5 November 2019

Ms. Jennifer Jodoin
KT Properties, Inc.
21710 Stevens Creek Blvd., Suite 200
Cupertino, California 95014

**SUBJECT: Preliminary Geotechnical Study**
**Woz Way Site**
**San Jose, California**
**Langan Project No. 770664301**

Dear Ms. Jodoin:

This letter report presents the results of our geotechnical review of projects in the vicinity of the Woz Way site in San Jose. The site is southwest of the intersection of S. Almaden Boulevard and Woz Way, as shown on Figure 1. The site is bound by S. Almaden Boulevard to the east, Woz Way to the north, City of San Jose and Santa Clara Valley Water District property to the west and Interstate-280 (I-280) Freeway ramp to the south. The site occupies approximately 3.86 acres and contains 18 parcels and a portion of Locust Street. Currently, the site is occupied by one-story houses and landscaping.

The proposed development will include a 20-story office tower building with three basement levels. Parking is currently planned for the basement levels, as well as for the first three levels of the tower. Based on our review of the project's conceptual plans (C2K, 2018), there are currently three different layouts (Options A through C) of the office building plan being considered.

## 1.0 SCOPE OF SERVICES

This letter report was prepared based on the scope presented in our proposal dated 9 August 2019. The purpose of our investigation is to provide preliminary evaluation of the subsurface conditions and potential for geologic hazards and provide preliminary recommendations for the geotechnical aspects of the proposed project and included the following:

- soil and groundwater conditions
- site seismicity and seismic hazards, if any
- probable foundation type(s) for the proposed building
- preliminary design parameters for the recommended foundation type(s),

- subgrade preparation for slab-on-grade floors
- earth pressures for temporary shoring
- site grading and excavation, including criteria for fill quality and compaction
- 2019 California Building Code (CBC) soil profile type and mapped values $S_S$ and $S_1$ and coefficients $F_A$ and $F_V$, as appropriate.

## 2.0 SUBSURFACE CONDITIONS

We began our investigation by reviewing the results of previous studies performed at the site vicinity (Treadwell & Rollo, 1998 and Langan, 2017 and 2018). Based on the data from the previous geotechnical investigations, we judge the site and site vicinity is underlain by alluviual deposits consisting of soft to very stiff clays with interbedded layers of loose to medium dense sands with varying amount of fines. The stiffness of the clay and relative density of the sand layers generally increase with depth. Generally, the upper 30 to 35 feet consists of medium stiff to stiff clay with interbedded loose to medium dense sand. Below these depths, the clays are stiff to very stiff and the sand layer are dense to very dense.

Groundwater was encountered in the site vicinity at depths of about 10 to 15 feet below existing ground surface (bgs). Based on the historic groundwater map (California Department of Conservation, 2002), the historic high groundwater at the site is approximately 20 feet bgs.

## 3.0 REGIONAL SEISMICITY

The major active faults in the area are the Monte Vista-Shannon, Calaveras, Hayward and San Andreas faults. These and other faults of the region are shown on Figure 4. For each of the active faults within 50 kilometers (km) of the site, the distance from the site and estimated mean characteristic Moment magnitude[1] [2007 Working Group on California Earthquake Probabilities (WGCEP) (2008) and Cao et al. (2003)] are summarized in Table 1.

[1] Moment magnitude is an energy-based scale and provides a physically meaningful measure of the size of a faulting event. Moment magnitude is directly related to average slip and fault rupture area.

**TABLE 1**
**Regional Faults and Seismicity**

| Fault Segment | Approx. Distance from fault (km) | Direction from Site | Mean Characteristic Moment Magnitude |
|---|---|---|---|
| Total Hayward | 10 | Northeast | 7.00 |
| Total Hayward-Rodgers Creek | 10 | Northeast | 7.33 |
| Monte Vista-Shannon | 11 | Southwest | 6.50 |
| Total Calaveras | 14 | East | 7.03 |
| N. San Andreas - Peninsula | 19 | Southwest | 7.23 |
| N. San Andreas (1906 event) | 19 | Southwest | 8.05 |
| N. San Andreas - Santa Cruz | 19 | Southwest | 7.12 |
| Zayante-Vergeles | 27 | Southwest | 7.00 |
| Greenville Connected | 36 | East | 7.00 |
| San Gregorio Connected | 43 | West | 7.50 |
| Mount Diablo Thrust | 45 | North | 6.70 |
| Monterey Bay-Tularcitos | 50 | Southwest | 7.30 |

