslope migration and differential movement. We believe this condition will result in minor ongoing cosmetic damage to the flatwork. To mitigate the risk of differential movement of the flatwork, we recommend the following options:

- Option 1: Construct the flatwork using a flexible pavement system that can accommodate differential movement, such as pavers.
- Option 2: Remove and replace the colluvium and/or artificial fill with engineered fill, keyed and benched into the supportive alluvial fan deposits in accordance with the recommendation provided above.

For flexible pavement we recommend the following minimum requirements which are based upon an anticipated Traffic Index (TI) of 3. If a greater TI is required for the project, contact C2 for appropriate recommendations.

- Scarify and recompact the upper of 6 inches of the sub-base to the requirements for engineered fill given above.
- Use a minimum pavement section of 2 inches of asphalt over 6 inches of CalTrans Class II baserock compacted to at least 95% relative compaction in accordance with the requirements for engineered fill given above.
- **Contact C2 to observe and test compaction of the sub-base recompaction and baserock compaction.**
- For concrete flexible pavers we recommend the following minimum requirements:
- Support pavers on a minimum of 6 inches of non-expansive fill compacted to the requirements for compacted fill given above.
- Proof-roll the surface of the non-expansive fill to provide a smooth, firm surface, then place pavers on a leveling course per manufacturer's recommendations.
- Periodically repair cracked pavers or re-level pavers that experience differential movement.

*Copyright – C2Earth, Inc.*

For concrete slabs-on-grade we recommend the following minimum requirements:

- Support concrete slabs-on-grade on a minimum of 12 inches of non-expansive fill compacted to the requirements for compacted fill given above.
- Proof-roll the surface of the non-expansive fill to provide a smooth, firm surface for slab support prior to placement of reinforcing steel.
- Design slab reinforcement in accordance with anticipated use and loading, but at a minimum, reinforce slabs with No. 3 rebar on 18-inch centers each way, placed mid-height in the slab.
- Support the reinforcing steel from below on concrete blocks (or similar) during concrete pouring to make sure that it remains mid-height in the slab.
- Place grooves in the concrete slabs at 10-foot intervals or in accordance with the structural design engineer's recommendations to help control cracking.
- The structural designer must evaluate moisture conditions related to concrete slab curing and performance. The builder must provide appropriate drying time as determined by the designer.

Where floor wetness is undesirable:

- The building designer or qualified waterproofing consultant must provide moisture barrier requirements.
- The following recommendations are typical moisture barrier standards. We do not guarantee that these measures will prevent all future moisture intrusion. If necessary, you should consult a qualified waterproofing consultant to provide waterproofing design.
- We recommend as a minimum using a puncture resistant, heavy-duty membrane (such as a minimum of 15 mil Stego Wrap, or equivalent) in direct contact with the floor slab and underlain by 6 inches of free-draining gravel.
- Use the gravel, heavy-duty membrane, and/or sand (if specified) in lieu of the upper 6 inches of the recommended non-expansive fill.

### 9.5. Drainage

Control of surface drainage is critical to the successful performance of the proposed improvements. The results of improperly controlled runoff may include foundation heave and/or settlement, erosion, gullying, ponding, and potential slope instability. To mitigate the risks associated with improperly controlled runoff, we recommend that you implement the following:

- Prevent surface water from ponding in areas adjacent to the foundation of the proposed residence and associated improvements by grading adjacent areas to create proper drainage by sloping them away from the structures.
- As an alternative, install area drains to collect surface runoff.

*Copyright – C2Earth, Inc.*

- Provide roof gutters with downspouts on the structures. Provide downspouts with slip-joint connectors or clean-outs, where they are connected to buried pipes, to facilitate maintenance (see Figure 19, Conceptual Downspout Clean-Out Diagram).
- Do not allow water collected in the gutters to discharge freely onto the ground surface adjacent to the foundation.
- Convey all collected water away from the structures via buried, closed conduit or hard surfaced drainage way, and discharge onto an energy dissipater at an appropriate downslope location approved by C2. Energy dissipaters may consist of a short "T" fitting placed in a shallow trench and covered or surrounded with cobbles (see Figure 20, Conceptual Energy Dissipater Diagram). The discharge must not be located on, or adjacent to, steep, potentially unstable terrain or where runoff will adversely impact adjacent parcels.
- Perform annual maintenance of the surface drainage systems, including:
  1) Inspecting and testing roof gutters and downspouts to make sure that they are in good working order and do not leak;
  2) inspecting and flushing area drains to make sure that they are free of debris and are in good working order; and
  3) inspecting surface drainage outfall locations to verify that introduced water flows freely through the discharge pipes and that no excessive erosion has occurred.
- Contact C2 if erosion is detected so that we may evaluate its extent and provide mitigation recommendations, if needed.

## 10. PLAN REVIEW AND CONSTRUCTION OBSERVATION

We must be retained to review the final grading, foundation, and drainage control plans in order to assess whether our recommendations have been properly incorporated into the proposed project. **WE MUST BE GIVEN AT LEAST TWO WEEKS TO REVIEW THE PLANS AND PREPARE A PLAN REVIEW LETTER.**

We must also be retained to observe the grading and the installation of foundations and drainage systems in order to:

- assess whether the actual soil conditions are similar to those encountered in our study;
- provide us with the opportunity to modify the foundation design, if variations in conditions are encountered; and
- observe whether the recommendations of our report are followed during construction.

Sufficient notification prior to the start of construction is essential, in order to allow for the scheduling of personnel to ensure proper monitoring.

*Copyright – C2Earth, Inc.*

**WE MUST BE NOTIFIED AT LEAST TWO WEEKS PRIOR TO THE ANTICIPATED START-UP DATE. IN ADDITION, WE MUST BE GIVEN AT LEAST TWO WORKING DAYS NOTICE PRIOR TO THE START OF ANY ASPECTS OF CONSTRUCTION THAT WE MUST OBSERVE.**

The phases of construction that we must observe include, but are not necessarily limited to, the following.

1. **EARTHWORK:** During construction to observe keyway and bench excavations, evaluate the need for subdrainage, and to test compaction of engineered fill
2. **FOOTING and MAT-SLAB EXCAVATIONs:** Prior to placement of reinforcing steel to evaluate depth to supportive material
3. **SEGMENTAL BLOCK RETAINING RETAINING WALL:** Prior to placement of the blocks to evaluate if the blocks are founded in material of sufficient supporting capacity and during placement of geogrid and/or fill
4. **RETAINING WALL BACKDRAIN:** During installation
5. **RETAINING WALL BACKFILL:** During backfill to observe and test compaction
6. **FLATWORK AND FLEXIBLE PAVEMENT:** Prior to and during placement of non-expansive fill to observe the subgrade preparation and to test compaction of non-expansive fill
7. **SURFACE DRAINAGE SYSTEMS:** Near completion to evaluate installation and discharge locations

* * * * * * * * *

A Bibliography, a List of Aerial Photographs, and the following Figures, Table, and Appendix are attached and complete this report.

*Copyright – C2Earth, Inc.*

## BIBLIOGRAPHY


**AMERICAN SOCIETY OF CIVIL ENGINEERS**, 2016, Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE/SEI 7-16).

**AMERICAN SOCIETY OF CIVIL ENGINEERS**, 2020, ASCE 7 Hazard Tool, available at www.asce7hazardtool.online.

**ANGELL, M.A., HANSON, K.L., and CRAMPTON, T,** 1997, Characterization of Quaternary Contractional Deformation adjacent to the San Andreas Fault, Palo Alto, California, Final Report submitted to the U.S. Geological Survey, National Earthquake Hazards Reduction Program, Award No. 1434-95-G-2586.

**BORCHERDT, R. D., J. F. GIBBS, and K. R. LAJOIE**, 1975, Maps Showing Maximum Earthquake Intensity Predicted in the Southern San Francisco Bay Region, California, for Large Earthquakes on the San Andreas and Hayward Faults, U. S. Geological Survey, Miscellaneous Field Studies Map MF-709, 1:125,000.

**CALIFORNIA BUILDING STANDARDS COMMISSION,** 2019 California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2 of 2.

**CALIFORNIA DIVISION OF MINES AND GEOLOGY**, 1991, State of California Special Studies Zone Map, Los Gatos 7½-Minute Quadrangle, 1:24,000.

**CALIFORNIA GEOLOGICAL SURVEY**, 2002, State of California, Seismic Hazard Zones, Los Gatos Quadrangle, Official Map, California Department of Conservation, Released: September 23, 2002.

**CALIFORNIA GEOLOGICAL SURVEY**, 2002, Seismic Hazard Zone Report for the Los Gatos 7.5-Minute Quadrangle, Santa Clara County California, California Department of Conservation, Seismic Hazard Zone Report 069.

**CALIFORNIA GEOLOGICAL SURVEY**, 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, California Department of Conservation, Division of Mines and Geology, Special Publication 117A.

**HUNT, R.E.**, 2005, Geotechnical Engineering Investigation Handbook, CRC Press, Boca Raton, Florida.

**McLAUGHLIN, R. J., J. C. CLARK, E. E. BRABB, E. J. HELLEY, and C.J. COLÓN,** 2001, Geologic Maps and Structure Sections of the Southwestern Santa Clara Valley and Southern Santa Cruz Mountains, Santa Clara and Santa Cruz Counties, California, U. S. Geological Survey, Miscellaneous Field Studies Map MF-2373.

**NOLAN ASSOCIATES**, 1999, Fault Rupture Hazard Zones, Figure 16-2, Town of Los Gatos General Plan Update.

**NOLAN ASSOCIATES**, 1999, Fault, Lineament, and Coseismic Deformation Map, Plate 3, January 17, 1999.

**SANTA CLARA COUNTY**, 2012, County Geologic Hazard Zones: Fault Rupture, Landslide, and Liquefaction, Sheet 35, Zones Version dated October 26, 2012, 1" = 2,000'.

**SCHMIDT, K. M., ELLEN, S. D., HAUGERUD, R. A., PETERSON, D. M.**, 1995, Map of Pavement and Pipe Breaks as Indicators of Range Front Faulting Resulting from the 1989 Loma Prieta Earthquake, U. S. Geological Survey, Open-File Report 95-820.

**SITAR, NICHOLAS, MIKOLA, ROOZBEH GERAILI, and CANDIA, GABRIEL,** 2012, Seismically Induced Lateral Earth Pressures on Retaining Structures and Basement Walls, Geotechnical Engineering State of the Art and Practice, Keynote Lectures from GeoCongress 2012, Geotechnical Special Publication No. 226, ASCE

**SORG, D. H., AND R. J. MCLAUGHLIN**, 1975, Geologic Map of the Sargent-Berrocal Fault Zone between Los Gatos and Los Altos Hills, Santa Clara County, California, U. S. Geological Survey Miscellaneous Field Studies Map MF-643, 1:62,500.

**STOVER, C. W., B. G. REAGOR, F. W. BALDWIN, and L. R. BREWER,** 1990, Preliminary Isoseismal Map for the Santa Cruz (Loma Prieta), California, Earthquake of October 17, 1989, U. S. Geological Survey, Open-File Report 90-18.

**TOPPOZADA, T. R. and BORCHERDT, G.**, 1998, Re-evaluation of the 1836 "Hayward Fault" and the 1838 San Andreas Fault Earthquakes, Bulletin of Seismological Society of America, 29(1).

**TREADWELL & ROLLO** , 2008, Revised Fault Hazard Investigation, Project No. 4844.01, September 4, 2008; unpublished consultant's report.

