CORNERSTONE EARTH GROUP

Type of Services	**Geotechnical Feasibility Study**
Project Name	**Downtown Specific Plan Amendments and Specific Development Project**
Location	**Sunnyvale, California**
Client	**David J. Powers & Associates**
Client Address	**1871 The Alameda, Suite 200 San Jose, California**
Project Number	**118-97-2**
Date	**October 3, 2018**

DRAFT

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TABLE OF CONTENTS

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SECTION 1: INTRODUCTION

This report has been prepared for the proposed future development at the above referenced property. The location of the site is shown on the Vicinity Map, Figure 1. For our use, we were provided with the following documents:

- An Assessor's Parcel Number (APN) map of the site
- A document titled "Revised Draft EIR Project Description, Section 1.0 Project Information and Description," dated September 5, 2018.
- A letter titled "Notice of Preparation, Draft Environmental Impact Report for the Downtown Specific Plan Amendments and Specific Development Project," prepared by the City of Sunnyvale, dated May 7, 2018.

1.1 PROJECT DESCRIPTION

The project will consist of development of five sites on six parcels within downtown Sunnyvale. Descriptions of the proposed development on each site/parcel are provided below.

100 Altair Way (Block 1a/1)

The proposed development would include demolishing and re-developing the approximately ½-acre site. The proposed development would include a seven-story, 134,324-square-foot office building with four levels of below-grade parking. The proposed office building will include an approximately 9,500 square foot rooftop terrace with recreational amenities including walking paths, bocce ball area, and picnic tables. Cuts on the order of 43 feet are anticipated for the below-grade parking garage.

300 Mathilda Avenue (within Sub-block 1)

The proposed development would include a five-story, mixed-use building with two levels of below-grade parking on the approximately 1.9-acre site. The proposed building would include up to 10,000 square feet of commercial use and up to 155,000 square feet of office use. An approximately 2,500-square-foot open space area is proposed north of the building and would include outdoor dining space and landscaped areas. The proposed development would also include an at-grade parking lot south of the proposed building. Cuts on the order of 30 feet are anticipated for the below-grade parking garage.

Macy's and Redwood Square (Sub-block 3)

The proposed development would include demolition of the existing building and construction of two, seven-story, mixed-use buildings with two levels of below-grade parking on the northern portion of the approximately 7.3-acre site. The proposed development on the northern portion would include up to 90,000 square feet of commercial use and up to 480,000 square feet of office use. The proposed development would also include extending South Frances Street south, through the northern portion of the site and a new east-west internal driveway that intersects the proposed South Frances Street extension and connects South Taaffe Street and Murphy Avenue.

The proposed development on the southern portion of the site would consist of two, 10-story mixed-used buildings including 45,000 square feet of ground floor commercial uses and up to 400 residential units. The development would include a two-level, below-grade parking structure beneath the two buildings. An approximately one-acre outdoor plaza including temporary commercial structures, landscaping, seating, play areas, and outdoor eating areas are proposed in the southeast corner of the site.

Cuts on the order of 30 feet are anticipated for the below-grade parking garages for both portions of the site.

Sub-block 6

The proposed development would include re-developing the approximately 3.9-acre site with one, seven-story mixed-use building. The proposed development would include 45,000 square feet of commercial use and 392 residential units. The proposed development would also include one level of below-grade parking, two levels of above ground parking with at-grade commercial uses and residential units lining the exterior of the parking and capped with a podium structure, and four or five levels of residential units above the podium. The residential units above the podium structure would be situated around open space areas including recreational amenities such as a pool, outdoor BBQ grills, landscaped areas, and seating areas. Cuts on the order of 15 feet or less are anticipated for the below-grade parking garage.

Murphy's Square (within Block 22)

The proposed development would include re-developing the existing at-grade parking lot with a four-story above-ground structure with three levels of below-grade parking on the approximately 1.5-acre site. The proposed development would include approximately 69,100 square feet of office space. Cuts on the order of 35 feet are anticipated for the below-grade parking garage.

1.2 SCOPE OF SERVICES

Our scope of services was presented in our agreement dated January 17, 2018, and includes geologic research and consolidation of data, site reconnaissance, identification of potential geologic, seismic and geotechnical impacts, a discussion of potential mitigation measures, drafting and report preparation.