Figure 2 also shows the earthquake epicenters for events with magnitude greater than 5.0 from January 1800 through August 2014. 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 Modified Mercalli (MM) scale (Figure 3) occurred east of Monterey Bay on the San Andreas Fault (Toppozada and Borchardt 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 an $M_w$ 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 loss of lives and property damage. This earthquake created a surface rupture along the San Andreas Fault from Shelter Cove to San Juan Bautista approximately 470 kilometers in length. It had a maximum intensity of XI (MM), an $M_w$ of about 7.9, and was felt 560 kilometers away in Oregon, Nevada, and Los Angeles. The Loma Prieta Earthquake occurred on 17 October 1989, in the Santa Cruz Mountains with a $M_w$ of 6.9, approximately 32 km from the site.

In 1868 an earthquake with an estimated maximum intensity of X on the MM scale occurred on the southern segment (between San Leandro and Fremont) of the Hayward Fault. The estimated $M_w$ for the earthquake is 7.0. In 1861, an earthquake of unknown magnitude (probably 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 ($M_w = 6.2$).

The most recent earthquake to be felt in the Bay Area occurred on 24 August 2014 and was located on the West Napa fault, approximately 107 kilometers north of the site, with an $M_w$ of 6.0.

The 2014 Working Group for California Earthquake Probabilities (WGCEP) at the U.S. Geologic Survey (USGS) predicted a 72 percent chance of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay Area in 30 years (2014 WGCEP, 2015). More specific estimates of the probabilities for different faults in the Bay Area are presented in Table 2.

**TABLE 2**
**WGCEP (2015) Estimates of 30-Year Probability (2014 to 2043) of a Magnitude 6.7 or Greater Earthquake**

| Fault | Probability (percent) |
|---|---|
| Hayward-Rodgers Creek | 32 |
| N. San Andreas | 33 |
| Calaveras | 25 |

## 4.0 GEOLOGIC HAZARDS

The site is in a seismically active area and will likely be subjected to very strong shaking during a major earthquake. Strong ground shaking during an earthquake can result in ground failure such as that associated with soil liquefaction[2], lateral spreading[3], and cyclic densification[4]. Each of these conditions has been preliminarily evaluated based on our literature review and is discussed in this section.

### 4.1 Liquefaction

Soil liquefaction is a phenomenon in which saturated soil with little to no cohesion liquefies during a major earthquake; it experiences a temporary loss of shear strength as a result of a transient rise in excess pore water pressure generated by strong ground motion. Flow failure, lateral

[2] Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporally loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits.

[3] Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

[4] Cyclic densification is a phenomenon in which non-saturated, cohesionless soil is compacted by earthquake vibrations, causing ground surface settlement.

spreading, differential settlement, loss of bearing, ground fissures, and sand boils are evidence of excess pore pressure generation and liquefaction.

The site is an area designated by the California Geological Survey (CGS), as a zone of potential liquefaction (CGS, 2002). On the basis of data from nearby sites, we conclude that saturated layers of sand below the groundwater table could potentially liquefy causing several inches of liquefaction-induced settlement below the existing ground surface. The excavation of three basement levels will remove most of these layers; however, some liquefaction-induced settlement may still occur beneath the excavation. We preliminarily estimate liquefaction induced settlement beneath the basement will be less than one inch. In addition, settlement on the order of a few inches may occur beneath the adjacent sidewalks and utilities during a major earthquake. The anticipated liquefaction induced settlements should be confirmed during the final geotechnical investigation.

### 4.2 Seismic Densification

Seismic densification, or cyclic densification, refers to seismically-induced differential compaction of non-saturated granular material (sand and gravel above the groundwater table) caused by earthquake vibrations. Data from previous investigations near the site indicate layers of loose to medium dense sand were encountered above groundwater level. These unsaturated sand layers may densify during a major earthquake; however, the proposed basement excavations will remove these layers. Settlement as a result of seismic densification on the order of 1/4-inch may occur beneath the adjacent sidewalks and utilities during a major earthquake. This should be confirmed during a final geotechnical investigation.

### 4.3 Lateral Spreading

Lateral spreading is a phenomenon in which a surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. The surficial blocks are transported downslope or in the direction of a free face, such as a channel, by earthquake and gravitational forces. Lateral spreading is generally the most pervasive and damaging type of liquefaction-induced ground failure generated by earthquakes.