**U.S. GEOLOGICAL SURVEY**, 2016, Earthquake Outlook for the San Francisco Bay Region 2014-2043, U.S. Geological Survey Fact Sheet – 2016-3020.

**YANEV, P.**, 1974, Peace of Mind in Earthquake Country: Chronicle Books, San Francisco, California.

## LIST OF AERIAL PHOTOGRAPHS

**"BAY AREA TRANSPORTATION STUDY"**, black and white, dated May 16, 1965, at a scale of 1" = 1,000', Aerial Survey Contract No. 67615, Serial Nos. SCL 45-42 and SCL 45-43, State of California Highway Transportation Agency, Division of Highways.

## FIGURES, TABLE, AND APPENDIX

FIGURE NO.

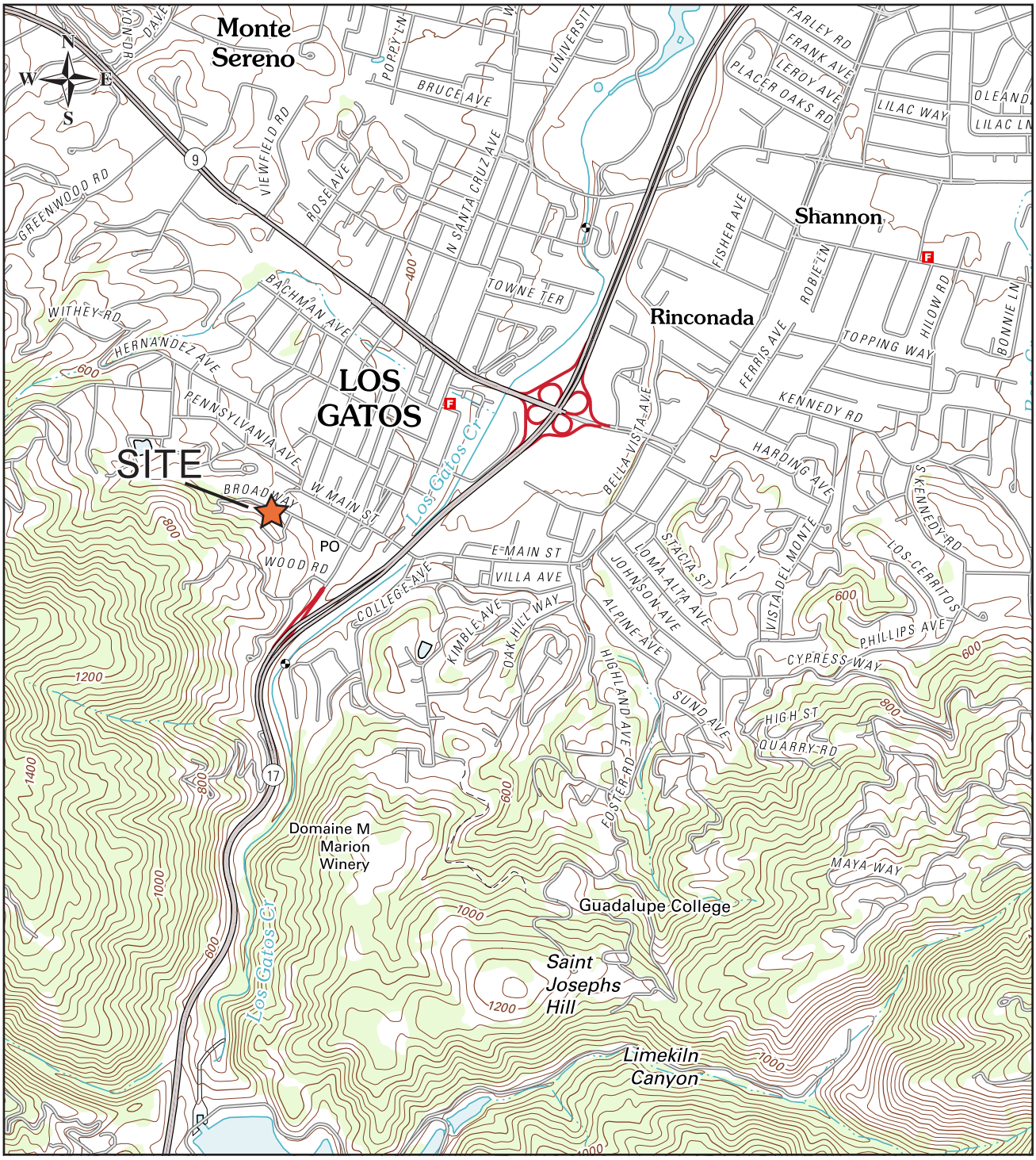
SITE LOCATION MAP.....1
REGIONAL GEOLOGIC MAP.....2
REGIONAL SEISMIC HAZARD ZONES MAP.....3
LOCAL LANDSLIDE HAZARD AREAS MAP.....4
LOCAL FAULT RUPTURE POTENTIAL MAP.....5
FAULT, LINEAMENT, AND COSEISMIC DEFORMATION MAP.....6
OBSERVED DISTRESS FROM THE 1989 LOMA PRIETA EARTHQUAKE MAP.....7
SITE PLAN AND ENGINEERING GEOLOGIC MAP.....8
GEOLOGIC CROSS-SECTION A-A'.....9
KEY TO LOGS.....10
SUMMARY OF FIELD SAMPLING PROCEDURES.....11
LOGS OF BORINGS 1 THROUGH 3.....12-14
PLASTICITY CHART.....15
CONCEPTUAL BASEMENT RETAINING WALL PRESSURE DIAGRAM.....16
CONCEPTUAL SITE RETAINING WALL PRESSURE DIAGRAM.....17
CONCEPTUAL RETAINING WALL BACKDRAIN DIAGRAM.....18
CONCEPTUAL DOWNSPOUT CLEAN-OUT DIAGRAM.....19
CONCEPTUAL ENERGY DISSIPATER DIAGRAM.....20

TABLE NO.

MODIFIED MERCALLI SCALE OF EARTHQUAKE INTENSITIES.....I

APPENDIX.

ASCE 7 HAZARDS REPORT.....A




BASE: The National Map US Topo; UNITED STATES GEOLOGICAL SURVEY; 2012

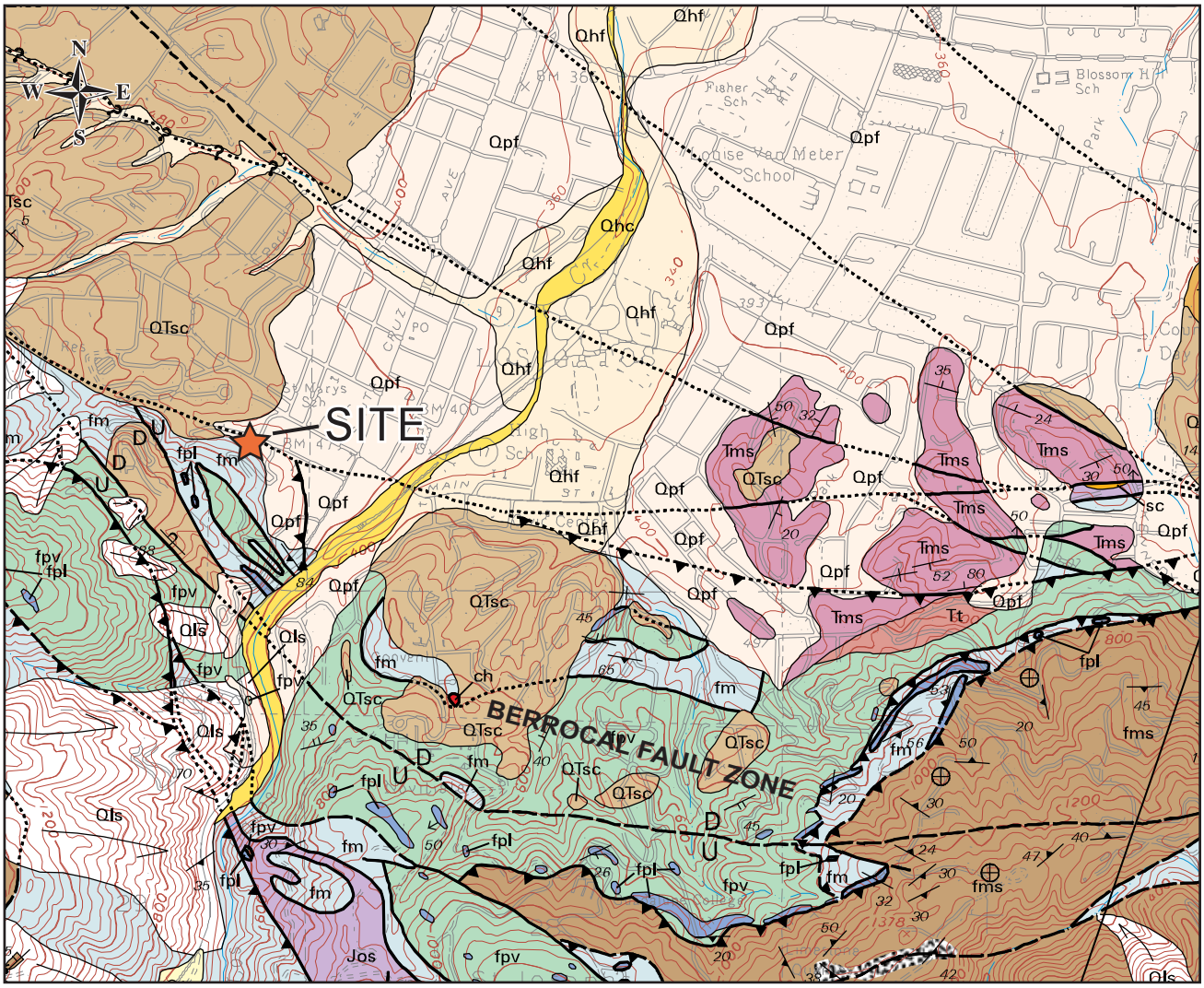
SITE LOCATION MAP

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| IV/CH | 1" = 2,000' | 20007C-01R1 | February 2020 | Figure 1 |

Copyright - C2Earth, Inc.