SECTION 2: REGIONAL SETTING

2.1 GEOLOGICAL SETTING

The Site is located in the southwestern alluvial plain of the Santa Clara Valley, at the southern end of the San Francisco Bay Area. The Santa Clara Valley is a broad alluvial plane between the Santa Cruz Mountains to the southwest and west, and the Diablo Range to the northeast. The San Andreas Fault system, including the Monte Vista-Shannon Fault, exists within the Santa Cruz Mountains and the Hayward and Calaveras Fault systems exist within the Diablo Range. Alluvial soil thicknesses in the area of Sunnyvale range from about 400 to greater than 700 feet (Rogers and Williams, 1974).

2.2 REGIONAL SEISMICITY

The San Francisco Bay area region is one of the most seismically active areas in the Country. While seismologists cannot predict earthquake events, geologists from the U.S. Geological Survey have recently updated earlier estimates from their 2014 Uniform California Earthquake Rupture Forecast (Version 3) publication. The estimated probability of one or more magnitude 6.7 earthquakes (the size of the destructive 1994 Northridge earthquake) expected to occur somewhere in the San Francisco Bay Area has been revised (increased) to 72 percent for the period 2014 to 2043 (Aagaard et al., 2016). The faults in the region with the highest estimated probability of generating damaging earthquakes between 2014 and 2043 are the Hayward (33%), Rodgers Creek (33%), Calaveras (26%), and San Andreas Faults (22%). In this 30-year period, the probability of an earthquake of magnitude 6.7 or larger occurring is 22 percent along the San Andreas Fault and 33 percent for the Hayward or Rodgers Creek Faults. During such an earthquake, the danger of fault rupture at the site is slight, but strong ground shaking would occur.

The faults considered capable of generating significant earthquakes are generally associated with the well-defined areas of crustal movement, which trend northwesterly. The table below presents the State-considered active faults within 25 kilometers of the site.

Table 1: Approximate Fault Distances

Fault Name	Distance	
	(miles)	(kilometers)
Monte Vista-Shannon	5.9	9.5
San Andreas (1906)	8.1	13.1
Hayward (Southeast Extension)	8.8	14.2
Hayward (Total Length)	11.9	19.1
Calaveras	12.8	20.6

A regional fault map is presented as Figure 3, illustrating the relative distances of the site to significant fault zones.

SECTION 3: SITE CONDITIONS

3.1 SITE RECONNAISSANCE AND SURFACE DESCRIPTION

The site consists of five sites on nine parcels (APNs: 209-07-007, 209-06-083, 209-35-022, 209-35-023, 209-35-016, 209-35-17, 209-35-18, 209-35-19, 209-34-019) for a total of approximately 15.1 acres. Our field engineer performed a site reconnaissance on October 3, 2018. At the time of the reconnaissance, several one- to three-story structures, at-grade parking lots and landscaping, and construction staging areas were observed. The structures appeared to be for commercial and residential use, and consist of both wood-frame, steel, and concrete construction. Portland cement concrete (PCC) and Asphalt Concrete (AC) pavements at the sites appeared to generally be in fair to poor condition, with the exception of the newly paved parking lot on sub-Block 6. Several tall, mature trees were observed through the various sites. The sites are relatively flat and generally level with current city streets and sidewalks.

3.2 ANTICIPATED SUBSURFACE CONDITIONS

During previous investigations in the general area, we encountered alluvial soils, consisting mostly of stiff to hard clays and medium dense to dense sands with varying amounts of clay and silt. Geologic mapping by Dibble and Minch (2007) describe the project areas underlain by alluvial fan and stream deposits of sand, gravel, silt, and clay.

3.3 GROUNDWATER

Groundwater was not encountered in our explorations during previous investigations in the site vicinity; however, the borings were not left open but were immediately backfilled when the boring was completed. As predominantly clays and clayey sands were encountered, the borings were likely not left open long enough for water to seep into the boring holes. Based on our previous experience in the area and CGS maps, we anticipate that the high ground water level will be on the order of 25 to 35 feet below current grades.

Fluctuations in ground water levels occur due to many factors including seasonal fluctuation, underground drainage patterns, regional fluctuations, and other factors. A design-level geotechnical investigation would help to determine the depths to groundwater at the site.

SECTION 4: GEOLOGIC HAZARDS

This section presents our review and comments concerning potential geologic hazards affecting the proposed project.

4.1 FAULT RUPTURE

As discussed above several significant faults are located within 25 kilometers of the site. The site is not located within a State-designated Alquist Priolo Earthquake Fault Zone, or a Santa Clara County Fault Hazard Zone. As shown in Figure 3, no known surface expression of fault traces is thought to cross the site; therefore, fault rupture hazard is not a significant geologic hazard at the site.