The project site is approximately 75 feet to 150 feet east of the Guadalupe River. According to Youd, Hansen, and Bartlett (1999), for significant lateral spreading displacements to occur, the soils should consist of saturated cohesionless sandy sediments with $(N_1)_{60}$ less than 15. During our final investigation, we should confirm if the potentially liquefiable soil underlying the site generally has $(N_1)_{60}$ greater than 15 and therefore does not fall within the parameters applicable to the Youd, Hansen, and Bartlett lateral displacement model. Also, if the potentially liquefiable soils are continuous, widespread shear zones may develop resulting significant lateral displacements to occur during liquefaction. During the 1906 and 1989 Loma Prieta earthquakes, lateral spreading was not observed but this should be confirmed during a final geotechnical investigation (Youd and Hoose, 1978 and Holzer, T.L., 1998).

## 4.4 Fault Rupture

Historically, ground surface ruptures closely follow the trace of geologically young faults. The site is not within an Earthquake Fault Zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act and no known active or potentially active faults exist on the site. Therefore, we conclude the risk of fault offset through the site from a known active fault is low. In a seismically active area, the remote possibility exists for future faulting in areas where no faults previously existed; however, we conclude that the risk of surficial ground deformation from faulting at the site is low.

## 4.5 Tsunami

The project site is not mapped within a tsunami inundation zone; therefore, we conclude the potential risk by inundation from tsunami to be low within the project site. However, the project civil engineer should evaluate the impact of sea level rise on the potential risk of inundation from a tsunami.

# 5.0 PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

The primary geotechnical issues that should be addressed during design development are adequate foundation support, presence of shallow groundwater and shoring. Our discussions and preliminary recommendations regarding foundation and other geotechnical aspects of the project are presented in the remainder of this report.

## 5.1 Foundations and Settlements

We anticipate construction will include an excavation of approximately 40 feet of soil for three basement levels. This will result in a slight net decrease in overburden pressure under the weight of the building and remove most of the medium stiff compressible clay layers encountered in the upper 30 to 35 feet, and potentially liquefiable saturated sand layers. Therefore, we do not anticipate excessive settlements in the clay layers below, if a shallow foundation system is used. Because the basement will extend below the groundwater table, we preliminarily conclude a mat foundation is feasible.

Building loads are currently not available; however, based on experience with similar projects, we estimate total settlements in the order of 1 to 3 inches. Differential settlement will depend on the rigidity of the mat. Assuming a mat with an average 5,000 to 6,000 uniform pressure of psf, we preliminarily recommend using a modulus of 20 to 60 kips per cubic foot (kcf). The modulus value should be confirmed during the final investigation once the building loads and static and seismically induced settlements are confirmed.

The basements will extend below the groundwater level and basement floor should be designed to resist hydrostatic uplift pressures and span between columns.

If the weight of the building is not sufficient to resist uplift then tiedown anchors may be required to resist the anticipated uplift pressures. Because the basement walls and mat will extend below the groundwater level, the basement walls and floors should be waterproofed and waterstops should be provided across all below grade construction joints.

## 5.2 Basement Walls

We recommend all basement walls be designed to resist lateral pressures imposed by the adjacent soil and vehicles. Because the site is in a seismically active area, the design should also be checked for seismic conditions. Under seismic loading conditions, there will be a seismic pressure increment that should be added to active earth pressures (Sitar et al., 2012). We used the procedures outlined in Sitar et al. (2012) and the peak ground acceleration based on the Design Earthquake ground motion level to compute the seismic pressure increment. Basement walls should be designed for the more critical loading condition of static or seismic conditions using the equivalent fluid weights and pressures presented in Table 3.

**TABLE 3**
**Preliminary Basement Wall Design Earth Pressures**
**(Drained Conditions)**

| Condition | Static Conditions | | Seismic Conditions[1] |
|---|---|---|---|
| | Unrestrained Walls (Active) | Restrained Walls (At rest) | Total Pressure – Active Plus Seismic Pressure Increment |
| Above Groundwater | 35 pcf | 55 pcf | 60 pcf |
| Below Groundwater | 80 pcf | 90 pcf | 90 pcf |

Note:
1. The more critical condition of either at-rest pressure for static conditions or active pressure plus a seismic pressure increment for seismic conditions should be checked.

