JOBTRAIN AIR QUALITY & GREENHOUSE GAS ASSESSMENT

East Palo Alto, California

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Introduction

The purpose of this report is to address air quality, community health risk, and greenhouse gas (GHG) impacts associated with the proposed office project located at 2535 Pulgas Avenue in East Palo Alto, California. The air quality impacts and GHG emissions would be associated with the demolition of the existing uses at the site, construction of the new building and infrastructure, and operation of the project. Air pollutant and GHG emissions associated with the construction and operation of the project were predicted using appropriate computer models. In addition, the potential health risk impact (construction and operation) and the impacts of existing toxic air contaminant (TAC) sources affecting the nearby and proposed sensitive receptors were evaluated. This analysis addresses those issues following the guidance provided by the Bay Area Air Quality Management District (BAAQMD).[1]

Project Description

The approximately 3.86-acre total project site is located at 2535 Pulgas Avenue and is within the Ravenswood/4 Corners Specific Plan area. The total project site is currently developed with two single-story buildings, approximately six accessory structures, and storage areas used for equipment and vehicle storage. The proposed project would demolish the existing buildings totaling 5,741 square feet (sf). It would then construct an approximately 110,000-sf, four-story office building with approximately 55,000-sf for JobTrain and approximately 55,000-sf for general office space. There would also be 357 surface parking lot spaces. The new office building would also include a 100-kilowatt (kW) emergency generator powered by a 134-horsepower (hp) diesel engine in the center of the southern half on the roof of the office building.

The first floor of the proposed building would feature approximately 10,500 square feet of ground floor open space for a carpentry yard and a children's play area. The carpentry classes utilizing the area would use basic small carpentry tools (i.e., hammers, saws) and no large equipment (i.e., forklifts). At the current JobTrain facility in Menlo Park lumber and material deliveries currently occur three to four times per year, but with the increased storage space available for carpentry uses at the proposed project, the frequency of deliveries is expected to diminish due to the increased amount of materials that can be stored onsite. However, for the purpose of this analysis, a maximum of four deliveries per year is conservatively assumed. The daycare would only be available to JobTrain students. The daycare's maximum capacity would be 24 children and the ages would be from three to five years old.

Setting

The project is located in San Mateo County, which is in the San Francisco Bay Area Air Basin. Ambient air quality standards have been established at both the State and federal level. The Bay Area meets all ambient air quality standards with the exception of ground-level ozone, respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$).

[1] Bay Area Air Quality Management District, *CEQA Air Quality Guidelines*, May 2017.

Air Pollutants of Concern

High ozone levels are caused by the cumulative emissions of reactive organic gases (ROG) and nitrogen oxides (NO_x). These precursor pollutants react under certain meteorological conditions to form high ozone levels. Controlling the emissions of these precursor pollutants is the focus of the Bay Area's attempts to reduce ozone levels. The highest ozone levels in the Bay Area occur in the eastern and southern inland valleys that are downwind of air pollutant sources. High ozone levels aggravate respiratory and cardiovascular diseases, reduced lung function, and increase coughing and chest discomfort.

Particulate matter is another problematic air pollutant of the Bay Area. Particulate matter is assessed and measured in terms of respirable particulate matter or particles that have a diameter of 10 micrometers or less (PM_{10}) and fine particulate matter where particles have a diameter of 2.5 micrometers or less ($PM_{2.5}$). Elevated concentrations of PM_{10} and $PM_{2.5}$ are the result of both region-wide (or cumulative) emissions and localized emissions. High particulate matter levels aggravate respiratory and cardiovascular diseases, reduce lung function, increase mortality (e.g., lung cancer), and result in reduced lung function growth in children.

Toxic Air Contaminants

Toxic air contaminants (TAC) are a broad class of compounds known to cause morbidity or mortality (usually because they cause cancer) and include, but are not limited to, the criteria air pollutants. TACs are found in ambient air, especially in urban areas, and are caused by industry, agriculture, fuel combustion, and commercial operations (e.g., dry cleaners). TACs are typically found in low concentrations, even near their source (e.g., diesel particulate matter [DPM] near a freeway). Because chronic exposure can result in adverse health effects, TACs are regulated at the regional, State, and federal level.

Diesel exhaust is the predominant TAC in urban air and is estimated to represent about three-quarters of the cancer risk from TACs (based on the Bay Area average). According to the California Air Resources Board (CARB), diesel exhaust is a complex mixture of gases, vapors, and fine particles. This complexity makes the evaluation of health effects of diesel exhaust a complex scientific issue. Some of the chemicals in diesel exhaust, such as benzene and formaldehyde, have been previously identified as TACs by the CARB, and are listed as carcinogens either under the State's Proposition 65 or under the Federal Hazardous Air Pollutants programs. The most recent Office of Environmental Health Hazard Assessment (OEHHA) risk assessment guidelines were published in February of 2015.[2] See *Attachment 1* for a detailed description of the community risk modeling methodology used in this assessment.

Sensitive Receptors

There are groups of people more affected by air pollution than others. CARB has identified the following persons who are most likely to be affected by air pollution: children under 16, the elderly

[2] OEHHA, 2015. *Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*. Office of Environmental Health Hazard Assessment. February.

over 65, athletes, and people with cardiovascular and chronic respiratory diseases. These groups are classified as sensitive receptors. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder care facilities, and elementary schools. For cancer risk assessments, infants and children are the most sensitive receptors, since they are more susceptible to cancer causing TACs. Residential locations are assumed to include infants and small children. The closest sensitive receptors to the project site are the single-family residences to the west along Illinois Street. There are additional residences south of the site at further distances. Further, the EPA Center Arts located southeast of the site hosts children ages 13 and older during daytime hours.

Regulatory Setting

Federal Regulations

The United States Environmental Protection Agency (EPA) sets nationwide emission standards for mobile sources, which include on-road (highway) motor vehicles such trucks, buses, and automobiles, and non-road (off-road) vehicles and equipment used in construction, agricultural, industrial, and mining activities (such as bulldozers and loaders). The EPA also sets nationwide fuel standards. California also has the ability to set motor vehicle emission standards and standards for fuel used in California, as long as they are the same or more stringent than the Federal standards.

In the past decade the EPA has established a number of emission standards for on- and non-road heavy-duty diesel engines used in trucks and other equipment. This was done in part because diesel engines are a significant source of nitrogen oxides, or NO_X, and particulate matter (PM_{10} and $PM_{2.5}$) and because the EPA has identified diesel particulate matter as a probable carcinogen. Implementation of the heavy-duty diesel on-road vehicle standards and the non-road diesel engine standards are estimated to reduce PM and NO_X emissions from diesel engines up to 95 percent in 2030 when the heavy-duty vehicle fleet is completely replaced with newer heavy-duty vehicles that comply with these emission standards.[3]

In concert with the diesel engine emission standards, the EPA has also substantially reduced the amount of sulfur allowed in diesel fuels. The sulfur contained in diesel fuel is a significant contributor to the formation of particulate matter in diesel-fueled engine exhaust. The new standards reduced the amount of sulfur allowed by 97 percent for highway diesel fuel (from 500 parts per million by weight [ppmw] to 15 ppmw), and by 99 percent for off-highway diesel fuel (from about 3,000 ppmw to 15 ppmw). The low sulfur highway fuel (15 ppmw sulfur), also called ultra-low sulfur diesel (ULSD) is currently required for use by all vehicles in the U.S.

All of the above Federal diesel engine and diesel fuel requirements have been adopted by California, in some cases with modifications making the requirements more stringent or the implementation dates sooner.

[3] USEPA, 2000. *Regulatory Announcement, Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements*. EPA420-F-00-057. December.

State Regulations

To address the issue of diesel emissions in the state, CARB developed the Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles[4]. In addition to requiring more stringent emission standards for new on-road and off-road mobile sources and stationary diesel-fueled engines to reduce particulate matter emissions by 90 percent, a significant component of the plan involves application of emission control strategies to existing diesel vehicles and equipment. Many of the measures of the Diesel Risk Reduction Plan have been approved and adopted, including the Federal on-road and non-road diesel engine emission standards for new engines, as well as adoption of regulations for low sulfur fuel in California.

CARB has adopted and implemented a number of regulations for stationary and mobile sources to reduce emissions of DPM. Several of these regulatory programs affect medium and heavy-duty diesel trucks that represent the bulk of DPM emissions from California highways. CARB regulations require on-road diesel trucks to be retrofitted with particulate matter controls or replaced to meet 2010 or later engine standards that have much lower DPM and $PM_{2.5}$ emissions. This regulation will substantially reduce these emissions between 2013 and 2023. While new trucks and buses will meet strict federal standards, this measure is intended to accelerate the rate at which the fleet either turns over so there are more cleaner vehicles on the road, or is retrofitted to meet similar standards. With this regulation, older, more polluting trucks would be removed from the roads sooner.

CARB has also adopted and implemented regulations to reduce DPM and NO_X emissions from in-use (existing) and new off-road heavy-duty diesel vehicles (e.g., loaders, tractors, bulldozers, backhoes, off-highway trucks, etc.). The regulations apply to diesel-powered off-road vehicles with engines 25 horsepower (hp) or greater. The regulations are intended to reduce particulate matter and NO_X exhaust emissions by requiring owners to turn over their fleet (replace older equipment with newer equipment) or retrofit existing equipment in order to achieve specified fleet-averaged emission rates. Implementation of this regulation, in conjunction with stringent Federal off-road equipment engine emission limits for new vehicles, will significantly reduce emissions of DPM and NO_X.

Bay Area Air Quality Management District (BAAQMD)

BAAQMD has jurisdiction over an approximately 5,600-square mile area, commonly referred to as the San Francisco Bay Area (Bay Area). The District's boundary encompasses the nine San Francisco Bay Area counties, including Alameda County, Contra Costa County, Marin County, San Francisco County, San Mateo County, Santa Clara County, Napa County, southwestern Solano County and southern Sonoma County.

BAAQMD is the lead agency in developing plans to address attainment and maintenance of the National Ambient Air Quality Standards and California Ambient Air Quality Standards. The District also has permit authority over most types of stationary equipment utilized for the proposed project. The BAAQMD is responsible for permitting and inspection of stationary sources;

[4] California Air Resources Board, 2000. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles*. October.

enforcement of regulations, including setting fees, levying fines, and enforcement actions; and ensuring that public nuisances are minimized.