## EXPLANATION

| | |
|---|---|
| Qls | - Landslide deposits, undivided |
| Qhf | - Alluvial fan deposits |
| Qhc | - Stream channel deposits |
| Qpf | - Alluvial fan deposits |
| QTsc | - Santa Clara Formation |
| Tms | - Monterey Shale |
| Tt | - Temblor Sandstone |
| Jos | - Serpentinized ultramafic rocks |

Franciscan Complex units

| | |
|---|---|
| fm | - Melange |
| fpl | - Foraminiferal limestone |
| fpv | - Volcanic rocks |
| fms | - Sandstone |

15 Strike and Dip

Horizontal Bedding

15 Inclined Shear Foliation

15 Strike and Dip of Volcanic Flow or of Dikes and Sills

Vertical Dip

Geologic Contact
dashed where approximate and dotted where concealed

D U Fault
U and D denote upthrown and downthrown blocks, dashed where approximate and dotted where concealed

Thrust Fault
barbs on upper plate

Qls Landslide Deposits
general direction of movement

BASE: Sheet 1: Los Gatos Quadrangle, Geologic Maps and Structure Section of the Southwestern Santa Clara Valley and Southern Santa Cruz Mountains, Santa Clara and Santa Cruz Counties, California; MCLAUGHLIN, ET AL.; 2001

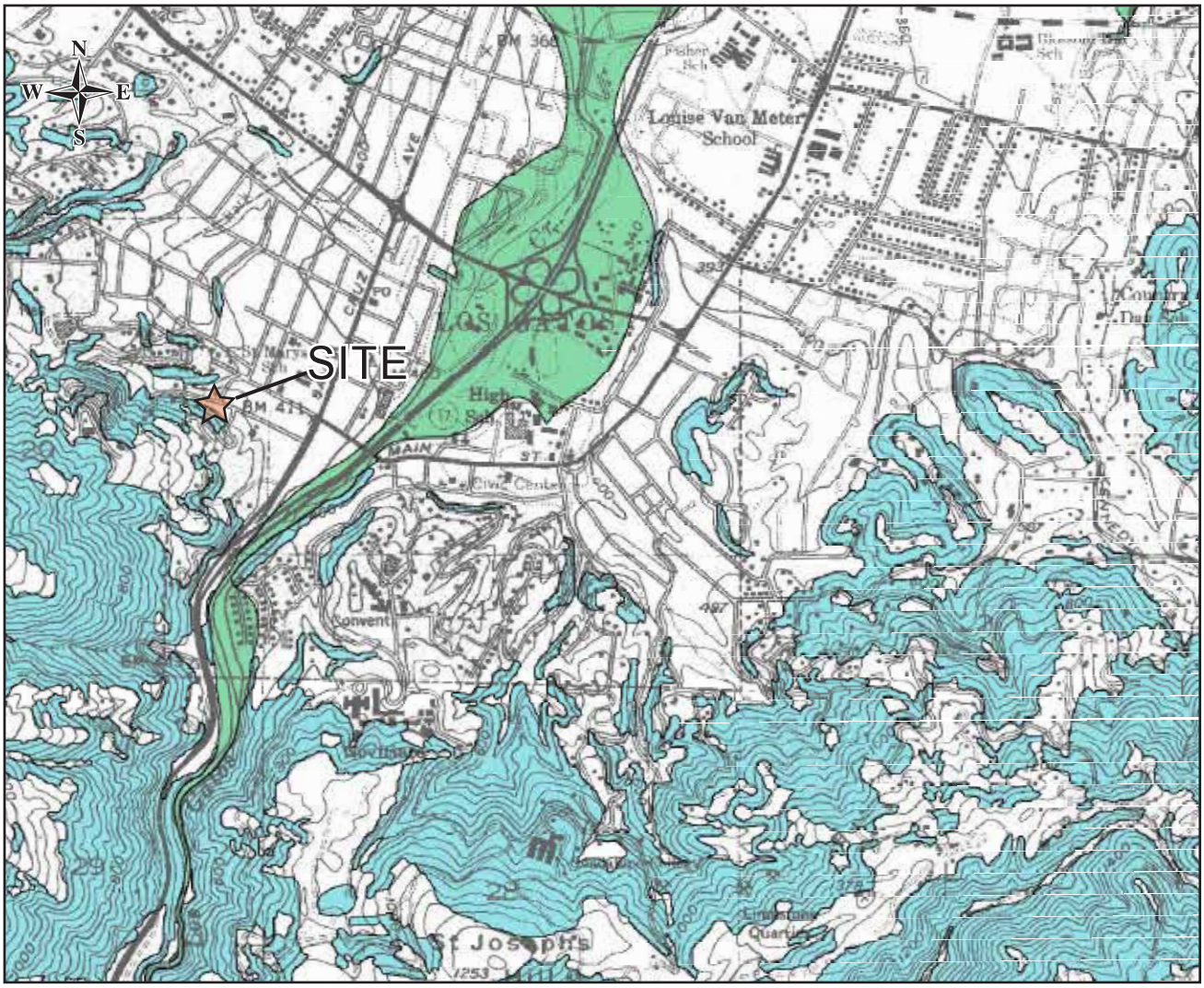
REGIONAL GEOLOGIC MAP

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| IV/CH | 1" = 2,000' | 20007C-01R1 | February 2020 | Figure 2 |

Copyright - C2Earth, Inc.




EXPLANATION

- **Earthquake-Induced Landslide Hazard Zones;** Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements.

- **Earthquake-Induced Liquefaction Hazard Zones;** Areas where historic occurrence of liquefaction, or local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements.

BASE: Seismic Hazard Zones, Los Gatos Quadrangle; California Geological Survey; 23 September 2002

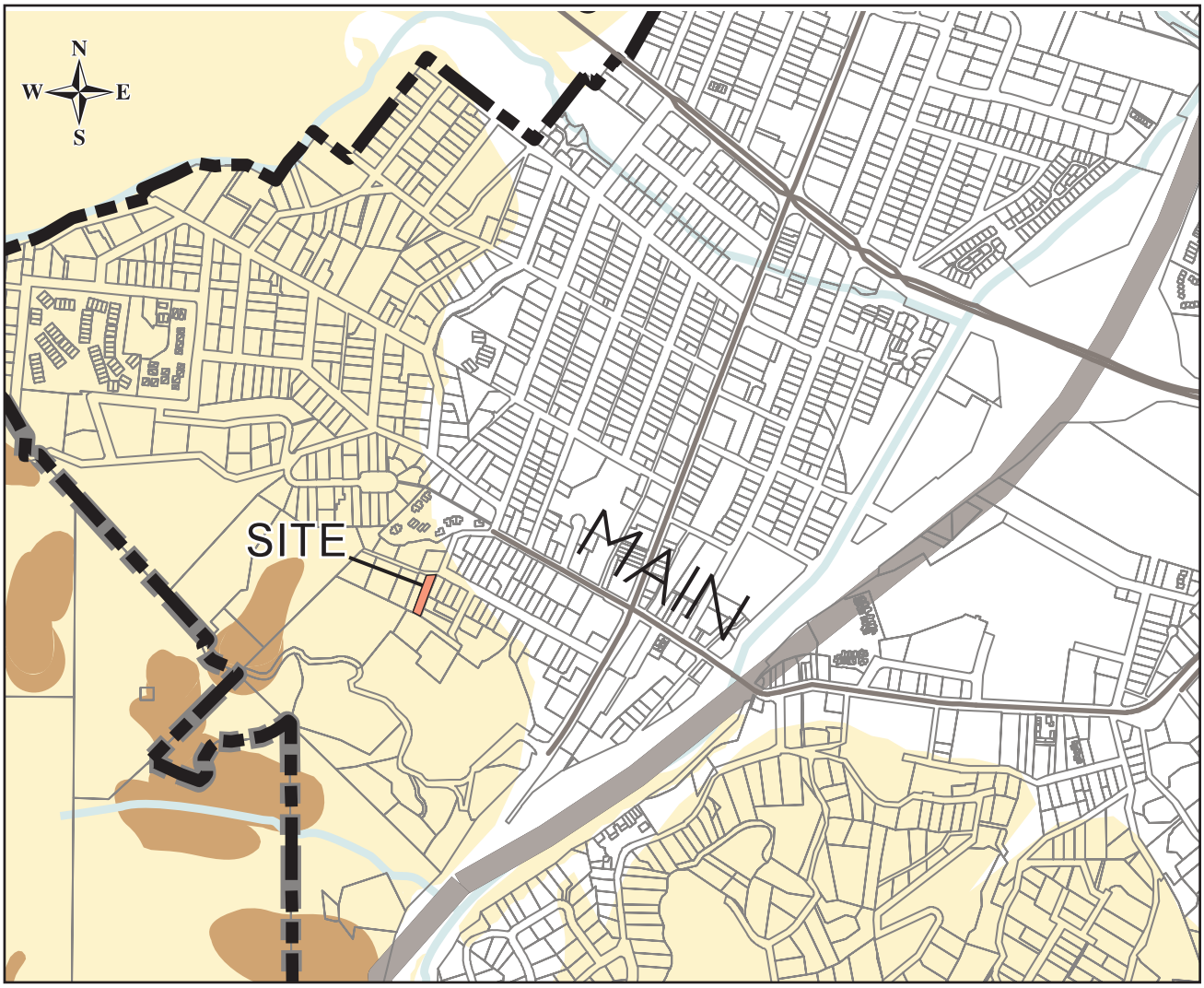
REGIONAL SEISMIC HAZARD ZONES MAP

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| IV/CH | 1" = 2,000' | 20007C-01R1 | February 2020 | Figure 3 |

*Copyright - C2Earth, Inc.*




EXPLANATION

- Town Boundary
- Sphere of Influence
- Water Body
- Creek
- Severe Landslide Hazard
- Landslide Potential

BASE: Town of Los Gatos General Plan Update; Landslide Hazard Areas, Figure 16-4

LOCAL LANDSLIDE HAZARD AREAS MAP

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| IV/CH | 1" = 1,000' | 20007C-01R1 | February 2020 | Figure 4 |

Copyright - C2Earth, Inc.

EXPLANATION

- Town Boundary
- Sphere of Influence
- Creek

Fault Rupture Potential

- High
- Moderate

BASE: Town of Los Gatos General Plan Update; Fault Rupture Hazard Zones, Figure 16-2

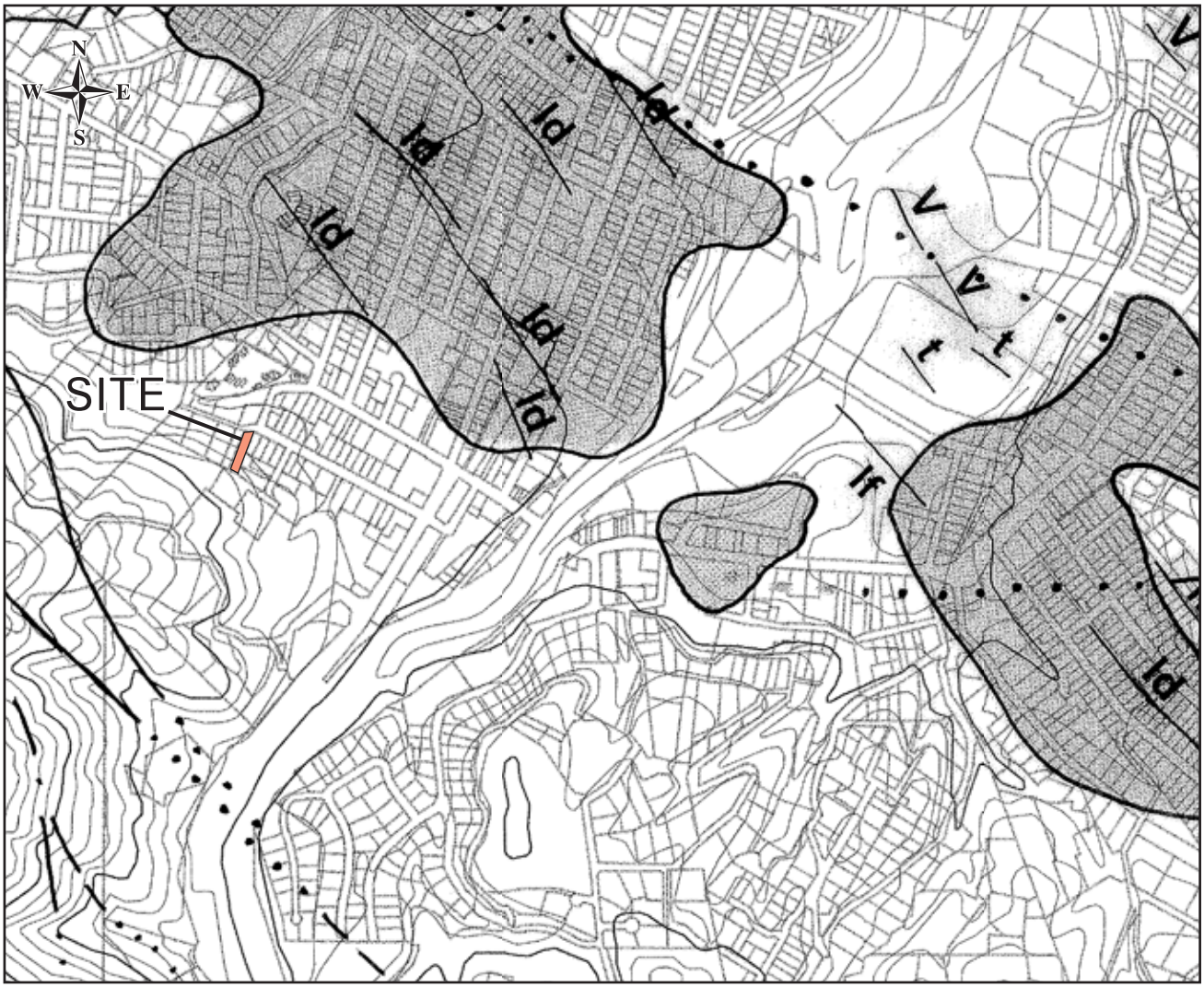
LOCAL FAULT RUPTURE POTENTIAL MAP

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| IV/CH | 1" = 500' | 20007C-01R1 | February 2020 | Figure 5 |