4.2 STRONG GROUND SHAKING

Moderate to severe (design-level) earthquakes can cause strong ground shaking, which is the case for most sites within the Bay Area. While a seismic hazard analysis was not prepared as part of the preparation of this report, strong ground shaking should be expected at the site during the life of the planned structure, which is typical of almost all sites in the Bay Area.

4.3 LIQUEFACTION POTENTIAL

The site is not located within a State-designated Liquefaction Hazard Zone (CGS, Cupertino Quadrangle, 2002; CGS, Mountain View Quadrangle, 2006) or a Santa Clara County Liquefaction Hazard Zone (Santa Clara County, 2003).

During strong seismic shaking, cyclically induced stresses can cause increased pore pressures within the soil matrix that can result in liquefaction triggering, soil softening due to shear stress loss, potentially significant ground deformation due to settlement within sandy liquefiable layers as pore pressures dissipate, and/or flow failures in sloping ground or where open faces are present (lateral spreading) (NCEER 1998). Limited field and laboratory data is available regarding ground deformation due to settlement; however, in clean sand layers settlement on the order of 2 to 4 percent of the liquefied layer thickness can occur. Soils most susceptible to liquefaction are loose, non-cohesive soils that are saturated and are bedded with poor drainage, such as sand and silt layers bedded with a cohesive cap.

Based on guidelines set forth in CGS Special Publication 117A (CGS, 2008), “screening investigation” could be used to determine whether a particular site has “obvious indicators” for potential failure as a result of liquefaction. Three of these indicators include soil type, soil density, and depth to ground water. Based on previous investigations near the site and mapped soil conditions, in our opinion, the potential for the presence of liquefiable sediments being present is considered low. We recommend the potential for liquefaction be evaluated as part of the design-level geotechnical investigation.

4.4 LATERAL SPREADING

Lateral spreading is horizontal/lateral ground movement of relatively flat-lying soil deposits towards a free face such as an excavation, channel, or open body of water; typically lateral spreading is associated with liquefaction of one or more subsurface layers near the bottom of the exposed slope. As failure tends to propagate as block failures, it is difficult to analyze and estimate where the first tension crack will form. There are no open faces within 200 feet of the site where lateral spreading could occur; therefore, in our opinion, the potential for lateral spreading to affect the site is considered low.

4.5 GROUND RUPTURE

The methods used to estimate liquefaction settlements assume that there is a sufficient cap of non-liquefiable material to prevent ground rupture or sand boils. For ground rupture to occur, the pore water pressure within liquefiable soil layers will need to be great enough to break through the overlying non-liquefiable layer, which could cause ground rupture. Based on our experience in the area, previous explorations in the vicinity, and the potential for liquefaction is low, the potential for ground rupture at the site appears to be low. In addition, if below-grade garages are constructed as part of the project, it is unlikely that there would remain any potential for ground rupture.

4.6 SEISMICALLY INDUCED SETTLEMENT

Strong earthquake shaking can cause seismically induced settlement of soil strata, resulting in settlement of near-surface soils. Factors that affect this hazard include soil composition and consistency, the magnitude of loading on native soils, such as from fills and structures, and any other changes in thickness or consistency abruptly over short distances. The potential for seismically induced settlement in the alluvial soils present is likely moderate to low. Additionally, if below-grade garages are constructed as part of the project, it is likely soils susceptible to seismically induced settlement will be excavated during construction.

4.7 EXPANSIVE SOILS

Expansive soils can undergo significant volume change with changes in moisture content. They shrink and harden when dried, and expand and soften when wetted.

The plasticity of the surficial soils encountered during previous investigations in the site vicinity indicated low to moderate expansion potential. Therefore, based on nearby testing, and the presence of alluvial surficial soils, in our opinion, it is likely that expansive soils exist at the site.

4.8 EXISTING FILLS

During our previous investigations in the site vicinity, we encountered up to 3 feet of undocumented fill below the current grades. Additionally, fill beneath the existing structures and improvements at the sites are also likely. As previously mentioned, the site is generally level; therefore, we anticipate any potential fill to be relatively shallow. As the proposed developments include one to four levels of below-grade parking, we also anticipate previous site fills would likely be removed during excavation of the garages. Any remaining fill material at the site should be further evaluated as part of the design-level geotechnical investigation for the planned site improvements. Likely mitigation would include removal and/or replacement with engineered fill. Provided fill materials meet the requirements for engineered fill, they could be used on site. Otherwise, they could be stockpiled on site for future use in landscaping or non-structural fill areas.