BAAQMD's Community Air Risk Evaluation (CARE) program addresses communities with higher air pollution levels. The program identifies areas where vulnerable populations are exposed to higher levels, applies the scientific methods and strategies to reduce air pollution health impacts in these areas and engages the community and other agencies to develop additional actions to reduce impacts. BAAQMD has developed maps that show areas with elevated pollution levels and identified impacted areas. East Palo Alto does not fall under any of these impacted areas.

The BAAQMD *California Environmental Quality Act (CEQA) Air Quality Guidelines*[5] were prepared to assist in the evaluation of air quality impacts of projects and plans proposed within the Bay Area. The guidelines provide recommended procedures for evaluating potential air impacts during the environmental review process consistent with CEQA requirements including thresholds of significance, mitigation measures, and background air quality information. They also include assessment methodologies for air toxics, odors, and greenhouse gas emissions. In June 2010, the BAAQMD's Board of Directors adopted CEQA thresholds of significance and an update of their *CEQA Guidelines*. In May 2011, the updated BAAQMD *CEQA Air Quality Guidelines* were amended to include a risk and hazards threshold for new receptors and modify procedures for assessing impacts related to risk and hazard impacts.

<u>BAAQMD Stationary Source Rules and Regulations</u>

Combustion equipment associated with the proposed project that includes new diesel engines to power generators would establish new sources of particulate matter and gaseous emissions. Emissions would primarily result from the testing of the emergency backup generators, operation of the boilers for space and water heating and some minor emissions from cooling towers. The project would also generate emissions from vehicles traveling to and from the project.

Certain emission sources would be subject to BAAQMD Regulations and Rules. The District's rules and regulations that may apply to the project include:

- Regulation 2 – Permits
    - Rule 2-1: General Requirements
    - Rule 2-2: New Source Review
- Regulation 6 – Particulate Matter and Visible Emissions
- Regulation 9 – Inorganic Gaseous Pollutants
    - Rule 9-1: Sulfur Dioxide
    - Rule 9-7: Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, And Process Heaters
    - Rule 9-8: Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines

[5] Bay Area Air Quality Management District, 2011. *CEQA Air Quality Guidelines*. May. (Updated May 2017)

Permits

Rule 2-1-301 requires that any person installing, modifying, or replacing any equipment, the use of which may reduce or control the emission of air contaminants, shall first obtain an Authority to Construct (ATC).

Rule 2-1-302 requires that written authorization from the BAAQMD in the form of a Permit to Operate (PTO) be secured before any such equipment is used or operated.

Rule 2-1 lists sources that are exempt from permitting. At the proposed facility, the diesel fuel storage tanks are expected to be exempt from permitting.

New Source Review

Rule 2-2, New Source Review (NSR), applies to all new and modified sources or facilities that are subject to the requirements of Rule 2-1-301. The purpose of the rule is to provide for review of such sources and to provide mechanisms by which no net increase in emissions will result.

Rule 2-2-301 requires that an applicant for an ATC or PTO apply Best Available Control Technology (BACT) to any new or modified source that results in an increase in emissions and has emissions of precursor organic compounds, non-precursor organic compounds, NOx, SO_2, PM_{10}, or CO of 10.0 pounds or more per highest day. Based on the estimated emissions from the proposed project, BACT will be required for NOx emissions from the diesel-fueled generator engines.

BACT for Diesel Generator Engines

Since the generators will be used exclusively for emergency use during involuntary loss of power, the BACT 2 levels listed for IC compression engines in the BAAQMD BACT Guidelines would apply. The BACT 2 NOx emission factor limit is 6.9 grams per horsepower hour (g/hp-hr). The project's proposed engines will have emissions lower than the BACT 2 level and, as such, will comply with the BACT requirements.

Offsets

Rule 2-2-302 require that offsets be provided for a new or modified source that emits more than 10 tons per year of NOx or precursor organic compounds. It is not expected that emissions of any pollutant will exceed the offset thresholds. Thus, is not expected that offsets for the proposed project would be required.

Prohibitory Rules

Regulation 6 pertains to particulate matter and visible emissions. Although the engines will be fueled with diesel, they will be modern, low emission engines. Thus, the engines are expected to comply with Regulation 6.

Rule 9-1 applies to sulfur dioxide. The engines will use ultra-low sulfur diesel fuel (less than 15 ppm sulfur) and will not be a significant source of sulfur dioxide emissions and are expected to comply with the requirements of Rule 9-1.

Rule 9-7 limits the emissions of NOx CO from industrial, institutional and commercial boilers, steam generators and process heaters. This regulation typically applies to boilers with a heat rating of 2 million British Thermal Units (BTU) per hour

Rule 9-8 prescribes NOx and CO emission limits for stationary internal combustion engines. Since the proposed engines will be used with emergency standby generators, Regulation 9-8-110 exempts the engines from the requirements of this Rule, except for the recordkeeping requirements (9-8-530) and limitations on hours of operation for reliability-related operation (maintenance and testing). The engines will not operate more than 50 hours per year, which will satisfy the requirements of 9-8-111.

Stationary Diesel Airborne Toxic Control Measure

The BAAQMD administers the state's Airborne Toxic Control Measure (ACTM) for Stationary Diesel engines (section 93115, title 17 CA Code of Regulations). The project's stationary sources will be new stationary emergency standby diesel engines larger than 50-hp. Since the engines will have an uncontrolled PM emission factor of less than 0.15 g/hp-hour and operate no more than 50 hours per year, the engines will comply with the requirements of the ACTM.

Vista 2035 East Palo Alto General Plan

On October 4, 2016, the City of East Palo Alto adopted the Vista 2035 East Palo Alto General Plan, which was an update to the City's 1999 General Plan and Zoning Ordinance.[6] The final version was published March 2017. The General Plan is the foundation for establishing goals, purposes, zoning and activities allowed on each land parcel to provide compatibility and continuity to the entire region as well as each individual neighborhood. This general plan includes goals and policies to improve air quality within East Palo Alto. The following goal and policy apply to the project.

Goal HE-4. **Safely and systemically address toxics, legacy pollutants, and hazardous materials**

Intent: To protect residents and visitors against harmful health and other impacts associated with dangerous materials that may pose a threat to life and property, and may dictate costly public improvements. Reduction or elimination of these hazards can be accomplished with concerted efforts.

[6] City of East Palo Alto, 2017. *Vista 2035 East Palo Alto General Plan*. March. Web: http://www.ci.east-palo-alto.ca.us/DocumentCenter/View/3187

Policies:

4.2 Pollutants. Continue to work with state, federal, regional, and local agencies to eliminate and reduce concentrations of regulated legacy pollutants.

Ravenswood/4 Corners Transit Oriented Development (TOD) Specific Plan DEIR

The Ravenswood and 4 Corners TOD Specific Plan is a document that outlines and provides detailed regulations for how this district will develop and expand in the near future.[7] This specific plan focuses on development (i.e. residential and commercial uses) that is near transit stops and improve proximity to services. The following performance standard is applicable to the project.

> *Air Contaminants* - No smoke, soot, flash, dust, cinders, direct, acids, fumes, vapors, odors, toxic, or radioactive substances waste or particulate, solid, liquid, or gaseous matter shall be introduced into the outdoor atmosphere, alone or in any combination, in a quantity or at a duration that interferes with safe occupancy of the site or surrounding sites. In addition, all uses shall be subject to any emission limits determined by BAAQMD

Significance Thresholds

In June 2010, BAAQMD adopted thresholds of significance to assist in the review of projects under CEQA and these significance thresholds were contained in the District's 2011 *CEQA Air Quality Guidelines*. These thresholds were designed to establish the level at which BAAQMD believed air pollution emissions would cause significant environmental impacts under CEQA. The thresholds were challenged through a series of court challenges and were mostly upheld. BAAQMD updated the *CEQA Air Quality Guidelines* in 2017 to include the latest significance thresholds that were used in this analysis are summarized in Table 1.

[7] City of East Palo Alto, 2013.*Ravenswood / 4 Corners TOD Specific Plan.* February. Web: https://www.ci.east-palo-alto.ca.us/Archive/ViewFile/Item/125

Table 1. BAAQMD CEQA Significance Thresholds

Criteria Air Pollutant	Construction Thresholds	Operational Thresholds	
	Average Daily Emissions (lbs./day)	**Average Daily Emissions (lbs./day)**	**Annual Average Emissions (tons/year)**
ROG	54	54	10
NO_x	54	54	10
PM_{10}	82 (Exhaust)	82	15
$PM_{2.5}$	54 (Exhaust)	54	10
CO	Not Applicable	9.0 ppm (8-hour average) or 20.0 ppm (1-hour average)	
Fugitive Dust	Construction Dust Ordinance or other Best Management Practices	Not Applicable	
Health Risks and Hazards	**Single Sources Within 1,000-foot Zone of Influence**	**Combined Sources (Cumulative from all sources within 1000-foot zone of influence)**	
Excess Cancer Risk	>10 per one million	>100 per one million	
Hazard Index	>1.0	>10.0	
Incremental annual $PM_{2.5}$	>0.3 µg/m^3	>0.8 µg/m^3	
Greenhouse Gas Emissions			
Land Use Projects – direct and indirect emissions	Compliance with a Qualified GHG Reduction Strategy OR 1,100 metric tons annually or 4.6 metric tons per capita (for 2020) *		
Note: ROG = reactive organic gases, NOx = nitrogen oxides, PM_{10} = course particulate matter or particulates with an aerodynamic diameter of 10 micrometers (µm) or less, $PM_{2.5}$ = fine particulate matter or particulates with an aerodynamic diameter of 2.5µm or less. GHG = greenhouse gases. *BAAQMD does not have a recommended post-2020 GHG threshold.			

AIR QUALITY IMPACTS AND MITIGATION MEASURES

Impact: **Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?**

The Bay Area is considered a non-attainment area for ground-level O_3 and $PM_{2.5}$ under both the Federal Clean Air Act and the California Clean Air Act. The area is also considered non-attainment for PM_{10} under the California Clean Air Act, but not the federal act. The area has attained both State and Federal ambient air quality standards for carbon monoxide. As part of an effort to attain and maintain ambient air quality standards for O_3, $PM_{2.5}$ and PM_{10}, the BAAQMD has established thresholds of significance for these air pollutants and their precursors. These thresholds are for O_3 precursor pollutants (ROG and NOx), PM_{10}, and $PM_{2.5}$ and apply to both construction period and operational period impacts.