*Copyright - C2Earth, Inc.*




EXPLANATION

- Concentration of coseismic ground deformation

- Fault trace
  dashed where uncertain
  dotted where concealed

s - Lineation indicative of faulting. Interpreted from aerial photograph analysis.
  v = vegetation
  t = tonal
  ld = linear depression
  lf = linear front

BASE: Town of Los Gatos General Plan Update; Fault, Lineament & Coseismic Deformation Map; Plate #3; NOLAN ASSOCIATES; 1/17/99

FAULT, LINEAMENT, AND COSEISMIC DEFORMATION MAP

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| IV/CH | 1" = 1,000' | 20007C-01R1 | February 2020 | Figure 6 |

Copyright - C2Earth, Inc.

EXPLANATION

Coseismic Concrete Pavement Breaks

- Fresh break or buckle suggestive of contractional deformation (Reported by USGS; some also reported by local governments)
- Apparently fresh break with unspecified sense of deformation (Reported by USGS; some also reported by local governments)
- Break with unspecified sense of deformation (Reported by local governments)
- Pavement break that pre-dates the earthquake (Reported by USGS)
- Contractional deformation that post-dates the earthquake (Reported by USGS)

Coseismic Pipe Breaks

- Fresh break or buckle suggestive of contractional deformation (Reported by local governments, utility companies, and USGS)
- Underground natural-gas distribution line (Reported by utility companies and local governments)
- Above ground natural-gas distribution line (Reported by utility companies)
- Fresh contractional break in channel lining of Los Gatos Creek (Reported by USGS)

BASE: Map of Pavement and Pipe Breaks As Indicators of Range-Front Faulting Resulting From the 1989 Loma Prieta Earthquake; SCHMIDT ET AL; 1995

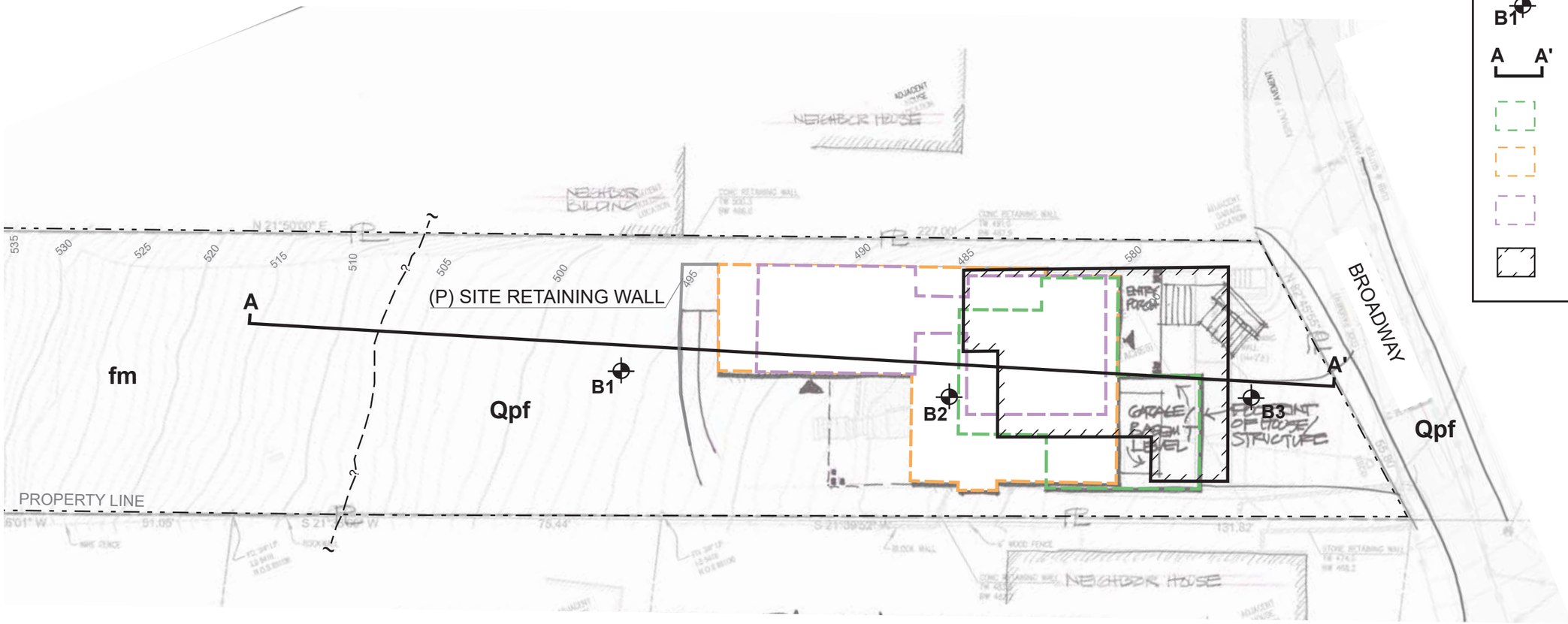
OBSERVED DISTRESS FROM THE 1989 LOMA PRIETA EARTHQUAKE MAP

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| IV/CH | 1" = 1,000' | 20007C-01R1 | February 2020 | Figure 7 |

*Copyright - C2Earth, Inc.*




NOTE: This cross-section is a conceptual illustration of general subsurface/geologic relationships and should not be used for any other purpose.

BASE: Existing Conditions Plan; Sheet C1; TS Civil ENGINEERING; 21 December 2019

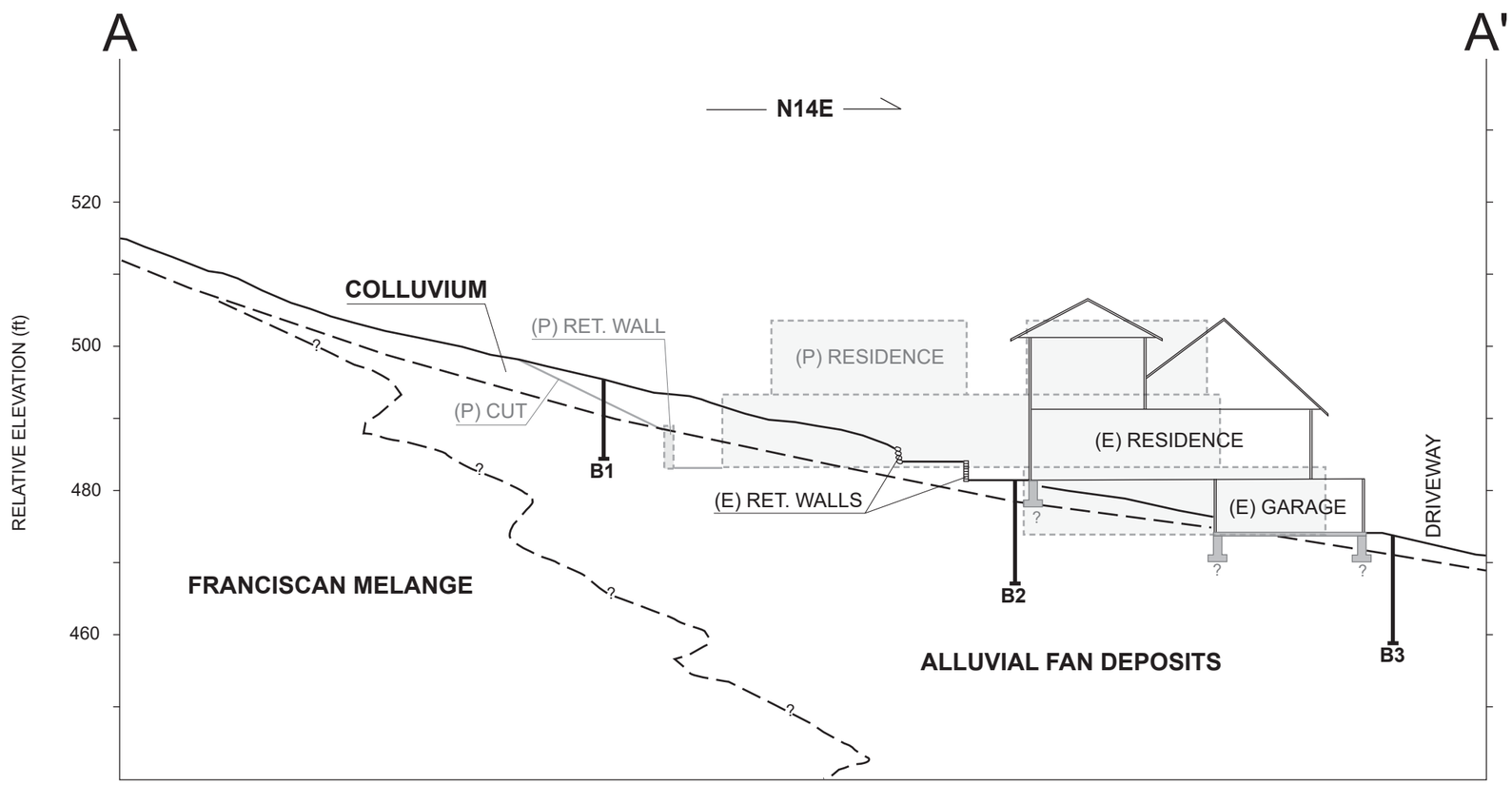
SITE PLAN AND ENGINEERING GEOLOGIC MAP

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| SC/CH | 1" = 20' | 20007C-01R1 | February 2020 | Figure 8 |

Copyright - C2Earth, Inc.




NOTE: This cross-section is a conceptual illustration of general geologic relationships and should not be used for any other purpose.

BASE: Existing Conmditions Plan; Sheet C1; TS Civil Engineering; 21 December 2019

GEOLOGIC CROSS-SECTION A-A'

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| KK/CH | 1" = 20' | 20007C-01R1 | February 2020 | Figure 9 |

Copyright - C2Earth, Inc.