Where traffic will pass within 10 feet of basement walls, temporary traffic loads should be considered in the design of the walls. Traffic loads may be modeled by a uniform pressure of 100 psf applied in the upper 10 feet of the walls. If the basement walls are designed to resist lateral forces such as wind or earthquake loading they should be checked using passive pressures. To calculate the passive resistance against the below-grade walls, we preliminarily recommend uniform pressure of 1,000 psf. This value includes a factor of safety of about 1.5. The walls should be checked by the structural engineer for this condition, if passive resistance of walls is needed.

The lateral earth pressures given assume the walls are properly backdrained above the water table to prevent the buildup of hydrostatic pressure. If the walls are not drained, they should be designed using the below groundwater earth pressures presented in Table 3 to account for hydrostatic pressure. One acceptable method for backdraining the walls is to place a prefabricated drainage panel against the back side of the wall. The drainage panel should extend to the design groundwater table and drain to a perforated PVC collector pipe. The pipe should be surrounded on all sides by at least four inches of Caltrans Class 2 permeable material (Caltrans Standard Specifications Section 68-2.02F(3)). We should check the manufacturer's specifications for the proposed drainage panel material to verify it is appropriate for its intended use.

### 5.2 2019 California Building Code Mapped Values

For seismic design in accordance with the provisions of 2019 California Building Code/ASCE 7-16, we preliminarily recommend the following, provided the structure meets the exceptions of Section 11.4.8 of ASCE 7-16:

- Risk-Targeted Maximum Considered Earthquake ($MCE_R$) $S_s$ and $S_1$ of 1.5g and 0.6g, respectively
- Site Class D
- Site Coefficients $F_A$ and $F_V$ of 1.0 and 1.7
- $MCE_R$ spectral response acceleration parameters at short periods, $S_{MS}$, and at one-second period, $S_{M1}$, of 1.5g and 1.0g, respectively
- Design Earthquake (DE) spectral response acceleration parameters at short period, $S_{DS}$, and at one-second period, $S_{D1}$, of 1.0g and 0.7g, respectively
- Peak ground acceleration, $PGA_M$ of 0.589g

If the structure does not meet the exceptions in Section 11.4.8 of ASCE 7-16, site-specific spectra will be required.

### 5.3 Shoring and Underpinning

Construction of three-basement levels will require an excavation of about 40 feet below the adjacent site grades. During excavation for the proposed basement levels, shoring will be required to laterally restrain the sides of the excavation and limit the movement of adjacent improvements, such as public streets and sidewalks.

We judge the most economical shoring system would consist of soldier piles with timber lagging but would require extensive dewatering to install lagging in areas where water is encountered; however, lowering the groundwater table could cause settlement to existing improvements and may not be acceptable to Caltrans. Another alternative is to use mixed-in-place, closely spaced, soil/cement columns to create a soil/cement mix wall that would likely be the most watertight shoring system and thus require the least dewatering. The soil cement wall should be designed as a cutoff wall to limit groundwater seepage and therefore reduce the potential for lowering the water table behind the shoring. In addition, mixed-in-place soil/cement walls would be relatively rigid and could significantly limit caving lateral deflections and ground subsidence related to the excavation.

For excavations of about 40 feet, tiebacks or internal bracing will need to be installed to provide lateral resistance and limit deflection. Internal braces may be required if there are obstructions precluding the use of tiebacks or if extending them beyond property lines is not permitted. Tiebacks underneath Caltrans right-of-way along the ramp will need to be coordinated with and approved by Caltrans.

## 5.4 Dewatering

To construct the basement of the building, the groundwater will need to be temporarily lowered to a depth of at least three feet below the bottom of the planned excavation. Sand and gravel layers may be present within the proposed depth of excavation. Some of these sand and gravel layers may be below the groundwater level and may act as a conduit for water to flow into the excavation from the sides.

Based on experience, we consider dewatering of the excavation to be of extreme importance to the performance of the shoring and maintaining a stable subgrade for construction of the foundation. A well-designed, installed, and operated dewatering system is therefore essential. Variables that will influence the performance of the dewatering system and the quantity of water produced include the shoring design (e.g. if a cutoff wall is installed and the depth of cut-off), the number of wells, the depth and positioning of the wells, the interval over which each well is screened, and the rate at which each well is pumped. The site dewatering should be designed and implemented by an experienced dewatering contractor.

Dewatering the site should remain as localized as possible. Widespread dewatering could result in subsidence of the area around the site due to increases in effective stress in the soil. Nearby streets and other improvements should be monitored for vertical movement and groundwater levels outside the excavation should be monitored through wells while dewatering is in progress. Should excessive settlement or groundwater drawdown be measured, the contractor should be prepared to recharge the groundwater outside the excavation through recharge wells. A recharge program should be submitted as part of the dewatering plan.