Construction period emissions

The California Emissions Estimator Model (CalEEMod) Version 2016.3.2 was used to estimate emissions from on-site construction activity, construction vehicle trips, and evaporative emissions. The project land use types and size, and anticipated construction schedule were input to CalEEMod. The CARB EMission FACtors 2017 (EMFAC2017) model was used to predict emissions from construction traffic, which includes worker travel, vendor trucks, and haul trucks.[8] The CalEEMod model output along with construction inputs are included in *Attachment 2* and EMFAC2017 vehicle emissions modeling outputs are included in *Attachment 3*.

CalEEMod Inputs

Land Use Inputs

The proposed project land uses were entered into CalEEMod as described in Table 2.

Table 1. Summary of Project Land Use Inputs

Project Land Uses	Size	Units	Square Feet (sf)	Acreage
General Office Building	55	1,000-sf	55,000	3.86
Parking Lot	357	Space	92,117	
Junior College (2Yr)	198	Student	65,500	

Construction Inputs

CalEEMod computes annual emissions for construction that are based on the project type, size and acreage. The model provides emission estimates for both on-site and off-site construction activities. On-site activities are primarily made up of construction equipment emissions, while off-site activity includes worker, hauling, and vendor traffic. The construction build-out scenario,

[8] See CARB's EMFAC2017 Web Database at https://www.arb.ca.gov/emfac/2017/

including equipment list and schedule, were based on information provided by the project applicant.

The construction equipment worksheet provided by the applicant included the schedule for each phase. Within each phase, the quantity of equipment to be used along with the average hours per day and total number of workdays was provided. Since different equipment would have different estimates of the working days per phase, the hours per day for each phase was computed by dividing the total number of hours that the equipment would be used by the total number of days in that phase. The construction schedule assumed that the earliest possible start date would be May 2021 and the project would be built out over a period of approximately 19 months, or 358 construction workdays. The earliest year of full operation was assumed to be 2023.

Construction Truck Traffic Emissions

The latest version of the CalEEMod model is based on the older version of the CARB EMFAC2014 motor vehicle emission factor model. This model has been superseded by the EMFAC2017 model; however, CalEEMod has not been updated to include EMFAC2017. Construction would produce traffic in the form of worker trips and truck traffic. The traffic-related emissions are based on worker and vendor trip estimates produced by CalEEMod and haul trips that were computed based on the estimate of demolition material to be exported, soil material imported and/or exported to the site, and the estimate of cement and asphalt truck trips. CalEEMod provides daily estimates of worker and vendor trips for each applicable phase. The total trips for those were computed by multiplying the daily trip rate by the number of days in that phase. Haul trips for demolition and grading were estimated from the provided demolition and grading volumes by assuming each truck could carry 10 tons per load. The number of concrete and asphalt total round haul trips were provided for the project and converted to total one-way trips, assuming two trips per delivery.

The construction traffic information was combined with EMFAC2017 motor vehicle emissions factors. EMFAC2017 provides aggregate emission rates in grams per mile for each vehicle type. The vehicle mix for this study was based on CalEEMod default assumptions, where worker trips are assumed to be comprised of light-duty autos (EMFAC category LDA) and light duty trucks (EMFAC category LDT1and LDT2). Vendor trips are comprised of delivery and large trucks (EMFAC category MHDT and HHDT) and haul trips, including cement trucks, are comprised of large trucks (EMFAC category HHDT). Travel distances are based on CalEEMod default lengths, which are 10.8 miles for worker travel, 7.3 miles for vendor trips and 20 miles for hauling (demolition material export and soil import/export). Since CalEEMod does not address cement or asphalt trucks, these were treated as vendor travel distances. Each trip was assumed to include an idle time of 5 minutes. Emissions associated with vehicle starts were also included. On-road emission rates from the years 2021-2022 for San Mateo County were used. Table 3 provides the traffic inputs that were combined with the EMFAC2017 emission database to compute vehicle emissions.

Table 3. Construction Traffic Data Used for EMFAC2017 Model Runs

CalEEMod Run/Land Uses and Construction Phase	Trips by Trip Type			Notes
	Total Worker[1]	Total Vendor[1]	Total Haul[2]	
Vehicle mix[1]	73.6% LDA 8.6% LDT1 27.8% LDT2	76.6% MHDT 23.4% HHDT	100% HHDT	
Trip Length (miles)	10.8	7.3	20.0 (Demo/Soil) 7.3 (Cement/Asphalt)	CalEEMod default distance with 5-min truck idle time.
Demolition	130	-	446	5,728-sf of existing building demolition and 2,100 tons of pavement demolition. CalEEMod default worker trips.
Grading	510	-	1,293	5,018-cy of export volume. 5,325-cy of import volume.[9] CalEEMod default worker trips.
Trenching	480	-	-	CalEEMod default worker trips.
Building Construction	15,792	6,580	1,280	640 cement truck round trips. CalEEMod default worker and vendor trips.
Architectural Coating	2,397	-	-	CalEEMod default worker trips.
Paving	110	-	240	1,000-cy of asphalt for paving. CalEEMod default worker trips.

Notes: [1] Based on 2021-2022 EMFAC2017 light-duty vehicle fleet mix for San Mateo County.
[2] Includes grading trips estimated by CalEEMod based on amount of material to be removed.

Summary of Computed Construction Period Emissions

Average daily emissions were annualized for each year of construction by dividing the annual construction emissions by the number of active workdays during that year. Table 4 shows average daily construction emissions of ROG, NO_X, PM_{10} exhaust, and $PM_{2.5}$ fugitive during construction of the project. As indicated in Table 4, predicted construction period emissions would not exceed the BAAQMD significance thresholds.

[9] The amount of soil imported for the proposed project has increased from 5,325 cubic yard to 6,000 cubic yards since the time of this analysis. This increased amount would slightly increase construction emissions, and given how far below the thresholds the criteria pollutant emissions are and how far away the off-site sensitive receptors are, the change in construction emissions and health risk would be negligible and not change the impact results.

Table 4. Construction Period Emissions

Year	ROG	NOx	PM_{10} Exhaust	$PM_{2.5}$ Fugitive
Construction Emissions Per Year (Tons)				
2021	0.10	1.07	0.05	0.05
2022	0.77	1.18	0.06	0.05
Average Daily Construction Emissions Per Year (pounds/day)				
2021 (175 construction workdays)	1.18	12.22	0.62	0.52
2022 (183 construction workdays)	8.38	12.86	0.61	0.51
BAAQMD Thresholds (pounds per day)	*54* lbs./day	*54* lbs./day	*82* lbs./day	*54* lbs./day
Exceed Threshold?	No	No	No	No

Construction activities, particularly during site preparation and grading, would temporarily generate fugitive dust in the form of PM_{10} and $PM_{2.5}$. Sources of fugitive dust would include disturbed soils at the construction site and trucks carrying uncovered loads of soils. Unless properly controlled, vehicles leaving the site would deposit mud on local streets, which could be an additional source of airborne dust after it dries. The BAAQMD CEQA Air Quality Guidelines consider these impacts to be less-than-significant if best management practices are implemented to reduce these emissions. *Mitigation Measure AQ-1 would implement BAAQMD-recommended best management practices*.

***Mitigation Measure AQ-1:* Include measures to control dust and exhaust during construction.**

During any construction period ground disturbance, the applicant shall ensure that the project contractor implement measures to control dust and exhaust. Implementation of the measures recommended by BAAQMD and listed below would reduce the air quality impacts associated with grading and new construction to a less-than-significant level. Additional measures are identified to reduce construction equipment exhaust emissions. The contractor shall implement the following best management practices that are required of all projects:

1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.

2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered.

3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.

4. All vehicle speeds on unpaved roads shall be limited to 15 miles per hour (mph).

5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.

6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne

toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.

7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.

8. Post a publicly visible sign with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

Effectiveness of Mitigation Measure AQ-1

The measures above are consistent with BAAQMD-recommended basic control measures for reducing fugitive particulate matter that are contained in the BAAQMD CEQA Air Quality Guidelines.

<u>Operational Period Emissions</u>

Operational air emissions from the project would be generated primarily from autos driven by future employees, students, and vendors. Evaporative emissions from architectural coatings and maintenance products (classified as consumer products) are typical emissions from these types of uses. CalEEMod was also used to estimate emissions from operation of the proposed project assuming full build-out.

Land Uses

The project land uses were entered into CalEEMod as described above for the construction period modeling.

Model Year

Emissions associated with vehicle travel depend on the year of analysis because emission control technology requirements are phased-in over time. Therefore, the earlier the year analyzed in the model, the higher the emission rates utilized by CalEEMod. The earliest year of full operation would be 2023. Emissions associated with build-out later than 2023 would be lower.

Trip Generation Rates

CalEEMod allows the user to enter specific vehicle trip generation rates. Therefore, the project-specific daily trip generation rate provided by the traffic consultant was entered into the model.[10] The project would produce 996 net daily trips taking into account the *25% TDM Trip Reduction for General Office* and *6% Additional TDM Trip Reduction for JabTrain.* The daily trip generation

[10] Hexagon Transportation Consultants, Inc., *Updated Transportation Impact Analysis for the Proposed New Office Building at 2535 Pulgas Avenue in East Palo Alto*, January 8,2021.

was calculated using the size of the project land uses and the adjusted total automobile trips per land use. The Saturday and Sunday trip rates were adjusted by multiplying the ratio of the CalEEMod default rates for Saturday and Sunday trips to the default weekday rate with the project-specific daily weekday trip rate. The default trip types and lengths specified by CalEEMod were used.