4.9 SEISMICALLY INDUCED WAVES

The terms tsunami or seiche are described as ocean waves or similar waves usually created by undersea fault movement or by a coastal or submerged landslide. Tsunamis may be generated at great distance from shore (far field events) or nearby (near field events). Waves are formed, as the displaced water moves to regain equilibrium, and radiates across the open water, similar to ripples from a rock being thrown into a pond. When the waveform reaches the coastline, it quickly raises the water level, with water velocities as high as 15 to 20 knots. The water mass, as well as vessels, vehicles, or other objects in its path create tremendous forces as they impact coastal structures.

Tsunamis have affected the coastline along the Pacific Northwest during historic times. The Fort Point tide gauge in San Francisco recorded approximately 21 tsunamis between 1854 and 1964. The 1964 Alaska earthquake generated a recorded wave height of 7.4 feet and drowned eleven people in Crescent City, California. For the case of a far-field event, the Bay area would have hours of warning; for a near field event, there may be only a few minutes of warning, if any.

A tsunami or seiche originating in the Pacific Ocean would lose much of its energy passing through San Francisco Bay. Based on the study of tsunami inundation potential for the San Francisco Bay Area (Ritter and Dupre, 1972), areas most likely to be inundated are marshlands, tidal flats, and former bay margin lands that are now artificially filled, but are still at or below sea level, and are generally within 1½ miles of the shoreline. The site is approximately 5 miles inland from the San Francisco Bay shoreline, and is approximately 91 to 110 feet above mean sea level. Therefore, the potential for inundation due to tsunami or seiche is considered low.

4.10 FLOODING

Based on our internet search of the Federal Emergency Management Agency (FEMA) flood map public database, the site is located within Zone X, described as “areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood."

SECTION 5: PRELIMINARY CONCLUSIONS

5.1 PRELIMINARY IMPACTS

Descriptions of our preliminary concerns follow the listed concerns.

- Strong ground shaking
- Depth to groundwater
- Proximity of basement excavation to adjacent improvements
- Potential presence of undocumented fill
- Potential for presence of moderately expansive soils
- Differential movement at on-grade to on-structure transitions

5.1.1 Strong Ground Shaking

Strong ground shaking is expected at this site, as with most sites in the Bay Area, during a major earthquake in the area.

To mitigate the effects of strong ground shaking, all planned structures should be designed in accordance with the recommendations in a final design-level geotechnical report, and the most recent California Building Code.

5.1.2 Depth to Groundwater

As discussed above, historic high groundwater is mapped at depths of approximately 25 to 35 feet below existing grades (CGS, 2002 and 2006). We anticipate cuts for the below-grade parking structures will be on the order of 15 to 43 feet; therefore, groundwater may be present in deeper excavations during construction and a dewatering system will likely be required. Significant dewatering, such as that proposed, can cause significant stress increases, and settlement in the area of well points, including off-site improvements. It is also likely that the proposed foundation system will need to be designed to resist the potential hydrostatic and uplift forces resulting from high groundwater above the planned basement bottoms.

5.1.3 Proximity of Basement Excavation to Adjacent Improvements

We anticipate that the basement will extend to within a few feet or less of the property lines. Design of shoring incorporating surcharge loads from adjacent buildings or underpinning of the adjacent structures will likely be required. Restrained temporary shoring (e.g. tiebacks, etc.) to support the one- to four-story excavations will likely be necessary.

5.1.4 Potential Presence of Undocumented Fill

As discussed, it is likely that undocumented fill is present at the site due to the previous and existing development at the site. Undocumented fill, if not mitigated, could potentially settle, and cause distress to new structures and other improvements. Although any existing fills within the building footprint will likely be removed during the basement excavation, any remaining fill materials can be mitigated, which should consist of the removal of undocumented fill materials. Provided the fill materials meet the requirements for engineered fill, they could be re-used on site as engineered fill. Otherwise, they could be stockpiled on site for future use in landscaping or non-structural fill areas, or should be removed from the site.