If the excavation is supported by a cutoff wall shoring system (such as a CDSM wall), we anticipate only dewatering within the site will be required, and there should be no significant lowering of the groundwater level outside of the excavation. In this case, we would not anticipate significant settlement of the surrounding improvements associated with the required dewatering.

## 6.0 FINAL REPORT

The conclusions and recommendations presented in this letter are preliminary. They should not be used to develop final design drawings. A final geotechnical investigation that includes borings, cone penetration tests (CPTs) and laboratory tests should be performed at the project site to develop final geotechnical recommendations. The borings and CPTs should extend at least 50 feet below the lowest finished floor elevation.

If you have any questions, please call. Thank you.

Sincerely yours,
**Langan Engineering and Environmental Services, Inc.**

Serena T. Jang, GE #2702
Senior Associate/Vice President

John Gouchon, GE #2282
Principal/Vice President

Attachments: References
Figures 1 through 3

770664301.03 STJ_Preliminary Geotechnical Study_Woz Way Site_San Jose.docx

## REFERENCES


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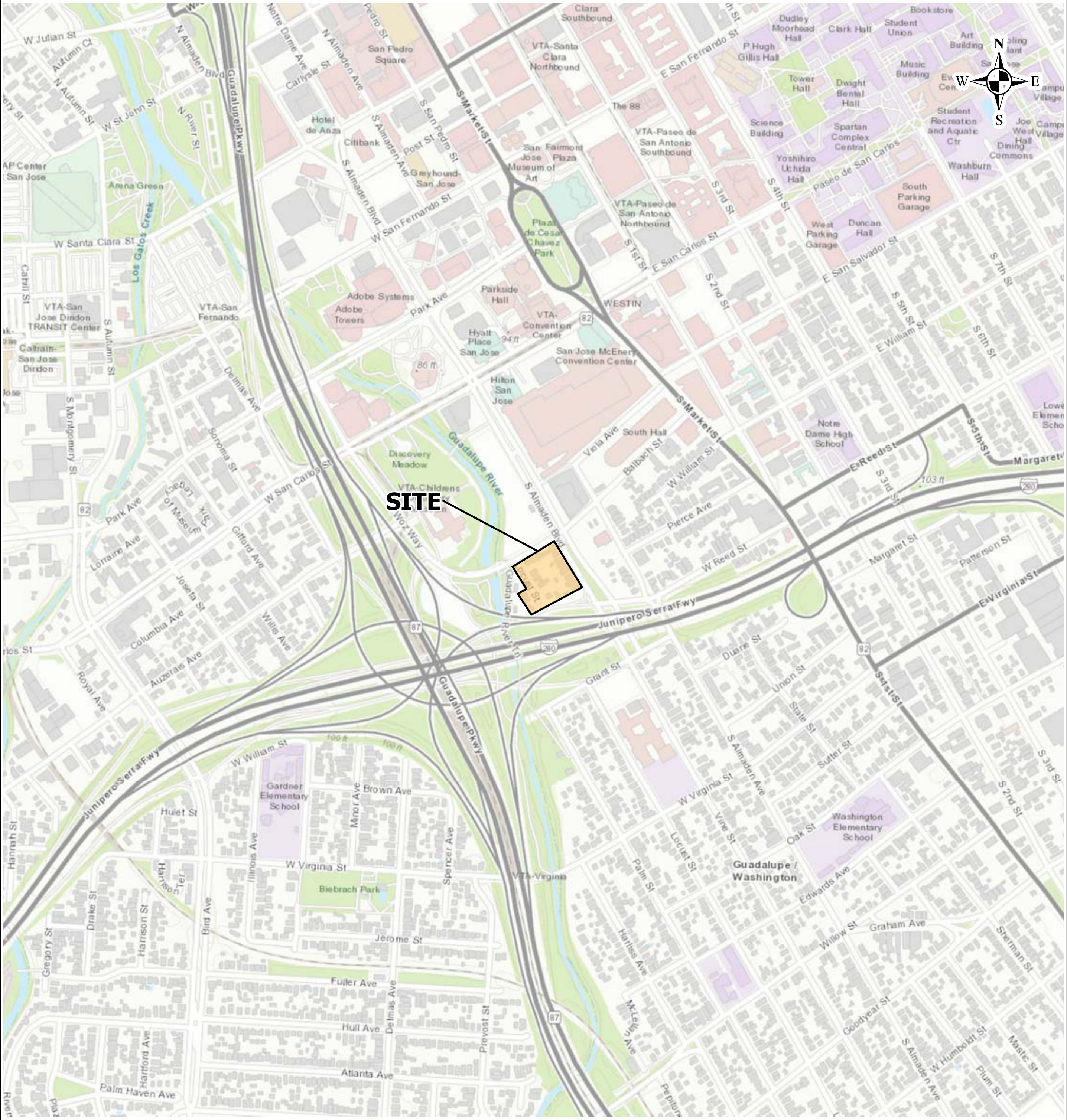
# FIGURES