EMFAC2017 Adjustment

The vehicle emission factors and fleet mix used in CalEEMod are based on EMission FACtors from 2014 (EMFAC2014), which is an older CARB emission inventory for on road and off road mobile sources. Since the release of CalEEMod Version 2016.3.2, new emission factors have been produced by CARB. EMFAC2017 became available for use in March 2018 and approved by the EPA in August 2019. It includes the latest data on California's car and truck fleets and travel activity. Additionally, CARB has recently released EMFAC off-model adjustment factors to account for the Safer Affordable Efficient (SAFE) Vehicle Rule Part one.[11,12] The SAFE vehicle Rule Part One revoked California's authority to set its own GHG emission standards and set zero emission vehicle mandates in California. As a result of this ruling, mobile criteria pollutant and GHG emissions would increase. Therefore, the CalEEMod vehicle emission factors and fleet mix were updated with the emission rates and fleet mix from EMFAC2017, which were adjusted with the CARB EMFAC off-model adjustment factors. More details about the updates in emissions calculation methodologies are available in the EMFAC2017 Technical Support Document.[13]

Energy

CalEEMod defaults for energy use were used, which include the 2016 Title 24 Building Standards. GHG emissions modeling includes those indirect emissions from electricity consumption. The electricity produced emission rate was modified in CalEEMod. CalEEMod has a default emission factor of 641.3 pounds of CO_2 per megawatt of electricity produced, which is based on Pacific Gas and Electric's (PG&E) 2008 emissions rate. However, PG&E published in 2019 emissions rates for 2010 through 2017, which showed the emission rate for delivered electricity had been reduced to 210 pounds CO2 per megawatt of electricity delivered in the year 2017.[14]

Peninsula Clean Energy (PCE) now provides electricity to 90-percent of San Mateo County, with 50 percent renewable and 90 percent being carbon free electricity. The 2018 rate provided by PCE was 129.77 pounds of CO_2 per megawatt of electricity delivered.[15] The CO_2 intensity rate input into CalEEMod was adjusted to account for 90 percent of PCE's rate and 10 percent of PG&E's

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[11] California Air Resource Board, 2019. *EMFAC Off-Model Adjustment Factors to Account for the SAFE Vehicle Rule Part One*. November. Web: https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf

[12] California Air Resource Board, 2020. *EMFAC Off-Model Adjustment Factors for Carbon Dioxide ($CO_2$0 Emissions to Accounts for the SAFE Vehicles Rule Part One and the Final SAFE Rule*. June. Web: https://ww3.arb.ca.gov/msei/emfac_off_model_co2_adjustment_factors_06262020-final.pdf?utm_medium=email&utm_source=govdelivery

[13] See CARB 2018: https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/road-documentation/msei-modeling-tools-emfac

[14] PG&E, 2019. *Corporate Responsibility and Sustainability Report*. Web: http://www.pgecorp.com/corp_responsibility/reports/2019/assets/PGE_CRSR_2019.pdf

[15] Correspondence with Michael Totah, Peninsula Clean Energy, August 30, 2019.

rate. Therefore, an electricity emission rate of 138 pounds per of CO_2 per megawatt of electricity delivered was used for this analysis.

Emergency Generator

The project would include a 100-kW emergency generator that is powered by a diesel engine. Emissions from the testing and maintenance of the proposed generator engine were calculated for a 134-hp diesel engine. The generator would be located in the center of the southern half on the roof of the office building. The CalEEMod modeling assumed 50 hours of annual operation for testing and maintenance purposes.

Other Inputs

Default model assumptions for emissions associated with solid waste generation use were applied to the project. Water/wastewater use were changed to 100% aerobic conditions to represent wastewater treatment plant conditions.

Existing Uses

A CalEEMod model run was developed to compute emissions from use of the existing land uses as if it were operating in 2023. Inputs for this modeling scenario included 4,500-sf[16] entered as "General Light Industry" and 3.76 acres entered as "Oher Non-Asphalt Surfaces". The existing trip generation rates and other inputs were applied to the existing modeling in the same manner described for the proposed project. Historical energy usage rates were assigned by CalEEMod.

Summary of Computed Operational Period Emissions

Annual emissions were predicted using CalEEMod. The daily emissions were estimated assuming 365 days of operation. Table 5 shows average daily emissions of ROG, NO_X, total PM_{10}, and total $PM_{2.5}$ during operation of the project. The operational period emissions would not exceed the BAAQMD significance thresholds.

Table 5. Operational Period Emissions

Scenario	ROG	NOx	PM_{10}	$PM_{2.5}$
2023 Project Operational Emissions (*tons/year*)	0.94 tons	0.63 tons	0.90 tons	0.25 tons
2023 Existing Operational Emissions (*tons/year*)	0.11 tons	0.11 tons	0.21 tons	0.05 tons
Net Annual Emissions (*tons/year*)	0.83 tons	0.52 tons	0.69 tons	0.20 tons
BAAQMD Thresholds (tons /year)	*10 tons*	*10 tons*	*15 tons*	*10 tons*
Exceed Threshold?	No	No	No	No
Net 2023 Project Operational Emissions (*lbs/day*)[1]	4.54 lbs.	2.85 lbs.	3.78 lbs.	1.08 lbs.
BAAQMD Thresholds (pounds/day)	*54* lbs.	*54* lbs.	*82* lbs.	*54* lbs.
Exceed Threshold?	No	No	No	No

Notes: [1] Assumes 365-day operation.

[16] The revised existing industrial use is 5,741-sf. This would 1) have a negligible increase of existing use operational emissions that would not change the impact finding and 2) using the smaller existing use/emissions to net out the project's overall operational emissions would yield a higher total net project operational emissions, so the more conservative scenario was analyzed in the report.

Impact: Expose sensitive receptors to substantial pollutant concentrations?

Project impacts related to increased community risk would occur by introducing a new sources of TAC emissions with the potential to adversely affect existing sensitive receptors in the project vicinity or by significantly exacerbating existing cumulative TAC impacts. This project would introduce new sources of TACs during construction (i.e., on-site construction and truck hauling emissions) and operation (i.e., emergency diesel generators and mobile sources).

Project construction activity would generate dust and equipment exhaust that would affect nearby sensitive receptors. The project's operation would include the installation of an emergency generator powered by diesel engines that would have TAC and air pollutant emissions. The project would generate some traffic, consisting of light-duty vehicles. However, the number of net daily trips generated by the project are low (i.e., 996 net daily trips)[17] and emissions from automobile traffic generated by the project would be spread out over a broad geographical area and not localized. Therefore, project traffic was not be considered a local source of substantial TACs or $PM_{2.5}$ that could lead to health impacts.

Project impacts to existing sensitive receptors were addressed for temporary construction activities and long-term operational conditions. There are also several sources of existing TACs and localized air pollutants in the vicinity of the project. The impact of the existing sources of TAC was also assessed in terms of the cumulative risk which includes the project contribution, as well as the risk on the new sensitive receptors introduced by the project.

Community Risk Methodology for Construction and Operation

Community risk impacts were addressed by predicting increased cancer risk, the increase in annual $PM_{2.5}$ concentrations and computing the Hazard Index (HI) for non-cancer health risks. The risk impacts from the project are the combination of risks from construction and operation sources. These sources include on-site construction activity, construction truck hauling, and increased traffic from the project. To evaluate the increased cancer risks from the project, a 30-year exposure period was used, per BAAQMD guidance,[18] with the sensitive receptors being exposed to both project construction and operation emissions during this timeframe.

The project increased cancer risk is computed by summing the project construction cancer risk and operation cancer risk contributions. Unlike, the increased maximum cancer risk, the annual $PM_{2.5}$ concentration and HI values are not additive but based on the annual maximum values for the entirety of the project. The project maximally exposed individual (MEI) is identified as the sensitive receptor that is most impacted by the project's construction and operation.

The methodology for computing community risks impacts is contained in *Attachment 1*. This involved the calculation of TAC and $PM_{2.5}$ emissions, dispersion modeling of these emissions, and computations of cancer risk and non-cancer health effects.

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[17] Hexagon Transportation Consultants, Inc., *Updated Transportation Impact Analysis for the Proposed New Office Building at 2535 Pulgas Avenue in East Palo Alto*, January 8,2021.
[18] BAAQMD, 2016. *BAAQMD Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines*. December 2016.

Modeled Sensitive Receptors

Receptors for this assessment included locations where sensitive populations would be present for extended periods of time (i.e., chronic exposures). This includes the existing residences to the west of the site and other existing residences to the south of the site, as shown in Figure 1. Residential receptors are assumed to include all receptor groups (i.e., infants, children, and adults) with almost continuous exposure to project emissions. Community risks were also computed for children at the EPA Center Arts (13 years and older).

Community Health Risk from Project Construction

Construction equipment and associated heavy-duty truck traffic generates diesel exhaust, which is a known TAC. These exhaust air pollutant emissions would not be considered to contribute substantially to existing or projected air quality violations. Construction exhaust emissions may still pose health risks for sensitive receptors such as surrounding residents. The primary community risk impact issue associated with construction emissions are cancer risk and exposure to $PM_{2.5}$. Diesel exhaust poses both a potential health and nuisance impact to nearby receptors. A health risk assessment of the project construction activities was conducted that evaluated potential health effects to nearby sensitive receptors from construction emissions of DPM and $PM_{2.5}$.[19] This assessment included dispersion modeling to predict the offsite and onsite concentrations resulting from project construction, so that increased cancer risks and non-cancer health effects could be evaluated.

<u>Construction Emissions</u>

The CalEEMod and EMFAC2017 models provided total annual PM_{10} exhaust emissions (assumed to be DPM) for the off-road construction equipment and for exhaust emissions from on-road vehicles, with total emissions from all construction stages as 0.0928 tons (186 pounds). The on-road emissions are a result of haul truck travel during demolition and grading activities, worker travel, and vendor deliveries during construction. A trip length of one mile was used to represent vehicle travel while at or near the construction site. It was assumed that these emissions from on-road vehicles traveling at or near the site would occur at the construction site. Fugitive $PM_{2.5}$ dust emissions were calculated by CalEEMod as 0.0587 tons (117 pounds) for the overall construction period.

<u>Dispersion Modeling</u>

The U.S. EPA AERMOD dispersion model was used to predict DPM and $PM_{2.5}$ concentrations at sensitive receptors (residences) in the vicinity of the project construction area. The AERMOD dispersion model is a BAAQMD-recommended model for use in modeling analysis of these types of emission activities for CEQA projects.[20] Emission sources for the construction site were grouped into two categories: exhaust emissions of DPM and fugitive $PM_{2.5}$ dust emissions.

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[19] DPM is identified by California as a toxic air contaminant due to the potential to cause cancer.
[20] Bay Area Air Quality Management District (BAAQMD), 2012, *Recommended Methods for Screening and Modeling Local Risks and Hazards, Version 3.0.* May.