5.1.5 Potential for Presence of Moderately Expansive Soils

Moderately expansive surficial soils were encountered during previous investigations near the site. To reduce the potential for damage to the planned surface structures and other improvements, the expansive properties of the native soils will be considered in developing design recommendations for foundations, slabs-on-grade, exterior concrete flatwork, pavements, and other site improvements bearing at-grade. In addition, it is important to limit moisture changes in the surficial soils by using positive drainage away from the buildings and other hardscaped areas, as well as limiting landscaping watering.

5.1.6 Differential Movement At On-grade to On-Structure Transitions

Some flatwork and vehicular pavement areas will likely transition from on-grade support to overlying the basement (on-structure). These transition areas typically experience increased differential movement due to a variety of causes, including difficulty in achieving compaction of retaining wall backfill closest to the wall, or settlement of backfill placed behind shoring when the excavation is not cut neat or there is raveling, requiring backfill behind lagging.

We recommend consideration be given to including subslabs beneath flatwork or pavers that can cantilever at least 3 feet beyond the wall at these transitions. If surface improvements are included that are highly sensitive to differential movement, additional measures may be necessary. Additional recommendations will be discussed during the design-level investigation.

5.2 FEASIBLE FOUNDATION ALTERNATIVES

We have reviewed the mapped conditions and data from our previous investigations near the site. The site appears to be underlain by alluvial soils. Shallow groundwater is not anticipated at the site; however, depending on the final depths of the below-grade parking structures, groundwater may be encountered. Additionally, perched groundwater may be encountered during basement excavation.

On a preliminary basis, a rigid mat foundation appears feasible to support the proposed structures. The mat foundation should be designed, as necessary, to resist hydrostatic and uplift forces from the groundwater. Ground anchors may be required as hold-downs depending on the buoyancy forces and final weight of the structures.

If total settlement due to static loads and seismic shaking are excessive, then deep foundations, combined with a mat foundation may be required. The foundation options may vary somewhat depending on actual site conditions, and structural loads, and the final level of the basement bottom. The feasibility of these foundations should be evaluated during the design-level investigation.

5.3 FINAL DESIGN-LEVEL GEOTECHNICAL REPORT

The preliminary information in this report is based upon review of available published information and our site reconnaissance. No exploration was completed for this initial study; therefore, we recommend that a final geotechnical investigation including exploration, laboratory testing, and analysis be completed once final development details are available.

SECTION 6: CLOSURE AND LIMITATIONS

We hope this report provides the information needed at this time. This report, an instrument of professional service, has been prepared for the sole use of David J. Powers & Associates specifically to support the design of the Downtown Specific Plan Amendments and Specific Development project in Sunnyvale, California. The opinions, conclusions, and preliminary recommendations presented in this report have been formulated in accordance with accepted geotechnical engineering practices that exist in Northern California at the time this report was prepared. No warranty, expressed or implied, is made or should be inferred. Recommendations in this report are based upon literature review and professional experience. No subsurface exploration of this project area was performed for this study. If variations or unsuitable conditions are encountered during construction, Cornerstone should be contacted to provide supplemental recommendations, as needed.

David J. Powers & Associates may have provided Cornerstone with plans, reports and other documents prepared by others. David J. Powers & Associates understands that Cornerstone reviewed and relied on the information presented in these documents and cannot be responsible for their accuracy.

Cornerstone prepared this report with the understanding that it is the responsibility of the owner or his representatives to see that the recommendations contained in this report are presented to other members of the design team and incorporated into the project plans and specifications, and that appropriate actions are taken to implement the geotechnical recommendations during construction.

Conclusions and recommendations presented in this report are valid as of the present time for the development as currently planned. Changes in the condition of the property or adjacent properties may occur with the passage of time, whether by natural processes or the acts of other persons. In addition, changes in applicable or appropriate standards may occur through legislation or the broadening of knowledge. Therefore, the conclusions and recommendations presented in this report may be invalidated, wholly or in part, by changes beyond Cornerstone's control. This report should be reviewed by Cornerstone after a period of three (3) years has elapsed from the date of this report. In addition, if the current project design is changed, then

Cornerstone must review the proposed changes and provide supplemental recommendations, as needed.

An electronic transmission of this report may also have been issued. While Cornerstone has taken precautions to produce a complete and secure electronic transmission, please check the electronic transmission against the hard copy version for conformity.

Recommendations provided in this report are based on the assumption that Cornerstone will be retained to provide observation and testing services during construction to confirm that conditions are similar to that assumed for design, and to form an opinion as to whether the work has been performed in accordance with the project plans and specifications. If we are not retained for these services, Cornerstone cannot assume any responsibility for any potential claims that may arise during or after construction as a result of misuse or misinterpretation of Cornerstone's report by others. Furthermore, Cornerstone will cease to be the Geotechnical-Engineer-of-Record if we are not retained for these services.