Notes:
1. Site located in the San Jose West USGS Quadrangle.
2. Topographic basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online, National Geographic Society, i-cubed.

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SCALE IN FEET

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|---|---|---|---|
| **LANGAN**<br>1 Almaden Boulevard, Suite 590<br>San Jose, CA 95113<br>T: 408.283.3600 F: 408.283.3601 www.langan.com<br>Langan Engineering & Environmental Services, Inc.<br>Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.<br>Langan International, LLC<br>Collectively known as Langan | Project<br>***WOZ WAY SITE***<br>SAN JOSE<br>SANTA CLARA COUNTY CALIFORNIA | Drawing Title<br>***SITE LOCATION MAP*** | Project No. 770664301<br>Date 11/5/2019<br>Scale 1 " = 1,000 '<br>Drawn By BJS | Figure<br>1 |



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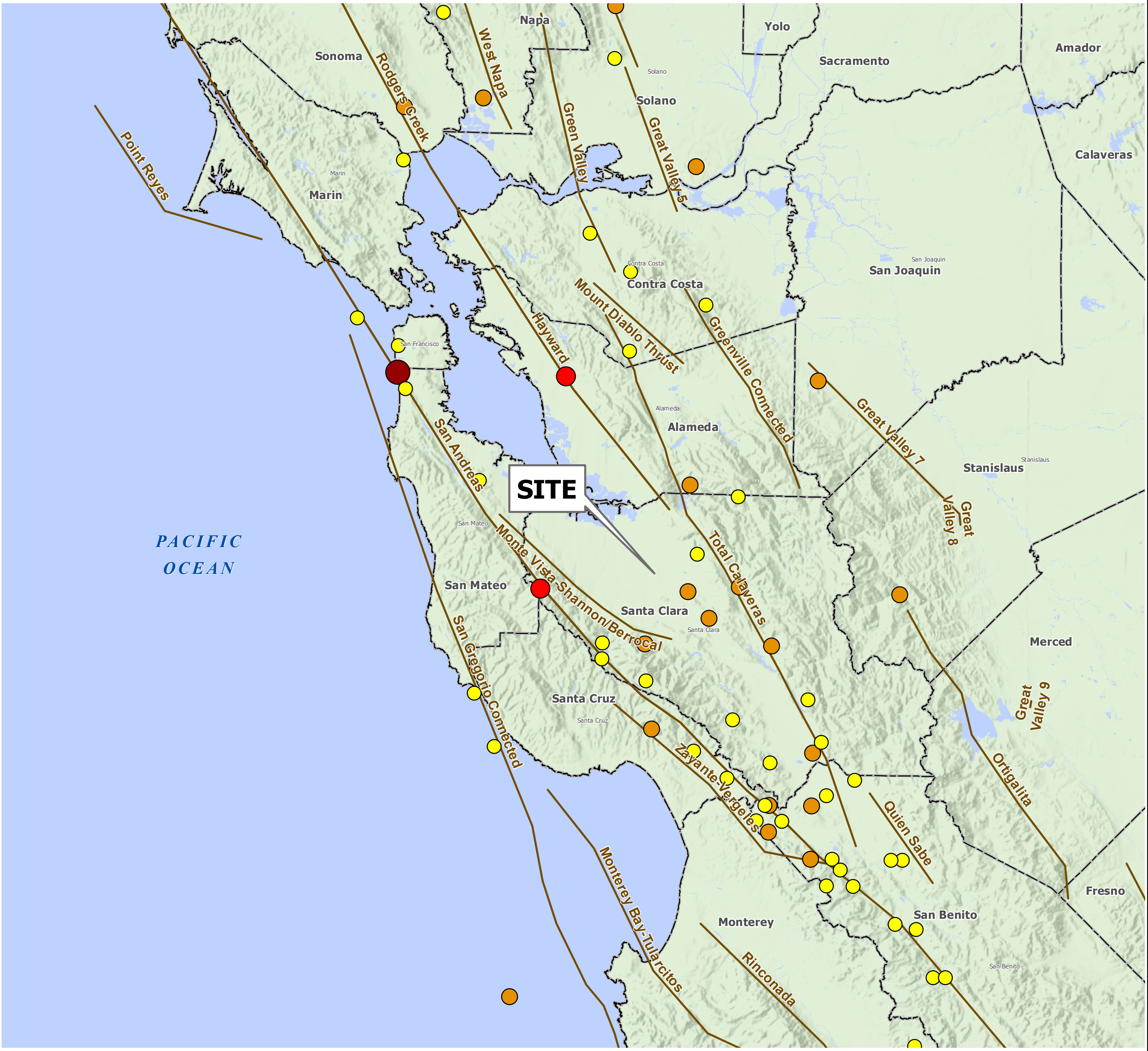