To represent the construction equipment exhaust emissions, an area source emission release height of 20 feet (6 meters) was used for the area sources.[21] The release height incorporates both the physical release height from the construction equipment (i.e., the height of the exhaust pipe) and plume rise after it leaves the exhaust pipe. Plume rise is due to both the high temperature of the exhaust and the high velocity of the exhaust gas. It should be noted that when modeling an area source, plume rise is not calculated by the AERMOD dispersion model as it would do for a point source (exhaust stack). Therefore, the release height from an area source used to represent emissions from sources with plume rise, such as construction equipment, should be based on the height the exhaust plume is expected to achieve, not just the height of the top of the exhaust pipe.

For modeling fugitive $PM_{2.5}$ emissions, a near-ground level release height of 6.5 feet (2 meters) was used for the area source. Fugitive dust emissions at construction sites come from a variety of sources, including truck and equipment travel, grading activities, truck loading (with loaders) and unloading (rear or bottom dumping), loaders and excavators moving and transferring soil and other materials, etc. All of these activities result in fugitive dust emissions at various heights at the point(s) of generation. Once generated, the dust plume will tend to rise as it moves downwind across the site and exit the site at a higher elevation than when it was generated. For all these reasons, a 6.5-foot release height was used as the average release height across the construction site. Emissions from the construction equipment and on-road vehicle travel were distributed throughout the modeled area sources.

The modeling used a five-year data set (2013-2017) of hourly meteorological data from the Moffett Federal Airfield that was prepared for use with the AERMOD model by BAAQMD. Construction emissions were modeled as occurring between 7:00 a.m. to 4:00 p.m., when the majority of construction activity would occur. Annual DPM and $PM_{2.5}$ concentrations from construction activities during the 2021-2022 period were calculated using the model. DPM and $PM_{2.5}$ concentrations were calculated at nearby sensitive receptors. A receptor height of 5 feet (1.5 meters) was used to represent the breathing height on the first floor of nearby single-family residences and older children at the EPA Center Arts.

<u>Summary of Construction Community Risk Impacts</u>

The increased cancer risk calculations were based on applying the BAAQMD recommended age sensitivity factors to the TAC concentrations, as described in *Attachment 1*. Age-sensitivity factors reflect the greater sensitivity of infants and small children to cancer causing TACs. The range of infant through adult exposures were assumed to occur at all residences and child exposure was assumed to occur at the EPA Center Arts during the entire construction period. Infant exposure at residences was used as a worst-case assumption, while child and adult exposures would be less.

The maximum modeled annual $PM_{2.5}$ concentration was calculated based on combined exhaust and fugitive concentrations. The maximum computed HI values was based on the ratio of the maximum DPM concentration modeled and the chronic inhalation refence exposure level of 5 $\mu g/m^3$.

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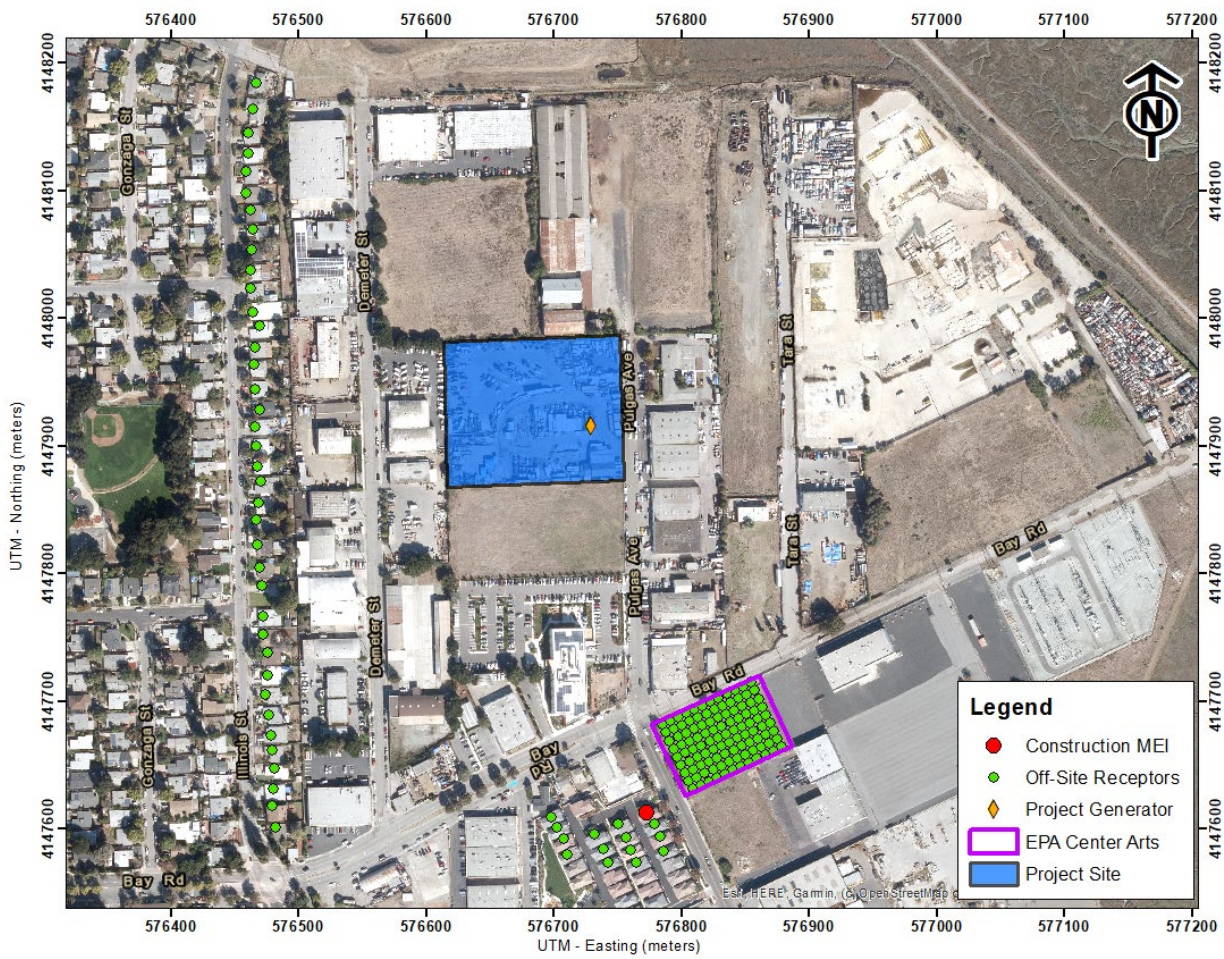
[21] California Air Resource Board, 2007. *Proposed Regulation for In-Use Off-Road Diesel Vehicles, Appendix D: Health Risk Methodology*. April. Web: https://ww3.arb.ca.gov/regact/2007/ordiesl07/ordiesl07.htm

The maximum modeled annual DPM and $PM_{2.5}$ concentrations, which includes both the DPM and fugitive $PM_{2.5}$ concentrations, were identified at nearby sensitive receptors to find the MEI. Results of this assessment indicated that the MEI most affected by construction was located on the first floor (5 feet above ground) of a single-family residence to the south of the project site along Pulgas Avenue. The location of the MEI and nearby sensitive receptors are shown in Figure 1. Table 6 lists the community risks from construction at the location of the residential MEI. *Attachment 4* to this report includes the emission calculations used for the construction modeling and the cancer risk calculations.

Additionally, modeling was conducted to predict the cancer risks, non-cancer health hazards, and maximum $PM_{2.5}$ concentrations associated with construction activities at the nearby art center. The maximum increased cancer risks were adjusted using child exposure parameters. The uncontrolled cancer risk, $PM_{2.5}$ concentration, and HI at the nearby art center would not exceed their respective BAAQMD single-source significance thresholds, as shown in Table 6.

Figure 1. Project Construction Site, Project Generator Location, Locations of Off-Site Sensitive Receptors, and TAC Impacts



Community Risks from Project Operation – Traffic and Generators

Operation of the project would have long-term emissions from mobile sources (i.e., traffic) and stationary sources (i.e., generator). While these emissions would not be as intensive at or near the site as construction activity, they would contribute to long-term effects to sensitive receptors.

Project Traffic

Diesel powered vehicles are the primary concern with local traffic-generated TAC impacts. This project would generate 996 daily trips with a majority of the trips being from light-duty vehicles (i.e., passenger cars). A truck would come three to four times a year to unload lumber for the carpentry area, but the frequency would diminish as storage becomes unavailable, and these few truck trips would have negligible emissions compared to the entirety of the project. Per BAAQMD recommended risks and methodology, a road with less than 10,000 total vehicle per day is considered a low-impact source of TACs and do not need to be considered in the CEQA analysis.[22] Therefore, emissions from project traffic are considered negligible and was not included within this analysis.

Project Emergency Diesel Generator

The project would include one 100-kW emergency generator powered by a 134-HP diesel engine located on the center of the southern half of the office building's roof. Figure 1 shows the location of the modeled emergency generator. Operation of a diesel generator would be a source of TAC emissions. The generator would be operated for testing and maintenance purposes, with a maximum of 50 hours per year of non-emergency operation under normal conditions. During testing periods, the engine would typically be run for less than one hour under light engine loads. The generator engine would be required to meet EPA emission standards and consume commercially available low sulfur diesel fuel. The emissions from the operation of the generator were calculated using the CalEEMod model.

This diesel engine would be subject to CARB's Stationary Diesel Airborne Toxics Control Measure (ATCM) and require permits from the BAAQMD, since it will be equipped with an engine larger than 50-HP. As part of the BAAQMD permit requirements for toxics screening analysis, the engine emissions will have to meet Best Available Control Technology for Toxics (TBACT) and pass the toxic risk screening level of less than ten in a million. The risk assessment would be prepared by BAAQMD. Depending on results, BAAQMD would set limits for DPM emissions (e.g., more restricted engine operation periods). Sources of air pollutant emissions complying with all applicable BAAQMD regulations generally will not be considered to have a significant air quality community risk impact.

To obtain an estimate of potential cancer risks and $PM_{2.5}$ impacts from operation of the emergency generator, the U.S. EPA AERMOD dispersion model was used to calculate the maximum annual DPM concentration at the off-site MEI location. The same receptor, breathing height, and

[22] Bay Area Air Quality Management District, 2012, *Recommended Methods for Screening and Modeling Local Risks and Hazards, Version 3.0.* May. Web: https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/risk-modeling-approach-may-2012.pdf?la=en

BAAQMD Moffett Federal Airfield meteorological data used in the construction dispersion modeling were used for the generator model. Stack parameters (stack height, exhaust flow rate, and exhaust gas temperature) for modeling the generators were based on BAAQMD default parameters for emergency diesel generators since project-specific information is not available.[23] Annual average DPM and $PM_{2.5}$ concentrations were modeled assuming that generator and fire pump testing could occur at any time of the day (24 hours per day, 365 days per year).