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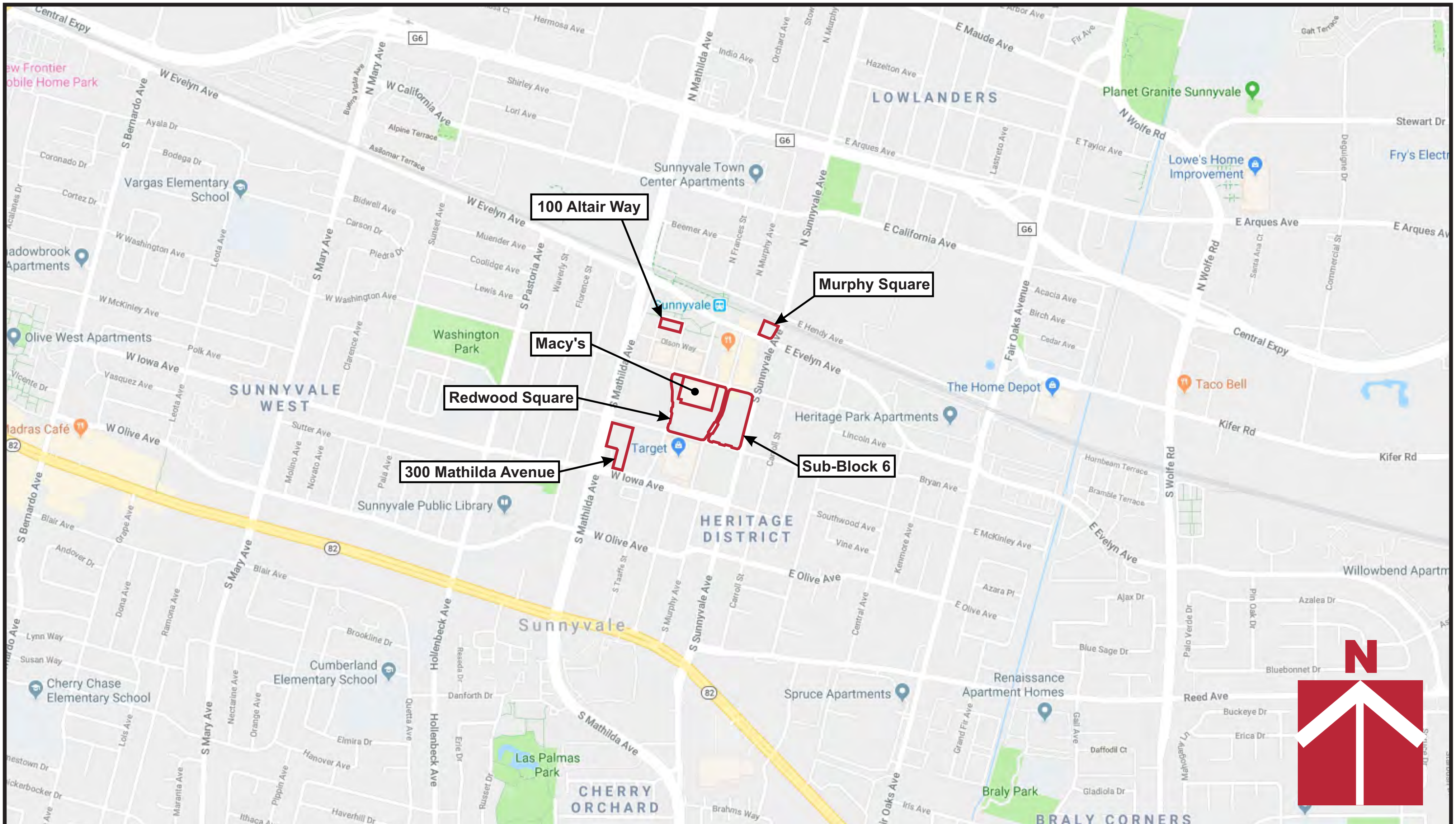