## Legend

- County Boundary
- Fault

**Earthquake Epicenter**

**Magnitude**

- Magnitude 5 to 5.9
- Magnitude 6 to 6.9
- Magnitude 7 to 7.4
- Magnitude 7.5 to 8

**Notes:**

1. Quaternary fault data displayed are based on a generalized version of USGS Quaternary Fault and fold database, 2010. For cartographic purposes only.
2. The Earthquake Epicenter (Magnitude) data is provided by the U.S Geological Survey (USGS) and is current through 08/26/2014.
3. Basemap hillshade and County boundaries provided by USGS and California Department of Transportation.
4. Map displayed in California State Coordinate System, California (Teale) Albers, North American Datum of 1983 (NAD83), Meters.


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| Project | Drawing Title | Project No. | Figure |
|---|---|---|---|
| WOZ WAY SITE<br>SAN JOSE<br>SANTA CLARA COUNTY CALIFORNIA | MAP OF MAJOR FAULTS AND EARTHQUAKE EPICENTERS IN THE SAN FRANCISCO BAY AREA | 770664301<br>Date: 11/5/2019<br>Scale: 1 " = 20 miles<br>Drawn By: BJS | 2 |



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**I** **Not felt by people, except under especially favorable circumstances. However, dizziness or nausea may be experienced.**
Sometimes birds and animals are uneasy or disturbed. Trees, structures, liquids, bodies of water may sway gently, and doors may swing very slowly.

**II** **Felt indoors by a few people, especially on upper floors of multi-story buildings, and by sensitive or nervous persons.**
As in Grade I, birds and animals are disturbed, and trees, structures, liquids and bodies of water may sway. Hanging objects swing, especially if they are delicately suspended.

**III** **Felt indoors by several people, usually as a rapid vibration that may not be recognized as an earthquake at first. Vibration is similar to that of a light, or lightly loaded trucks, or heavy trucks some distance away. Duration may be estimated in some cases.**
Movements may be appreciable on upper levels of tall structures. Standing motor cars may rock slightly.

**IV** **Felt indoors by many, outdoors by a few. Awakens a few individuals, particularly light sleepers, but frightens no one except those apprehensive from previous experience. Vibration like that due to passing of heavy, or heavily loaded trucks. Sensation like a heavy body striking building, or the falling of heavy objects inside.**
Dishes, windows and doors rattle; glassware and crockery clink and clash. Walls and house frames creak, especially if intensity is in the upper range of this grade. Hanging objects often swing. Liquids in open vessels are disturbed slightly. Stationary automobiles rock noticeably.

**V** **Felt indoors by practically everyone, outdoors by most people. Direction can often be estimated by those outdoors. Awakens many, or most sleepers. Frightens a few people, with slight excitement; some persons run outdoors.**
Buildings tremble throughout. Dishes and glassware break to some extent. Windows crack in some cases, but not generally. Vases and small or unstable objects overturn in many instances, and a few fall. Hanging objects and doors swing generally or considerably. Pictures knock against walls, or swing out of place. Doors and shutters open or close abruptly. Pendulum clocks stop, or run fast or slow. Small objects move, and furnishings may shift to a slight extent. Small amounts of liquids spill from well-filled open containers. Trees and bushes shake slightly.