To calculate the increased cancer risk from the generator at the MEI, the cancer risks exposure duration was adjusted to account for the residential MEI being exposed to construction for the first two years of the 30-year lifetime period. The exposure duration for the generators was adjusted for 28 years. Table 6 lists the community risks from emergency diesel generator at the location of residential MEI. The emissions and health risk calculations for the proposed generators are included in *Attachment 4*.

Summary of Project-Related Community Risks at the Off-Site Project MEI

The cumulative risk impacts from a project is the combination of construction and operation sources. These sources include on-site construction activity and the project generator. The project impact is computed by adding the construction cancer risk for an infant to the increased cancer risk for the project operational conditions for the generator at the MEI over a 30-year period. The project MEI is identified as the sensitive receptor that is most impacted by the project's construction and operation.

For this project, the sensitive receptor identified in Figure 1 as the construction MEI is also the project MEI. At this location, the MEI would be exposed to two years of construction cancer risks and 28 years of operational (i.e., emergency backup generator) cancer risks. The cancer risks from construction and operation of the project were summed together. Unlike the increased maximum cancer risk, the annual $PM_{2.5}$ concentration and HI risks are not additive but based on an annual maximum risk for the entirety of the project.

As shown in Table 6, the unmitigated maximum increased cancer risks, maximum $PM_{2.5}$ concentration, and health hazard indexes from construction and operation activities at the project MEI do not exceed their respective BAAQMD single-source thresholds of greater than 10.0 per million for cancer risk, greater than 0.3 $\mu g/m^3$ for $PM_{2.5}$ concentration and greater than 1.0 for HI. *Attachment 4* to this report includes the emission calculations used for the construction modeling and the cancer risk calculations.

[23] Bay Area Air Quality Management District, San Francisco Department of Public Health, and San Francisco Planning Department, 2012. *The San Francisco Community Risk Reduction Plan: Technical Support Document,* BAAQMD, December. Web: https://www.gsweventcenter.com/Appeal_Response_References/2012_1201_BAAQMD.pdf

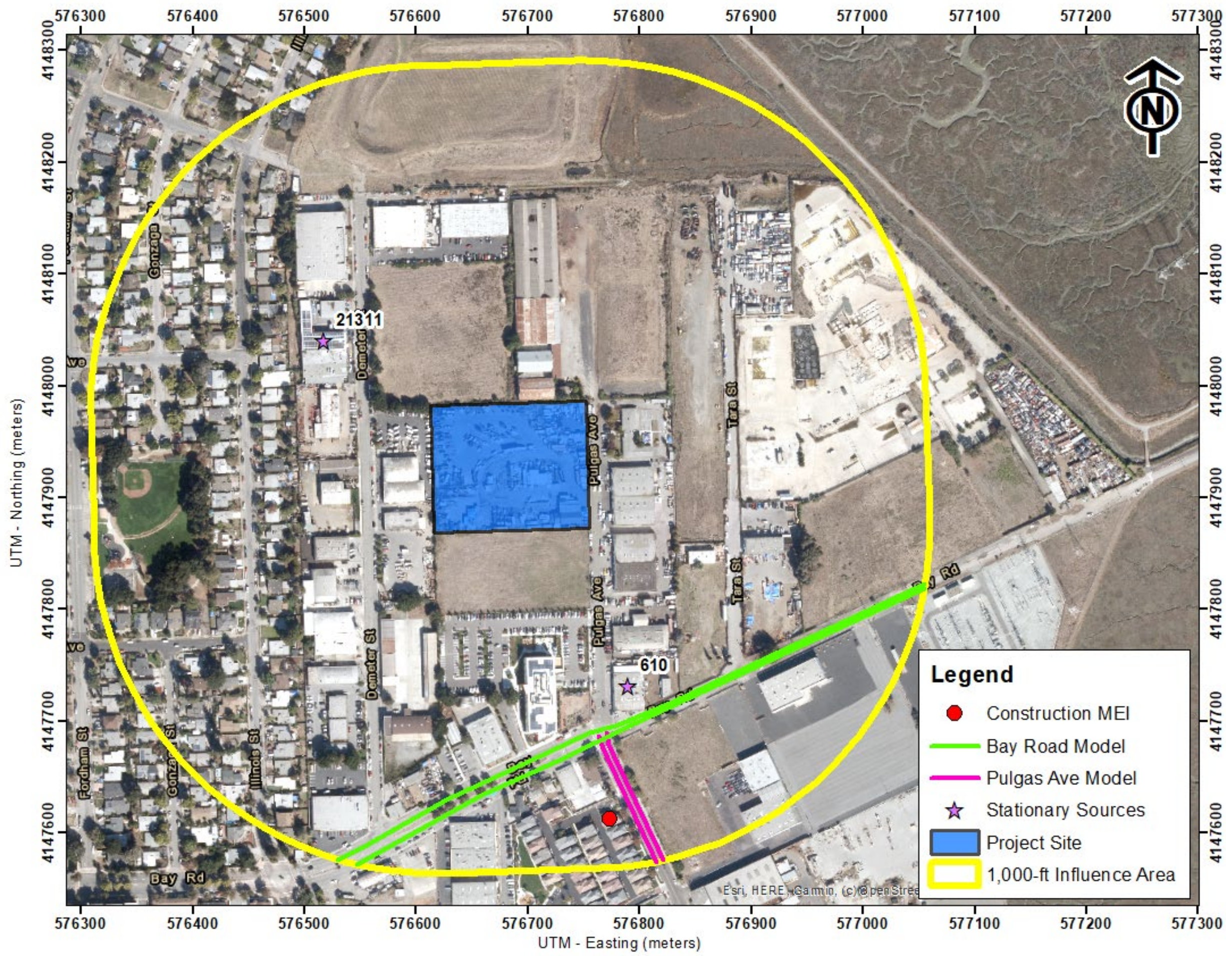
Table 6. Construction and Operation Risk Impacts at the Offsite Project MEI

Source		Cancer Risk (per million)	Annual $PM_{2.5}$ ($\mu g/m^3$)	Hazard Index
Project Construction (Years 0-2)	Unmitigated	6.20 (infant)	0.04	<0.01
Project Generators (Years 2-30)		0.03 (child)	<0.01	<0.01
Unmitigated Total/Maximum Project (Years 0-30)		6.23	0.04	<0.01
BAAQMD Single-Source Threshold		***>10.0***	***>0.3***	***>1.0***
Exceed Threshold?	Unmitigated	*No*	*No*	*No*
Most Affected Nearby Child – EPA Center Arts Child Receptor				
Project Construction (Years 0-2)	Unmitigated	3.22 (child)	0.03	<0.01
Project Generators (Years 2-9)		0.04 (child)	<0.01	<0.01
Unmitigated Total/Maximum Project (Years 0-9)		3.26	0.03	<0.01
BAAQMD Single-Source Threshold		***>10.0***	***>0.3***	***>1.0***
Exceed Threshold?	Unmitigated	*No*	*No*	*No*

Cumulative Community Risks of all TAC Sources at the Off-Site Project MEI

Community health risk assessments typically look at all substantial sources of TACs that can affect sensitive receptors that are located within 1,000 feet of a project site (i.e., influence area). These sources include freeways or highways, rail lines, busy surface streets, and stationary sources identified by BAAQMD. A review of the project influence area indicates that traffic on Bay Road and Pulgas Avenue would exceed an average daily traffic (ADT) of 10,000 vehicles. Other nearby streets are assumed to have less than 10,000 vehicles per day. A review of BAAQMD's stationary source map website identified three stationary sources with the potential to affect the project MEI. Figure 2 shows the location of the sources affecting the MEI. Community risk impacts from these sources upon the MEI reported in Table 7. Details of the modeling and community risk calculations are included in *Attachment 5.*

Figure 2. Project Site and Nearby TAC and PM2.5 Sources



<u>Local Roadways – Bay Road and Pulgas Avenue</u>

Bay Road and Pulgas Avenue are located near the project site and project MEI. Traffic on Bay Road and Pulgas Avenue is a source of TACs that could adversely affect sensitive receptors at the project site and MEIs. This assessment was conducted following guidance provided by the BAAQMD and OEHHA to analyze potential community health risk impacts at the project site and MEIs from nearby sources of TAC emissions.

Potential community risk impacts from Bay Road and Pulgas Avenue traffic TAC emissions to sensitive receptors at the project site and MEI were evaluated. This analysis involved the development of DPM, total organic gases (TOG), and $PM_{2.5}$ emissions for project traffic on Bay Road and Pulgas Avenue and using these emissions with an air quality dispersion model to calculate TAC and $PM_{2.5}$ concentrations at project site and MEI receptor locations. Increased cancer risks, non-cancer health effects represented by the HI, and the increase in annual $PM_{2.5}$ concentrations were then computed using the modeled TAC and $PM_{2.5}$ concentrations and BAAQMD methods and exposure parameters described in *Attachment 1*.

Busy roadways are a source of TAC emissions that could affect new sensitive receptors at the project site and at the MEI. Bay Road and Pulgas Avenue are busy arterial roadways near the project site and MEI. In the vicinity of the project site, using cumulative plus project traffic volumes provided by the project's traffic engineer,[24] the ADT on Bay Road was estimated to be 22,606 vehicles and the ADT on Pulgas Avenue was estimated to be 15,372 vehicles. Because these traffic volumes are greater than an ADT of 10,000, a refined analysis of Bay Road and Pulgas Avenue to assess potential impacts to the sensitive receptors at the project site and MEI was conducted.

Traffic Emissions

DPM, TOG, and $PM_{2.5}$ emissions from traffic on Bay Road and Pulgas Avenue in the project site and MEI areas were calculated using the CT-EMFAC2017 model, a Caltrans version of CARB's EMFAC2017 emissions model, and local roadway traffic volumes. CT-EMFAC2017 provides emission factors for mobile source criteria pollutants and TACs, including DPM.