<table>
<tr><td rowspan="3">CORNERSTONE EARTH GROUP</td><td>Vicinity Map</td><td>Project Number
118-97-2</td></tr>
<tr><td rowspan="2">Aries Way Mixed-Use Development
Sunnyvale, CA</td><td>Figure Number
Figure 1</td></tr>
<tr><td>Date September 2018 | Drawn By RRN</td></tr>
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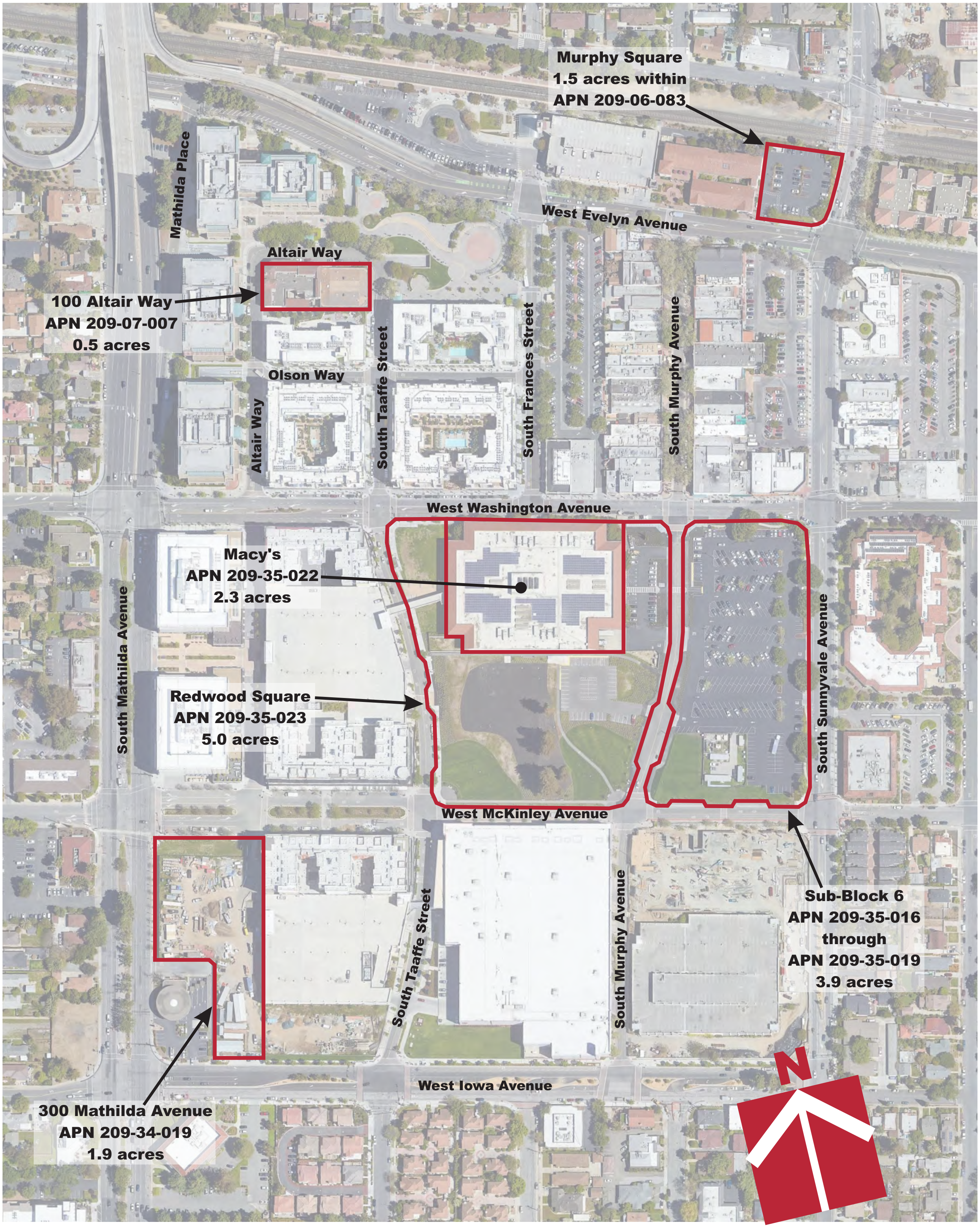

Legend

Approximate Site Boundary

0 300 600

APPROXIMATE SCALE (FEET)