**VI** **Felt by everyone, indoors and outdoors. Awakens all sleepers. Frightens many people; general excitement, and some persons run outdoors.**
Persons move unsteadily. Trees and bushes shake slightly to moderately. Liquids are set in strong motion. Small bells in churches and schools ring. Poorly built buildings may be damaged. Plaster falls in small amounts. Other plaster cracks somewhat. Many dishes and glasses, and a few windows break. Knickknacks, books and pictures fall. Furniture overturns in many instances. Heavy furnishings move.

**VII** **Frightens everyone. General alarm, and everyone runs outdoors.**
People find it difficult to stand. Persons driving cars notice shaking. Trees and bushes shake moderately to strongly. Waves form on ponds, lakes and streams. Water is muddied. Gravel or sand stream banks cave in. Large church bells ring. Suspended objects quiver. Damage is negligible in buildings of good design and construction; slight to moderate in well-built ordinary buildings; considerable in poorly built or badly designed buildings, adobe houses, old walls (especially where laid up without mortar), spires, etc. Plaster and some stucco fall. Many windows and some furniture break. Loosened brickwork and tiles shake down. Weak chimneys break at the roofline. Cornices fall from towers and high buildings. Bricks and stones are dislodged. Heavy furniture overturns. Concrete irrigation ditches are considerably damaged.

**VIII** **General fright, and alarm approaches panic.**
Persons driving cars are disturbed. Trees shake strongly, and branches and trunks break off (especially palm trees). Sand and mud erupts in small amounts. Flow of springs and wells is temporarily and sometimes permanently changed. Dry wells renew flow. Temperatures of spring and well waters varies. Damage slight in brick structures built especially to withstand earthquakes; considerable in ordinary substantial buildings, with some partial collapse; heavy in some wooden houses, with some tumbling down. Panel walls break away in frame structures. Decayed pilings break off. Walls fall. Solid stone walls crack and break seriously. Wet grounds and steep slopes crack to some extent. Chimneys, columns, monuments and factory stacks and towers twist and fall. Very heavy furniture moves conspicuously or overturns.

**IX** **Panic is general.**
Ground cracks conspicuously. Damage is considerable in masonry structures built especially to withstand earthquakes; great in other masonry buildings - some collapse in large part. Some wood frame houses built especially to withstand earthquakes are thrown out of plumb, others are shifted wholly off foundations. Reservoirs are seriously damaged and underground pipes sometimes break.

**X** **Panic is general.**
Ground, especially when loose and wet, cracks up to widths of several inches; fissures up to a yard in width run parallel to canal and stream banks. Landsliding is considerable from river banks and steep coasts. Sand and mud shifts horizontally on beaches and flat land. Water level changes in wells. Water is thrown on banks of canals, lakes, rivers, etc. Dams, dikes, embankments are seriously damaged. Well-built wooden structures and bridges are severely damaged, and some collapse. Dangerous cracks develop in excellent brick walls. Most masonry and frame structures, and their foundations are destroyed. Railroad rails bend slightly. Pipe lines buried in earth tear apart or are crushed endwise. Open cracks and broad wavy folds open in cement pavements and asphalt road surfaces.

**XI** **Panic is general.**
Disturbances in ground are many and widespread, varying with the ground material. Broad fissures, earth slumps, and land slips develop in soft, wet ground. Water charged with sand and mud is ejected in large amounts. Sea waves of significant magnitude may develop. Damage is severe to wood frame structures, especially near shock centers, great to dams, dikes and embankments, even at long distances. Few if any masonry structures remain standing. Supporting piers or pillars of large, well-built bridges are wrecked. Wooden bridges that "give" are less affected. Railroad rails bend greatly and some thrust endwise. Pipe lines buried in earth are put completely out of service.

**XII** **Panic is general.**
Damage is total, and practically all works of construction are damaged greatly or destroyed. Disturbances in the ground are great and varied, and numerous shearing cracks develop. Landslides, rock falls, and slumps in river banks are numerous and extensive. Large rock masses are wrenched loose and torn off. Fault slips develop in firm rock, and horizontal and vertical offset displacements are notable. Water channels, both surface and underground, are disturbed and modified greatly. Lakes are dammed, new waterfalls are produced, rivers are deflected, etc. Surface waves are seen on ground surfaces. Lines of sight and level are distorted. Objects are thrown upward into the air.

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| Project | Drawing Title | Project No. | Figure |
|---|---|---|---|
| **WOZ WAY SITE**<br>SAN JOSE<br>SANTA CLARA COUNTY CALIFORNIA | **MODIFIED MERCALLI INTENSITY SCALE** | 770664301<br>Date<br>11/5/2019 | 3 |



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