Emission processes modeled with CT-EMFAC2017 include running exhaust for DPM, $PM_{2.5}$ and TOG, running evaporative losses for TOG, and tire and brake wear and fugitive road dust for $PM_{2.5}$. DPM emissions are projected to decrease in the future and are reflected in the CT-EMFAC2017 emissions data. Inputs to the model include region (i.e., San Mateo County), type of road (major/collector), truck percentages (BAAQMD truck percentages for non-state highways in San Mateo County[25]), and traffic mix assigned by CT-EMFAC2017 for the county. Average hourly traffic distributions for San Mateo County roadways were developed using the EMFAC model,[26] which were then applied to Bay Road and Pulgas Avenue traffic volumes to obtain estimated hourly traffic volumes and emissions. An average travel speed of 25 mph for Bay Road and Pulgas Avenue were used for all for all hours of the day based on posted speed limits.

In order to estimate TAC and $PM_{2.5}$ emissions over the 30-year exposure period used for calculating the increased cancer risks for the residential sensitive receptors at the project site and residential MEI from traffic on Bay Road and Pulgas Avenue, the CT-EMFAC2017 model was used to develop vehicle emission factors for the year 2021 (project construction start year). Emissions associated with vehicle travel depend on the year of analysis because emission control technology requirements are phased-in over time. Therefore, the earlier the year analyzed in the model, the higher the emission rates utilized by CT-EMFAC2017. Year 2021 emissions were conservatively assumed as being representative of future conditions over the time period that cancer risks are evaluated (30 years for residential MEI, 3 years for on-site daycare) since, as discussed above, overall vehicle emissions, and in particular diesel truck emissions, will decrease in the future.

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[24] Hexagon Transportation Consultants, Inc., *2519 & 2535 Pulgas Avenue Office Development*, December 6, 2019.
[25] Bay Area Air Quality Management District, 2012, *Recommended Methods for Screening and Modeling Local Risks and Hazards, Version 3.0.* May. Web: https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/risk-modeling-approach-may-2012.pdf?la=en
[26] The Burden output from EMFAC2007, a prior version of CARB's EMFAC model, was used for this since the current web-based version of EMFAC2014 does not include Burden type output with hour by hour traffic volume information.

Dispersion Modeling

Dispersion modeling of TAC and $PM_{2.5}$ emissions was conducted using the EPA AERMOD air quality dispersion model, which is recommended by the BAAQMD for this type of analysis.[27] TAC and $PM_{2.5}$ emissions from traffic on Bay Road and Pulgas Avenue within about 1,000 feet of the project site were evaluated. Vehicle traffic on the roadways was modeled using a series of adjacent volume sources along a line (line volume sources); with line segments used for each of the travel directions on Bay Road and Pulgas Avenue. A 5-year data set (2013-2017) of hourly meteorological data from the Moffett Field Airport was used for the modeling. Other inputs to the model included road geometries and elevations, hourly traffic emissions, and receptor locations. Annual TAC and $PM_{2.5}$ concentrations for 2021 from traffic on Bay Road and Pulgas Avenue were calculated using the model. Concentrations were calculated at the residential MEI with receptor heights of 5 feet (1.5 meters) to represent the breathing heights of the first floor of the home.

The roadway traffic contributions to cancer risk, annual $PM_{2.5}$ concentrations, and HI are shown in Table 7 for the residential MEI. Details of the emission calculations, dispersion modeling, and cancer risk calculations are contained in *Attachment 5*.

BAAQMD Permitted Stationary Sources

Permitted stationary sources of air pollution near the project site were identified using BAAQMD's *Permitted Stationary Sources 2018* GIS website,[28] which identifies the location of nearby stationary sources and their estimated risk and hazard impacts, including emissions and adjustments to account for new OEHHA guidance. Three sources were identified using this tool with two sources being spray booths and one being a generator. A Stationary Source Information Form (SSIF) containing the identified sources was prepared and submitted to BAAQMD. BAAQMD provided updated emissions data and risk values.[29] After further review, one source (#1434) is part of the existing project site and would be removed.

The screening level risks and hazards provided by BAAQMD for the stationary sources were adjusted for distance using BAAQMD's *Distance Adjustment Multiplier Tool for Diesel Internal Combustion Engines and Generic Equipment*. Community risk impacts from the stationary sources upon the MEIs are reported in Table 7.

Construction Risk Impacts from Nearby Developments

Within the 1,000-ft influence area, there are new developments identified by the City that could be constructed or are planned for possible construction around the time as the proposed project. These developments include the Sobrato Center for Community Services (2519 Pulgas Ave) office project, EPA Center Arts (1950 Bay Road) project, 1804 Runnymede residential project, 965 Weeks residential project, 2020 Bay Road mixed-use project, EPA Waterfront mixed-use project, Harvest Properties mixed-use project, and Four Corners (1675 Bay Road) mixed-use project.

[27] BAAQMD. *Recommended Methods for Screening and Modeling Local Risks and Hazards*. May 2012
[28] BAAQMD, https://baaqmd.maps.arcgis.com/apps/webappviewer/index.html?id=2387ae674013413f987b1071715daa65
[29] Correspondence with Areana Flores, MSc, Environmental Planner, BAAQMD, February 9, 2021.

The EPA Center Arts project has already completed construction, and therefore, was not included in the cumulative risk assessment. The 1804 Runnymede and 965 Weeks residential projects are outside the project's 1,000-foot influence area and therefore their construction risks would not have an impact on this project's cumulative risk assessment. The 2020 Bay Road, EPA Waterfront, Harvest Properties, and Four Corners mixed-use projects are not allowed to proceed until after the approval of the Ravenswood/4 Corners Specific Plan Update and will likely not overlap with construction of the proposed project. Therefore, their construction risks were not included in the cumulative risk assessment.

The only nearby project identified by the City likely to be construction at the same time as the proposed project within the project's 1,000-foot influence area is the Sobrato Center for Community Services office project. The Sobrato Center for Community Services did not have available construction impact results at the time of this study, therefore, it was assumed the construction risks from this development would be less than the BAAQMD single-source thresholds for community risks and hazards This approach likely provides an overestimate of the community risk and hazard levels because it assumes that maximum impacts from this development occur concurrently with the proposed project.

Summary of Cumulative Risks at the Project MEI

Table 7 reports both the project and cumulative community risk impacts at the sensitive receptors most affected by construction (i.e., the MEI). Without mitigation, the project's community risk from project construction activities would not exceed the single-source maximum increased cancer risk, $PM_{2.5}$ concentration, or HI thresholds. In addition, the combined unmitigated cancer risk, $PM_{2.5}$ concentration, and HI values would not exceed their respective cumulative thresholds.

Table 7. Cumulative Community Risk Impacts from Combined TAC Sources at MEI

Source	Maximum Cancer Risk (per million)	$PM_{2.5}$ concentration ($\mu g/m^3$)	Hazard Index
Project Impacts			
Unmitigated Total/Maximum Project (Years 0-30)	6.23 (infant)	0.04	<0.01
BAAQMD Single-Source Threshold	***>10.0***	***>0.3***	***>1.0***
Exceed Threshold? Unmitigated	*No*	*No*	*No*
Cumulative Impacts			
Bay Road, 22,606 ADT	5.21 (infant)	0.21	<0.01
Pulgas Avenue, 15,372 ADT	4.06 (infant)	0.18	<0.01
West Bay Sanitary District (Facility ID #21311, Generators), MEI +1,000 feet	0.02	--	--
Cal Spray Inc. (Facility ID #610, Spray booth & abrasives blasting) MEI 300 feet	--	<0.01	<0.01
Sobrato Center for Community Services Mitigated Construction Emissions – MEI 600 feet south	<10.0	<0.3	<1.0
Combined Sources Unmitigated	25.52 (infant)	<0.74	<1.05
BAAQMD Cumulative Source Threshold	*>100*	*>0.8*	*>10.0*
Exceed Threshold? Unmitigated	*No*	*No*	*No*

Non-CEQA: On-Site Community Risk Assessment for TAC Sources - New Project Daycare

In addition to evaluating health impact from project construction, a health risk assessment was completed to assess the impact existing TAC sources would have on the new proposed sensitive receptors (child daycare) that that project would introduce. The same TAC sources identified above were used in this health risk assessment.[30]

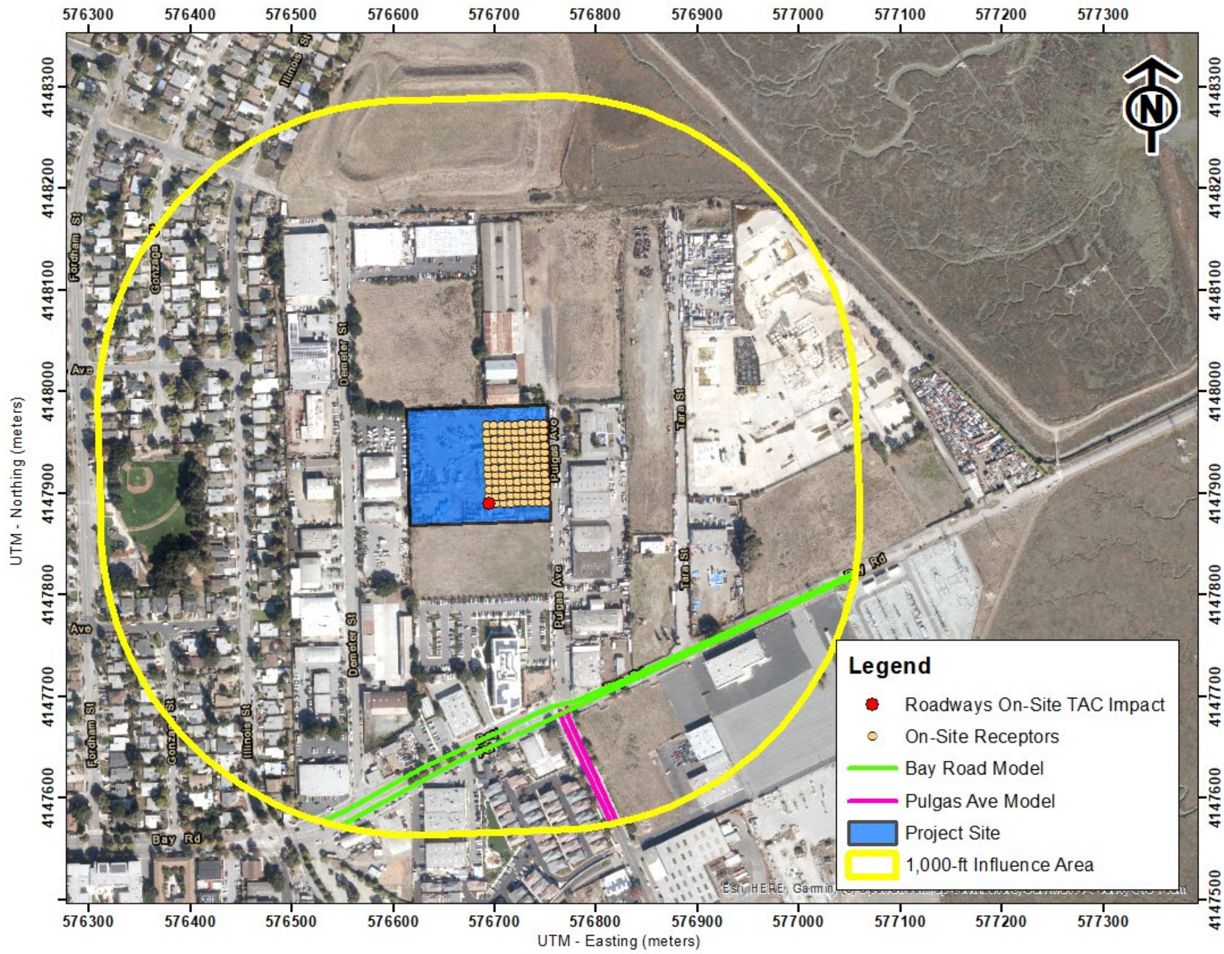
<u>Local Roadways – Bay Road and Pulgas Avenue</u>