## UNIFIED SOIL CLASSIFICATION SYSTEM

| PRIMARY DIVISIONS | | | GROUP SYMBOL | SECONDARY DIVISIONS |
|---|---|---|---|---|
| COARSE GRAINED SOILS<br>MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE | GRAVELS<br>MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE | CLEAN GRAVELS (LESS THAN 5% FINES) | GW | Well graded gravels; gravel-sand mixtures, little or no fines. |
| | | | GP | Poorly graded gravels or gravel-sand mixtures, little or no fines. |
| | | GRAVEL WITH FINES | GM | Silty gravels, gravel-sand-silt mixtures, non-plastic fines. |
| | | | GC | Clayey gravels, gravel-sand-clay mixtures, plastic fines. |
| | SANDS<br>MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE | CLEAN SANDS (LESS THAN 5% FINES) | SW | Well graded sands, gravelly sands, little or no fines. |
| | | | SP | Poorly graded sands or gravelly sands, little or no fines. |
| | | SANDS WITH FINES | SM | Silty sands, sand-silt mixtures, non-plastic fines. |
| | | | SC | Clayey sands, sand-clay mixtures, plastic fines. |
| FINE GRAINED SOILS<br>MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE | SILTS AND CLAYS<br>LIQUID LIMIT IS LESS THAN 50% | | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity. |
| | | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. |
| | | | OL | Organic silts and organic silty clays of low plasticity. |
| | SILTS AND CLAYS<br>LIQUID LIMIT IS GREATER THAN 50% | | MH | Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts. |
| | | | CH | Inorganic clays of high plasticity, fat clays. |
| | | | OH | Organic clays of medium to high plasticity, organic silts. |
| HIGHLY ORGANIC SOILS | | | Pt | Peat and other highly organic soils. |

## GRAIN SIZES

| U.S. STANDARD SERIES SIEVE | 200 | 40 | 10 | 4 | ¾" | 3" | 12" SIEVE OPENINGS |
|---|---|---|---|---|---|---|---|
| SILTS AND CLAYS | SAND | | | GRAVEL | | COBBLES | BOULDERS |
| | FINE | MEDIUM | COARSE | FINE | COARSE | | |

## CONSISTENCY AND RELATIVE DENSITY

CONSISTENCY

| SILTS AND CLAYS | STRENGTH[2] | BLOWS/FOOT[1] |
|---|---|---|
| VERY SOFT | 0 - ¼ | 0 - 2 |
| SOFT | ¼ - ½ | 2 - 4 |
| FIRM | ½ - 1 | 4 - 8 |
| STIFF | 1 - 2 | 8 - 16 |
| VERY STIFF | 2 - 4 | 16 - 32 |
| HARD | OVER 4 | OVER 32 |

RELATIVE DENSITY

| SANDS AND GRAVELS | BLOWS/FOOT[1] |
|---|---|
| VERY LOOSE | 0 - 4 |
| LOOSE | 4 - 10 |
| MEDIUM DENSE | 10 - 30 |
| DENSE | 30 - 50 |
| VERY DENSE | OVER 50 |

[1] Number of blows of 140-pound hammer falling 30 inches to drive a 2-inch O.D (1 3/8-inch I.D) split spoon

[2] Unconfined compressive strength in tons/sq. ft. as determined by laboratory testing or approximated in general conformance with the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation

KEY TO LOGS

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DOCUMENT ID. | DATE | |
|---|---|---|
| 20007C-01R1 | February 2020 | Figure 10 |

Copyright - C2Earth, Inc.

The standard penetration resistance (SPT) blow counts are obtained in general accordance with ASTM Test Designation D1586. The drive weight assembly consists of a 140-pound hammer dropped through a 30-inch free fall. A blow count is defined as the number of hammer blows per six inches of penetration, or 50 blows for 6 inches or less of penetration. The driving of samplers was discontinued if the observed blow count was 50 for 6 inches or less of penetration.

SPT samples are collected in a standard, 2-inch outer diameter, split-barrel sampler without liners (see Figure A below). Samplers holding 2-inch diameter liners (see Figure B below) and 2½-inch diameter liners (see Figure C below) are used to obtain "undisturbed" samples. Occasionally a portable power driven sampler holding 1-inch diameter liners is used for field sampling (see Figure D below). Resistance is measured in seconds per foot and does not correlate with the ASTM SPT. Undisturbed samples may also be collected using a Pitcher Barrel sampler (see Figure E below). Material recovered over the length of the sampler is shaded. A measure of resistance is not collected with this technique.

Blow counts are converted to SPT counts which are shown on the boring logs by the following relation:

$$B = \frac{N\,W\,H}{(140)(30)} \left( \frac{D_{o\,SPT}^{2} - D_{i\,SPT}^{2}}{D_o^{2} - D_i^{2}} \right)$$

B = Equivalent number of blows per foot with a SPT
N = Number of blows per foot actually recorded
W = Weight of hammer (lb)
H = Height of hammer drop (in)
$D_o$ = Outside Diameter (in)
$D_i$ = Inside Diameter (in)

The blow counts used for these conversions were taken over the last two sample intervals if the sampler was driven 12 inches or more. If the sampler is driven less than 12 inches, the blow counts of the last sample were converted to SPT counts of 50 blows over an equivalent SPT run length.

SPT Figure A | 2″ Liner Figure B | 2.5″ Liner Figure C | 1″ Liner Figure D | Pitcher Barrel Figure E

■ = Undisturbed Sample ☒ = Disturbed Sample

Where obtained, the shear strength of the soil samples is shown on the boring logs in far right-hand column.

SUMMARY OF FIELD SAMPLING PROCEDURES

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DOCUMENT ID. | DATE | |
|---|---|---|
| 20007C-01R1 | February 2020 | Figure 11 |

Copyright - C2Earth, Inc.

| EQUIPMENT | Minuteman | RELATIVE ELEVATION | 496 feet | LOGGED BY | K. Kiefer |
|---|---|---|---|---|---|
| DEPTH TO GROUNDWATER | Not Encountered | DEPTH TO BEDROCK | Not Encountered | DATE DRILLED | 1/21/2020 |

| DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS | CONSIST. | SOIL TYPE | DEPTH (FEET) | SAMPLE | PENETRATION RESISTANCE (BLOWS / FT.) | WATER CONTENT (%) | DRY DENSITY (PCF) | SHEAR STRENGTH (KSF) |
|---|---|---|---|---|---|---|---|---|
| **SANDY/CLAYEY SILT**; very dark brown (10YR 2/2) to dark brown (10YR 3/3); heterogenous; subrounded fine-grained sand; trace subrounded to subangular gravel; medium plasticity; trace roots and rootlets; moist; charcoal (Colluvium) | Firm to Stiff | ML | 1 | | 7 | | | |
| | | | 3 | | 10 | | | |
| | | | 4 | | 13 | | | |
| **SANDY SILT**; dark reddish brown (5YR 3/2); heterogeneous; fine-to medium-grained sand; trace-to scattered subangular gravel; rock fragments; low plasticity; well innundated; moist (Alluvial Fan Deposits) | Hard | ML | 8 | | 30 | 18 | 107 | |
| | | | 11 | | 55 | 15 | 108 | |
| Bottom of Boring = 11 feet | | | | | | | | |

LOG OF BORING 1

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DOCUMENT ID. | DATE | |
|---|---|---|
| 20007C-01R1 | February 2020 | Figure 12 |

Copyright - C2Earth, Inc.

| EQUIPMENT | Minuteman | RELATIVE ELEVATION | 484 feet | LOGGED BY | K. Kiefer |
|---|---|---|---|---|---|
| DEPTH TO GROUNDWATER | Not Encountered | DEPTH TO BEDROCK | Not Encountered | DATE DRILLED | 1/21/2020 |

| DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS | CONSIST. | SOIL TYPE | DEPTH (FEET) | SAMPLE | PENETRATION RESISTANCE (BLOWS / FT.) | WATER CONTENT (%) | DRY DENSITY (PCF) | SHEAR STRENGTH (KSF) |
|---|---|---|---|---|---|---|---|---|
| **SAND** | | | | | | | | |
| **SILTY CLAY**; dark brown (10YR 3/3); heterogeneous; trace subrounded fine-grained sand; trace subangular gravel; medium plasticity; trace roots; moist; trace charcoal (Colluvium) | Firm | CL | 1 | | 5 | | | |
| | | | 2 | | | | | |
| | | | 3 | | 8 | 24 | | |
| **SANDY SILT**; dark brown (7.5YR 3/3) to dark reddish brown (5YR 3/3); heterogeneous; trace subrounded fine-grained sand; scattered subrounded to subangular gravel; rock fragments; low plasticity; moist (Alluvial Fan Deposits) | Stiff to Hard | ML | 4 | | 14 | | | |
| | | | 5 | | | | | |
| | | | 6 | | | | | |
| | | | 7 | | | | | |
| | | | 8 | | 22 | 21 | 99 | |
| | | | 9 | | | | | |
| | | | 10 | | | | | |
| | | | 11 | | 50 | 18 | 108 | 2.6 |
| | | | 12 | | | | | |
| | | | 13 | | | | | |
| | | | 14 | | 46 | | | |
| Bottom of Boring =14.5 feet | | | 15 | | | | | |
| | | | 16 | | | | | |
| | | | 17 | | | | | |
| | | | 18 | | | | | |
| | | | 19 | | | | | |
| | | | 20 | | | | | |

LOG OF BORING 2

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DOCUMENT ID. | DATE | |
|---|---|---|
| 20007C-01R1 | February 2020 | Figure 13 |

Copyright - C2Earth, Inc.

| EQUIPMENT | Truck Mounted Mobile B-24 | RELATIVE ELEVATION | 474 feet | LOGGED BY | K. Kiefer |
|---|---|---|---|---|---|
| DEPTH TO GROUNDWATER | Not Encountered | DEPTH TO BEDROCK | Not Encountered | DATE DRILLED | 1/21/2020 |

| DESCRIPTION AND CLASSIFICATION: DESCRIPTION AND REMARKS | CONSIST. | SOIL TYPE | DEPTH (FEET) | SAMPLE | PENETRATION RESISTANCE (BLOWS / FT.) | WATER CONTENT (%) | DRY DENSITY (PCF) | SHEAR STRENGTH (KSF) |
|---|---|---|---|---|---|---|---|---|
| **CONCRETE DRIVEWAY** | | | | | | | | |
| **SANDY SILT**; Dark Brown (10YR 3/3); heterogeneous; fine-grained sub rounded sand; trace subangular gravel; moist (Colluvium) | Very Stiff | ML | 1 | | 20 | | | |
| **SILTY SAND**; dark yellowish brown (10YR 4/4) to yellowish brown (10YR 5/6); heterogeneous; subrounded fine-grained sand; trace subangular gravel; low plasticity (Alluvial Fan Deposits) | Medium Dense to Dense | SM to SC | 2 | | | | | |
| | | | 3 | | 28 | | | |
| | | | 4 | | 36 | | | |
| | | | 5 | | | | | |
| | | | 6 | | | | | |
| | | | 7 | | | | | |
| | | | 8 | | | | | |
| | | | 9 | | | | | |
| | | | 10 | | 39 | 13 | 120 | 2.1 |
| | | | 11 | | | | | |
| | | | 12 | | | | | |
| | | | 13 | | | | | |
| | | | 14 | | | | | |
| | | | 15 | | 41 | | | |
| Bottom of Boring =15 feet | | | 16 | | | | | |
| | | | 17 | | | | | |
| | | | 18 | | | | | |
| | | | 19 | | | | | |
| | | | 20 | | | | | |