Base by Google Earth, dated 3/28/2018

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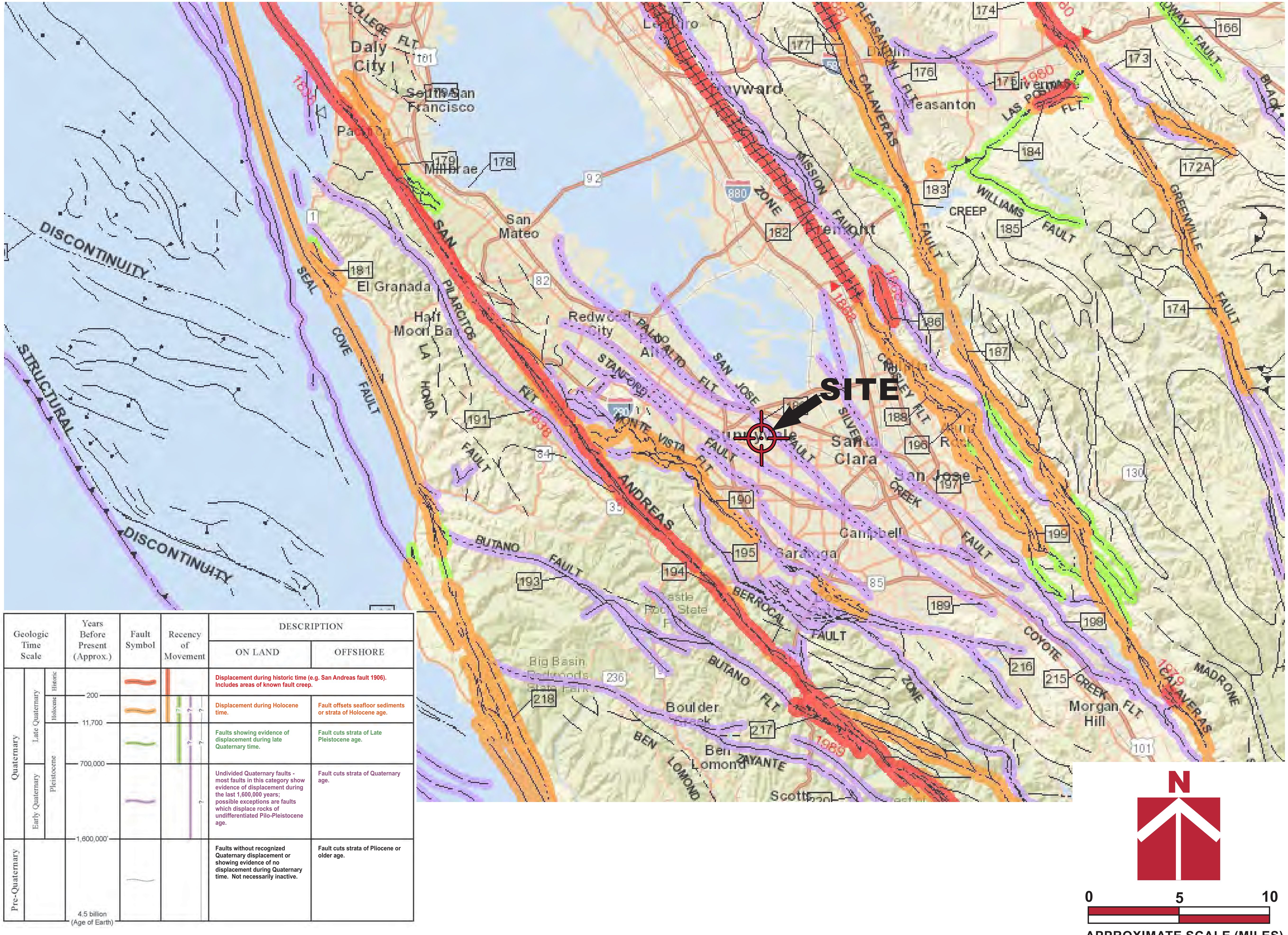
Site Plan	Project Number 118-97-2
Aries Way Mixed-Use Development Sunnyvale, CA	Figure Number Figure 1
	Date September 2018 / Drawn By RRN



Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION ON LAND	DESCRIPTION OFFSHORE
Quaternary	Late Quaternary	Historic	200			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	11,700			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
		Pleistocene	700,000			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
	Early Quaternary		1,600,000			Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Pilo-Pleistocene age.	Fault cuts strata of Quaternary age.
Pre-Quaternary			4.5 billion (Age of Earth)			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.

Base by California Geological Survey - 2010 Fault Activity Map of California (Jennings and Bryant, 2010)

Project Number 118-97-2

Figure Number Figure 3

Date September 2018

Drawn By RRN

Regional Fault Map

Aries Way Mixed-Use Development
Sunnyvale, CA

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