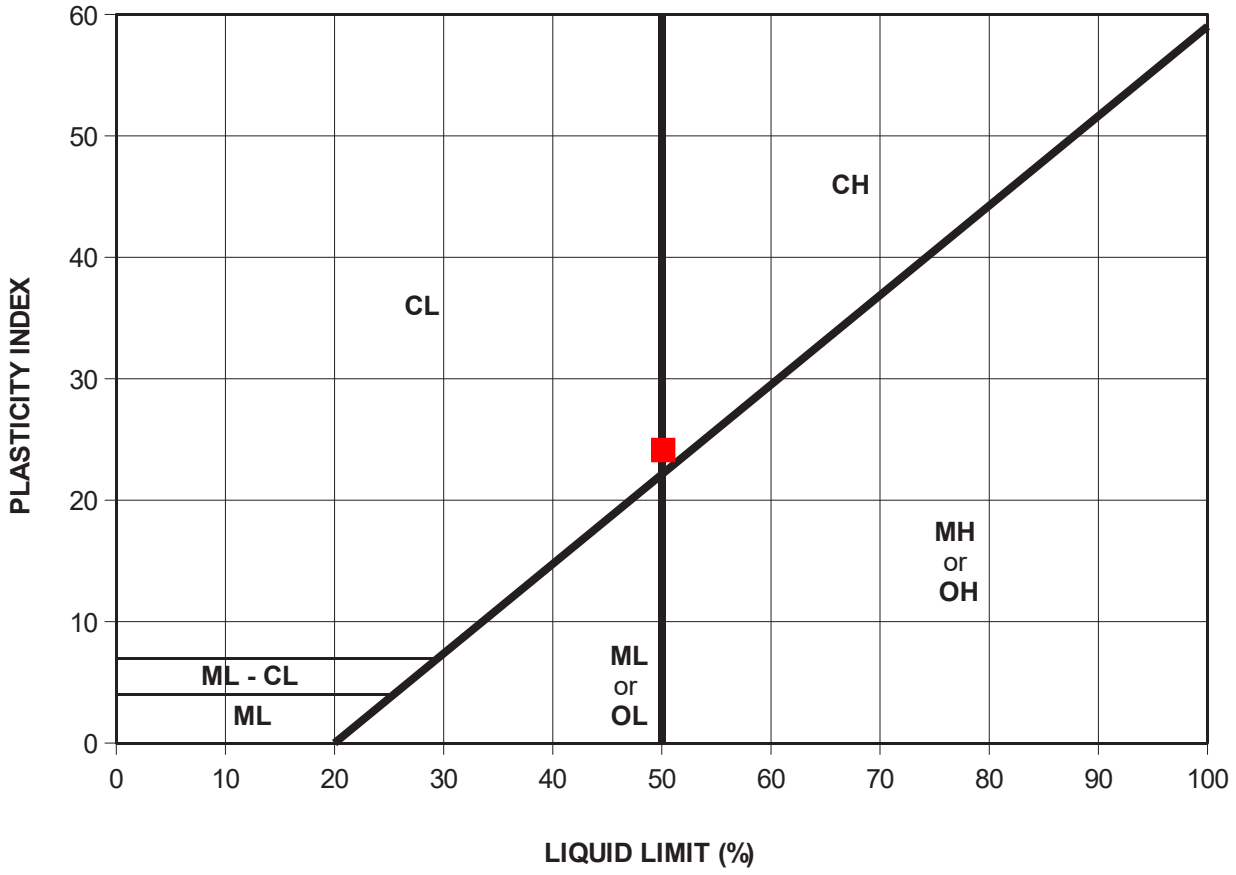
LOG OF BORING 3

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DOCUMENT ID. | DATE | |
|---|---|---|
| 20007C-01R1 | February 2020 | Figure 14 |

Copyright - C2Earth, Inc.




| KEY | SAMPLE NUMBER | SAMPLE DEPTH (ft) | WATER CONTENT (%) | LIQUID LIMIT (%) | PLASTICITY INDEX | PLASTIC LIMIT (%) | PASSING No. 200 SIEVE (%) | LIQUIDITY INDEX | UNIFIED SOIL CLASSIFICATION SYMBOL |
|---|---|---|---|---|---|---|---|---|---|
| ■ | B2-2 | 2.5 | 24 | 50 | 24 | 26 | 60 | -0.1 | CL |

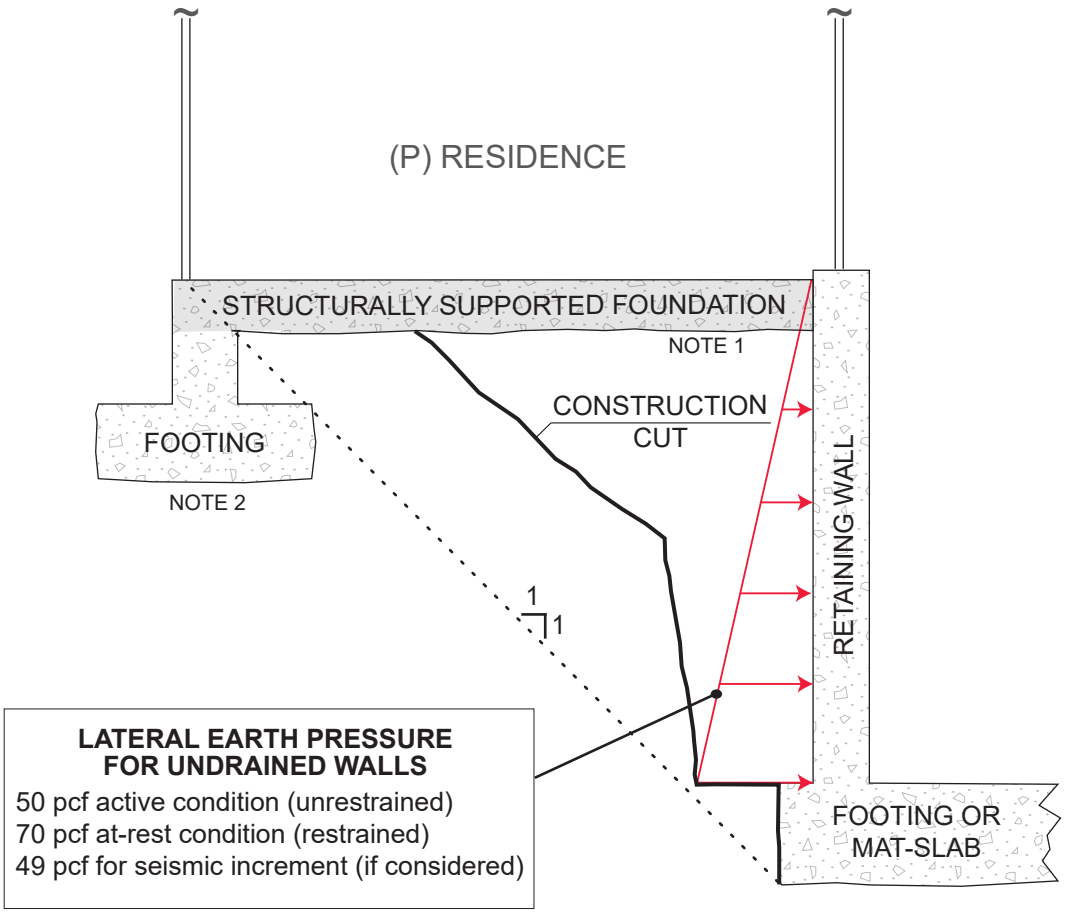
PLASTICITY CHART

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| SC/CH | Not Applicable | 20007C-01R1 | February 2020 | Figure 15 |

*Copyright - C2Earth, Inc.*




NOTE 1: Design foundation elements (including footings and slabs) to structurally span the retaining wall excavation area defined by the area above a 1:1 plane projected upward from the bottom of the construction excavation.

NOTE 2: Design footings to gain support below a 1:1 plane projected upward from the bottom of the construction excavation

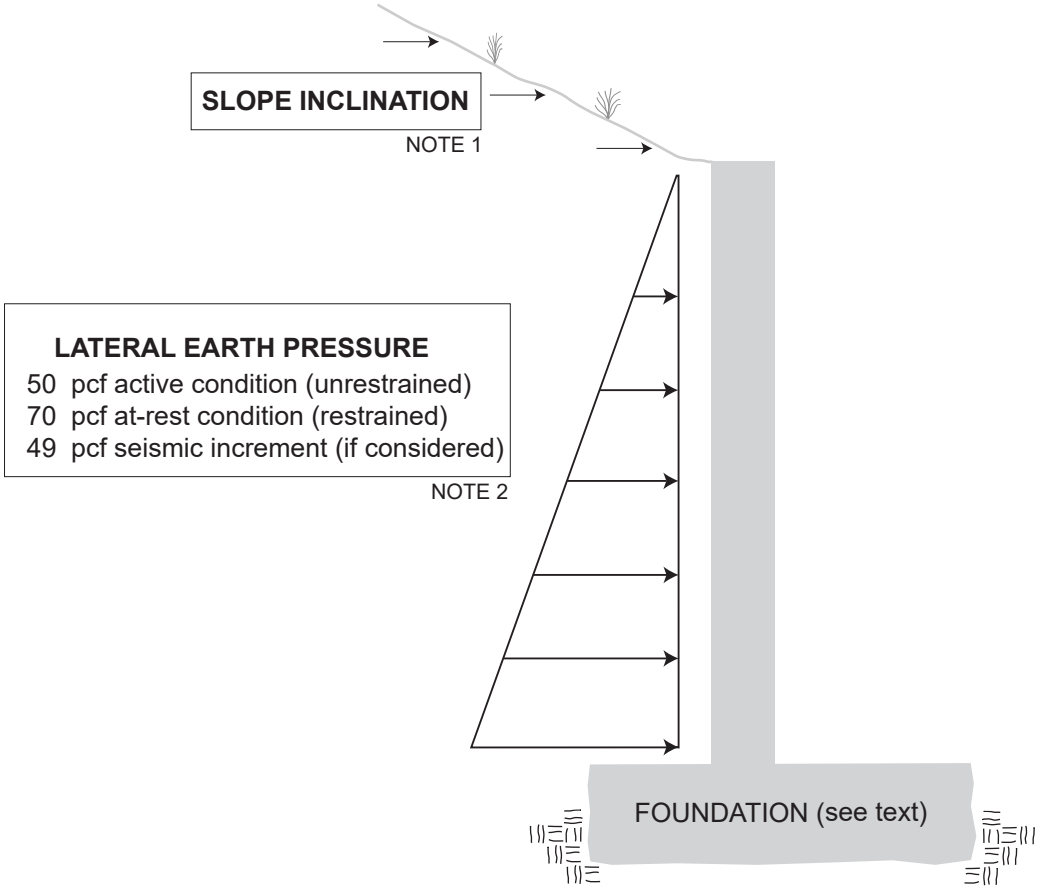
CONCEPTUAL BASEMENT RETAINING WALL PRESSURE DIAGRAM

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| KK/CH | Not Applicable | 20007C-01R1 | Feburary 2020 | Figure 16 |

Copyright - C2Earth, Inc.




NOTE 1: Add an additional equivalent fluid pressure increment to the active and at-rest condition for sloping backfill above the wall where inclinations are greater than 4:1 (horizontal to vertical), as follows:

+8 pcf for slope inclinations between 3:1 and 4:1
+12 pcf for slope inclinations between 2:1 and 3:1

NOTE 2: Lateral earth pressures are shown for drained retaining walls. Contact us to provide additional recommendations if undrained walls are planned.

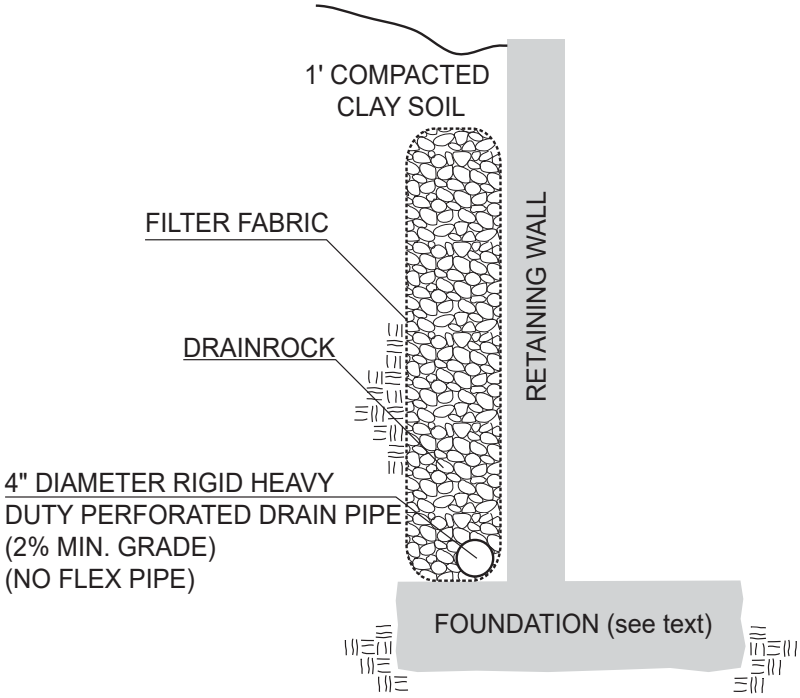
CONCEPTUAL SITE RETAINING WALL PRESSURE DIAGRAM

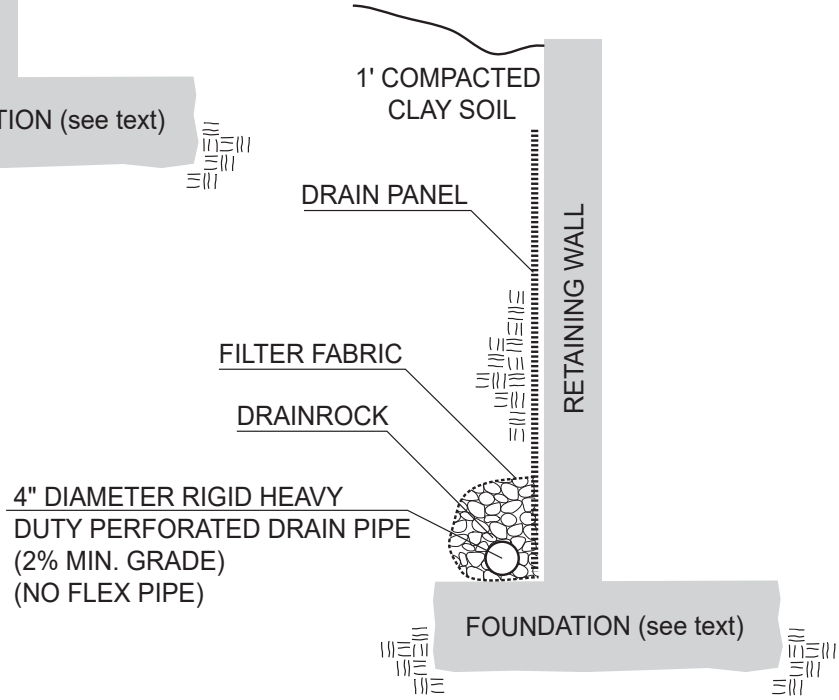
C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| KK/CH | Not Applicable | 20007C-01R1 | Feburary 2020 | Figure 17 |

Copyright - C2Earth, Inc.



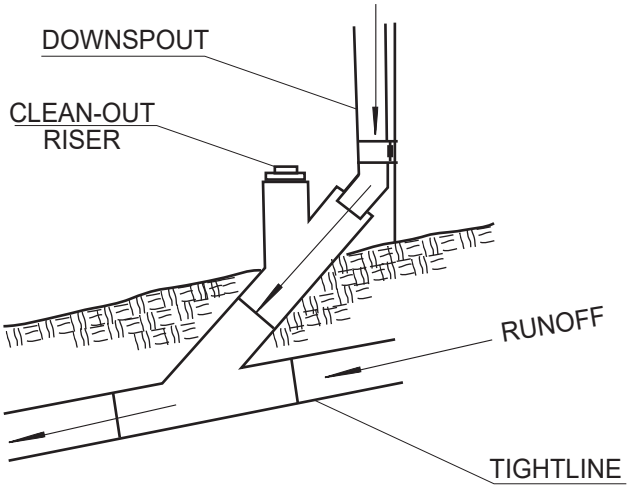

CONCEPTUAL RETAINING WALL BACKDRAIN DIAGRAM

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| KK/CH | Not Applicable | 20007C-01R1 | Feburary 2020 | Figure 18 |

*Copyright - C2Earth, Inc.*



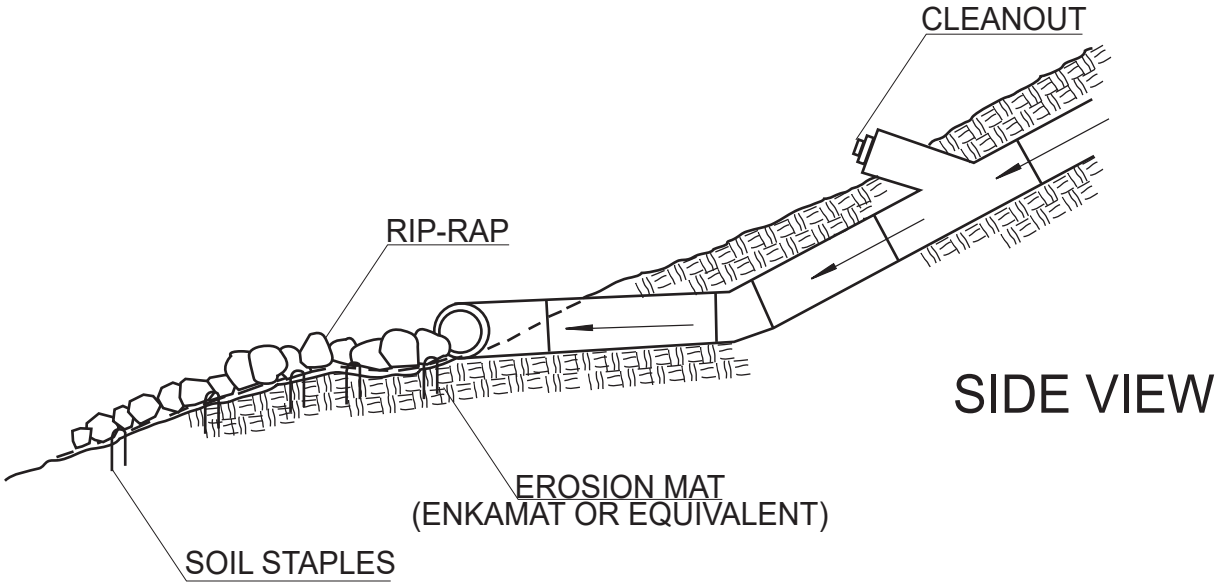

CONCEPTUAL DOWNSPOUT CLEAN-OUT DIAGRAM

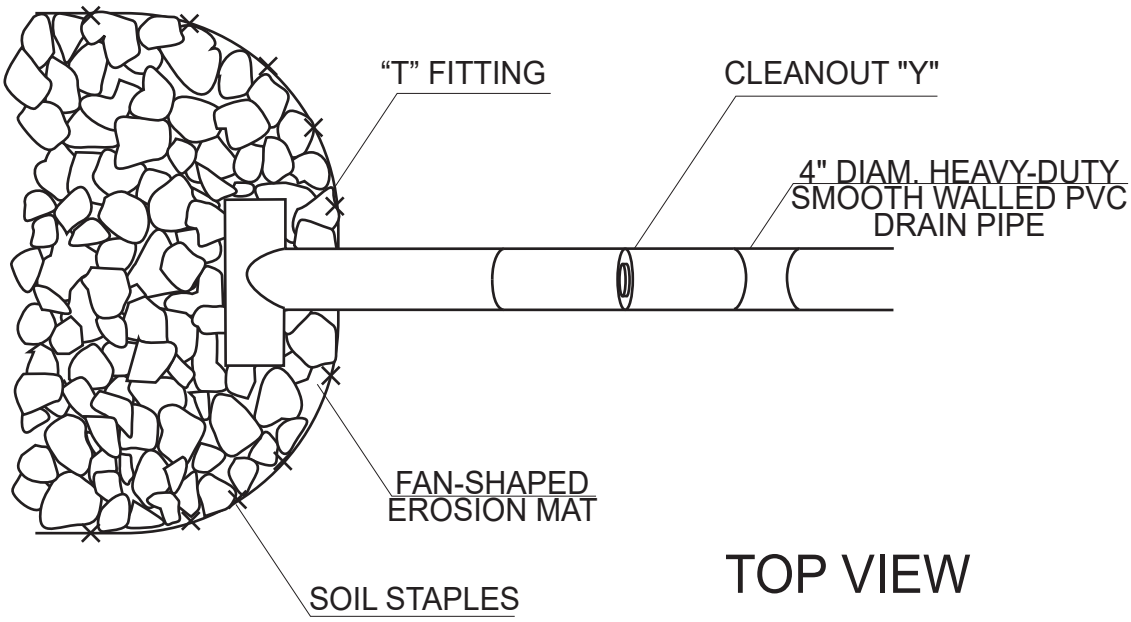
C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| KK/CH | Not Applicable | 20007C-01R1 | Feburary 2020 | Figure 19 |

*Copyright - C2Earth, Inc.*




CONCEPTUAL ENERGY DISSIPATER DIAGRAM

C2EARTH

DE MATTEI PROPERTY
101 Broadway
Los Gatos, California

| DRAFTED/REVIEWED | SCALE | DOCUMENT ID. | DATE | |
|---|---|---|---|---|
| KK/CH | Not Applicable | 20007C-01R1 | Feburary 2020 | Figure 20 |

*Copyright - C2Earth, Inc.*

TABLE I

## MODIFIED MERCALLI SCALE OF EARTHQUAKE INTENSITIES

I. Not felt by people, except under especially favorable circumstances.

II. Felt only by persons at rest on the upper floors of buildings. Some suspended objects may swing.

III. Felt by some people who are indoors, but it may not be recognized as an earthquake. The vibration is similar to that caused by the passing of light trucks. Hanging objects swing.

IV. Felt by many people who are indoors, by a few outdoors. At night some people are awakenad. Dishes, windows and doors are disturbad: walls make creaking sounds; stationary cars rock noticeably. The sensation is like a heavy object striking a building; the vibration is similar to that caused by the passing of heavy trucks.

V. Felt indoors by practically everyone, outdoors by most people. The direction and duration of the shock can be estimated by people outdoors. At night, sleepers are awakened and some run out of buildings. Liquids are disturbed and sometimes spilled. Small, unstable objects and some furnishings are shifted or upset. Doors close or open.

VI. Felt by everyone, and many people are frightened and run outdoors. Walking is difficult. Small church and school bells ring. Windows, dishes, and glassware are broken; liquids spill; books and other standing objects fall; pictures are knocked from walls; furniture is moved or overturned. Poorly built buildings may be damaged, and weak plaster will crack.

VII. Causes general alarm. Standing upright is very difficult. Persons driving cars also notice the shaking. Damage is negligible in buildings of very good design and construction, slight to moderate in well-built ordinary structures, considerable in poorly built or designed structures. Some chimneys are broken; interiors and furnishings experience considerable damage; architectural ornaments fall. Small slides occur along sand or gravel banks of water channels; concrete irrigation ditches are damaged. Waves form in the water and it becomes muddied.

VIII. General fright and near panic. The steering of cars is difficult. Damage is slight in specially designed earthquake-resistant structures, considerable in well-built ordinary buildings. Poorly built or designed buildings experience partial collapses. Numerous chimneys fall; the walls of frame buildings are damaged; interiors experience heavy damage. Frame houses that are not properly bolted down may move on their foundations. Decayed pilings are broken off. Tress are damaged. Cracks appear in wet ground and on steep slopes. Changes in the flow or temperature of springs and wells are noted.

IX. Panic is general. Interior damage is considerable in specially designed earthquake-resistant structures. Well-built ordinary buildings suffer severe damage, with partial collapses; frame structures thrown out of plumb or shifted off of their foundations. Unreinforced masonry buildings collapse. The ground cracks conspicuously and some underground pipes are broken. Reservoirs are damaged seriously.

X. Most masonry and many frame structures are destroyed. Specially designed earthquake-resistant structures may suffer serious damage. Some well-built bridges are destroyed, and dams, dikes and embankments are seriously damaged. Large landslides are triggered by the shock. Water is thrown onto the banks of canals, rivers and lakes. Sand and mud are shifted horizontally on beaches and flat land. Rails are bent slightly. Many buried pipes and conduits are broken.

XI. Few, if any, masonry structures remain standing. Other structures are severely damaged. Broad fissures, slumps and slides develop in soft or wet soils. Underground pipe lines and conduits are put completely out of service. Rails are severely bent.

XII. Damage is total, with practically all works of construction severely damaged or destroyed. Waves are observed on ground surfaces, and all soft or wet soils are greatly disturbed. Heavy objects are thrown into the air, and large rock masses are displaced.

---

*YANEV,P.,1974, Peace of Mind in Earthquake Country, Chronicle Books, San Francisco, California.*

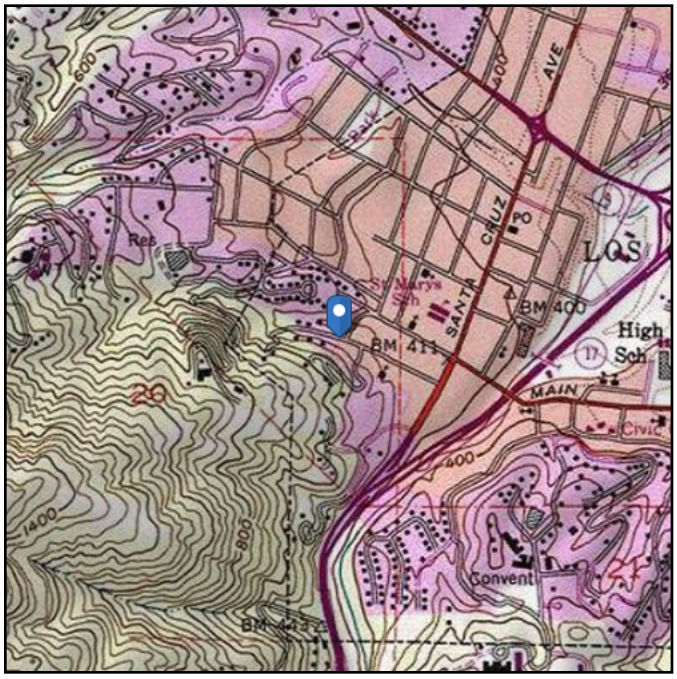
**APPENDIX A:** ASCE 7 HAZARDS REPORT

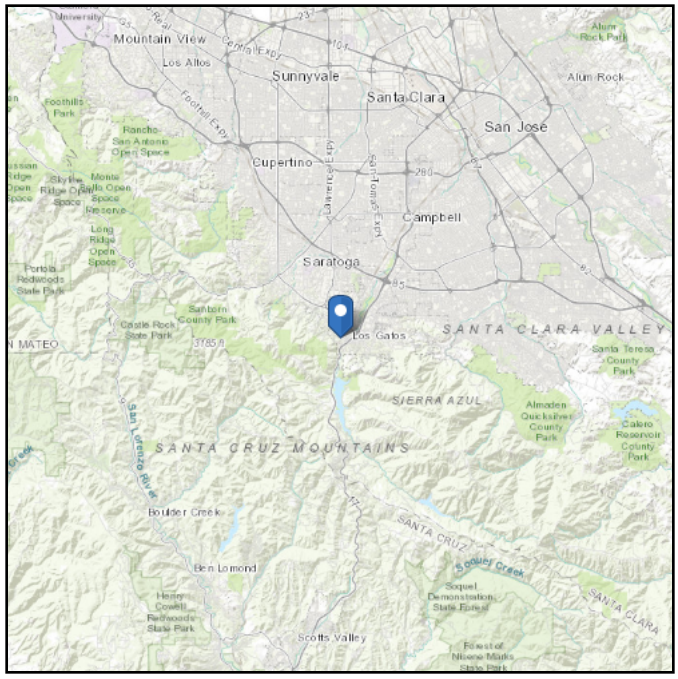
# ASCE 7 Hazards Report

**Address:**
101 Broadway
Los Gatos, California
95030

**Standard:** ASCE/SEI 7-16
**Risk Category:** II
**Soil Class:** C - Very Dense Soil and Soft Rock

**Elevation:** 479.13 ft (NAVD 88)
**Latitude:** 37.223038
**Longitude:** -121.987941



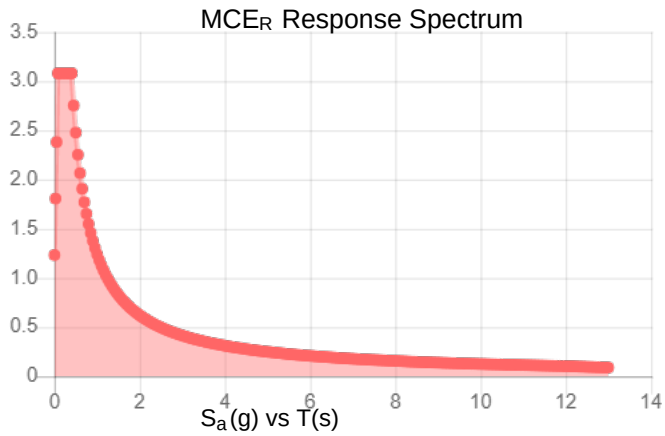
# Seismic

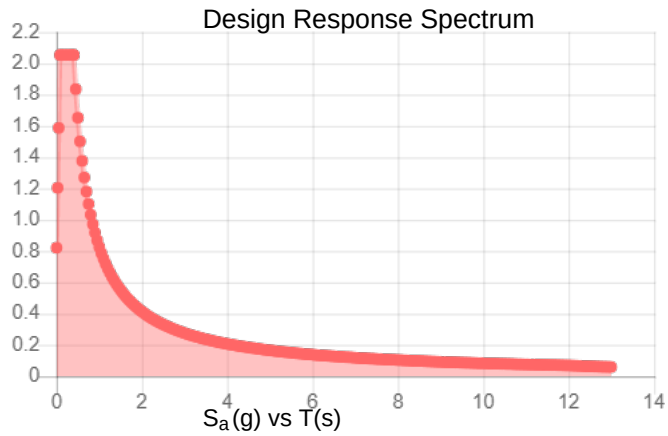
**Site Soil Class:** C - Very Dense Soil and Soft Rock

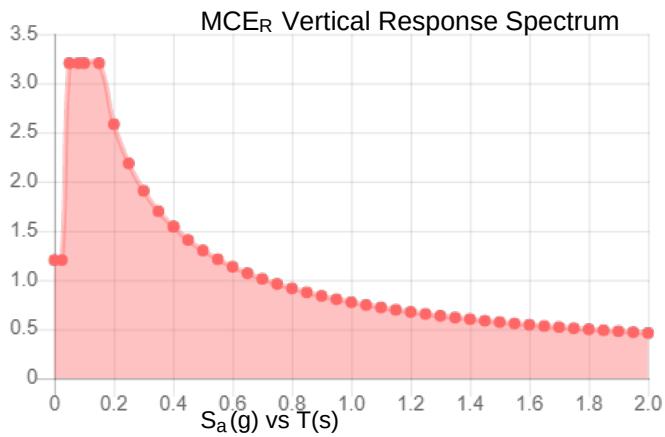
**Results:**

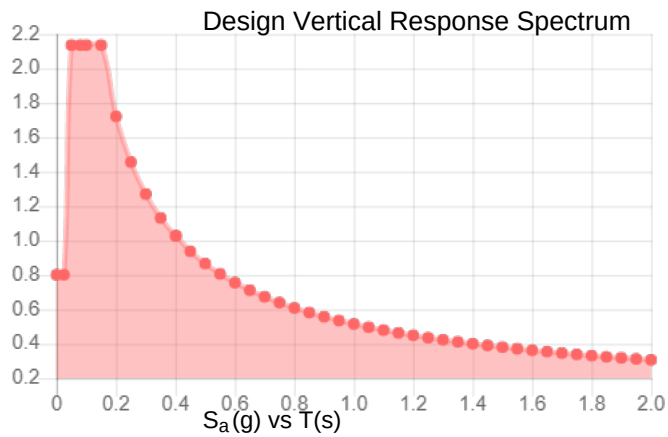
| | | | |
|---|---|---|---|
| $S_S$ : | 2.567 | $S_{D1}$ : | 0.826 |
| $S_1$ : | 0.885 | $T_L$ : | 12 |
| $F_a$ : | 1.2 | PGA : | 1.051 |
| $F_v$ : | 1.4 | $PGA_M$ : | 1.261 |
| $S_{MS}$ : | 3.08 | $F_{PGA}$ : | 1.2 |
| $S_{M1}$ : | 1.239 | $I_e$ : | 1 |
| $S_{DS}$ : | 2.053 | $C_v$ : | 1.3 |

**Seismic Design Category** E




**Data Accessed:** Wed Feb 12 2020

**Date Source:** USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE 7 standard.

In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.

# APPLICATION TO USE

NOTE: THIS APPLICATION FOR AUTHORIZATION TO USE THIS COPYRIGHTED DOCUMENT MUST BE COMPLETED FOR USE OR COPYING OF THE FOLLOWING DOCUMENT BY ANYONE OTHER THAN THE CLIENT.

GEOLOGIC AND GEOTECHNICAL STUDY
PROPOSED RESIDENTIAL REDEVELOPMENT

DE MATTEI PROPERTY
101 BROADWAY
LOS GATOS, CALIFORNIA

Document Id. 20007C-01R1
Dated 14 February 2020

TO: C2Earth, Inc.
750 Camden Avenue, Suite A
Campbell, CA 95008

FROM: _____
_____
_____
_____

Please clearly identify name and address of person/entity applying to use or copy this document.

APPLICANT: _____ hereby applies for permission to use the above referenced document for the following purpose(s):

Applicant understands and agrees that the document listed above is a copyrighted document, that C2Earth, Inc. is the copyright owner and that unauthorized use or copying of the document is strictly prohibited without the express written permission of C2Earth, Inc. Applicant understands that C2Earth, Inc. may withhold such permission at its sole discretion, or grant such permission upon such terms and conditions as it deems acceptable, such as the execution of a Hold Harmless Agreement or the payment of a re-use fee.

Signature: _____ Date: _____