The roadway analysis for the project daycare with children was conducted in the same manner as described above for the off-site MEI. The project set of receptors were placed on the proposed building location and were spaced every 23 feet (7 meters). Roadway impacts were modeled at receptor heights of 3 feet (1 meter) representing child sensitive receptors on the first floor in the daycare. The portions of Bay Road and Pulgas Avenue included in the modeling are shown in Figure 3 along with the project site and receptor locations where impacts were modeled.

Maximum increased cancer risks were calculated at the project site using the maximum modeled TAC concentrations. A 3-year child daycare exposure period was used in calculating cancer risks assuming the children (3-5 years old) in the new daycare area would be there for 9 hours per day for 250 days per year. The highest impacts from Bay Road occurred at the receptor closest to Bay Road on the southeastern side of the site. The highest impacts from Pulgas Avenue occurred at the southwestern corner of the site. Cancer risks associated with Bay Road and Pulgas Avenue are greatest closest to Bay Road and Pulgas Avenue and decrease with distance from the roads. The roadways' community risk impacts at the project site are shown in Table 8. Details of the emission calculations, dispersion modeling, and cancer risk calculations are contained in *Attachment 5.*

[30] We note that to the extent this analysis considers *existing* air quality issues in relation to the impact on *future residents* of the Project, it does so for informational purposes only pursuant to the judicial decisions in *CBIA v. BAAQMD* (2015) 62 Cal.4th 369, 386 and *Ballona Wetlands Land Trust v. City of Los Angeles* (2011) 201 Cal.App.4th 455, 473, which confirm that the impacts of the environment on a project are excluded from CEQA unless the project itself "exacerbates" such impacts.

Figure 3. Project Site, On-Site Residential Receptors, Roadway Segments Evaluated, and Locations of Maximum Roadway TAC Impacts



BAAQMD Permitted Stationary Sources

The stationary source screening analysis for the new project sensitive receptors was conducted in the same manner as described above for the project MEI. Table 8 shows the health risk results from the stationary sources.

Construction Risk Impacts from Nearby Developments

The construction risk impacts from nearby developments review for the new project sensitive receptors was conducted in the same manner as described above for the project MEI, assuming this project would be operational while the nearby development is still being constructed. Table 8 shows the construction health risk results from the nearby development.

Cumulative Community Health Risk at Project Site

Community risk impacts from the existing TAC sources and future nearby developments upon the project site are reported in Table 8. The risks from the singular TAC sources are compared against the BAAQMD single-source threshold. The risks from all the sources are then combined and compared against the BAAQMD cumulative-source threshold. As shown, none of the sources exceed the single-source or cumulative-source thresholds.

Table 8. Impacts from Combined Sources to Project Site Receptors

Source	Cancer Risk (per million)	Annual $PM_{2.5}$ ($\mu g/m^3$)	Hazard Index
Bay Road, 22,606 ADT	0.22 (child)	0.03	<0.01
Pulgas Avenue, 15,372 ADT	0.03 (child)	<0.01	<0.01
West Bay Sanitary District (Facility ID #21311, generators), Project Site 200 feet	0.25	--	--
Cal Spray Inc (Facility ID #610, Spray booth & abrasives blasting), Project Site 400 feet	--	<0.01	<0.01
Sobrato Center for Community Services Mitigated Construction Emissions – Project Site 5 feet north	<10.0	<0.3	<1.0
BAAQMD Single-Source Threshold	***>10.0***	***>0.3***	***>1.0***
Exceed Threshold?	*No*	*No*	*No*
Cumulative Total	<10.50	<0.35	<1.03
BAAQMD Cumulative Source Threshold	***>100***	***>0.8***	***>10.0***
Exceed Threshold?	*No*	*No*	*No*

GREENHOUSE GAS EMISSIONS

Setting

Gases that trap heat in the atmosphere, GHGs, regulate the earth's temperature. This phenomenon, known as the greenhouse effect, is responsible for maintaining a habitable climate. The most common GHGs are carbon dioxide (CO_2) and water vapor but there are also several others, most importantly methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). These are released into the earth's atmosphere through a variety of natural processes and human activities. Sources of GHGs are generally as follows:

- CO_2, CH_4, and N_2O are byproducts of fossil fuel combustion.
- N_2O is associated with agricultural operations such as fertilization of crops.
- CH_4 is commonly created by off-gassing from agricultural practices (e.g., keeping livestock) and landfill operations.
- Chlorofluorocarbons (CFCs) were widely used as refrigerants, propellants, and cleaning solvents but their production has been stopped by international treaty.
- HFCs are now used as a substitute for CFCs in refrigeration and cooling.
- PFCs and sulfur hexafluoride emissions are commonly created by industries such as aluminum production and semi-conductor manufacturing.

Each GHG has its own potency and effect upon the earth's energy balance. This is expressed in terms of a global warming potential (GWP), with CO_2 being assigned a value of 1 and sulfur hexafluoride being several orders of magnitude stronger. In GHG emission inventories, the weight of each gas is multiplied by its GWP and is measured in units of CO_2 equivalents (CO_2e).

An expanding body of scientific research supports the theory that global climate change is currently affecting changes in weather patterns, average sea level, ocean acidification, chemical reaction rates, and precipitation rates, and that it will increasingly do so in the future. The climate and several naturally occurring resources within California are adversely affected by the global warming trend. Increased precipitation and sea level rise will increase coastal flooding, saltwater intrusion, and degradation of wetlands. Mass migration and/or loss of plant and animal species could also occur. Potential effects of global climate change that could adversely affect human health include more extreme heat waves and heat-related stress; an increase in climate-sensitive diseases; more frequent and intense natural disasters such as flooding, hurricanes and drought; and increased levels of air pollution.

Recent Regulatory Actions for GHG Emissions

Executive Order S-3-05 – California GHG Reduction Targets

Executive Order (EO) S-3-05 was signed by Governor Arnold Schwarzenegger in 2005 to set GHG emission reduction targets for California. The three targets established by this EO are as follows: (1) reduce California's GHG emissions to 2000 levels by 2010, (2) reduce California's GHG emissions to 1990 levels by 2020, and (3) reduce California's GHG emissions by 80 percent below 1990 levels by 2050.

Assembly Bill 32 – California Global Warming Solutions Act (2006)

Assembly Bill (AB) 32, the Global Warming Solutions Act of 2006, codified the State's GHG emissions target by directing CARB to reduce the State's global warming emissions to 1990 levels by 2020. AB 32 was signed and passed into law by Governor Schwarzenegger on September 27, 2006. Since that time, the CARB, CEC, California Public Utilities Commission (CPUC), and Building Standards Commission have all been developing regulations that will help meet the goals of AB 32 and Executive Order S-3-05, which has a target of reducing GHG emissions 80 percent below 1990 levels.

A Scoping Plan for AB 32 was adopted by CARB in December 2008. It contains the State's main strategies to reduce GHGs from business-as-usual emissions projected in 2020 back down to 1990 levels. Business-as-usual (BAU) is the projected emissions in 2020, including increases in emissions caused by growth, without any GHG reduction measures. The Scoping Plan has a range of GHG reduction actions, including direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, and market-based mechanisms such as a cap-and-trade system.

As directed by AB 32, CARB has also approved a statewide GHG emissions limit. On December 6, 2007, CARB staff resolved an amount of 427 million metric tons (MMT) of CO_2e as the total statewide GHG 1990 emissions level and 2020 emissions limit. The limit is a cumulative statewide limit, not a sector- or facility-specific limit. CARB updated the future 2020 BAU annual emissions forecast, in light of the economic downturn, to 545 MMT of CO_2e. Two GHG emissions reduction measures currently enacted that were not previously included in the 2008 Scoping Plan baseline inventory were included, further reducing the baseline inventory to 507 MMT of CO_2e. Thus, an estimated reduction of 80 MMT of CO_2e is necessary to reduce statewide emissions to meet the AB 32 target by 2020.

Executive Order B-30-15 & Senate Bill 32 GHG Reduction Targets – 2030 GHG Reduction Target

In April 2015, Governor Brown signed EO B-30-15, which extended the goals of AB 32, setting a greenhouse gas emissions target at 40 percent of 1990 levels by 2030. On September 8, 2016, Governor Brown signed Senate Bill (SB) 32, which legislatively established the GHG reduction target of 40 percent of 1990 levels by 2030. In November 2017, CARB issued *California's 2017 Climate Change Scoping Plan*. [31] While the State is on track to exceed the AB 32 scoping plan 2020 targets, this plan is an update to reflect the enacted SB 32 reduction target.

SB 32 was passed in 2016, which codified a 2030 GHG emissions reduction target of 40 percent below 1990 levels. CARB is currently working on a second update to the Scoping Plan to reflect the 2030 target set by Executive Order B-30-15 and codified by SB 32. The proposed Scoping Plan Update was published on January 20, 2017 as directed by SB 32 companion legislation AB 197. The mid-term 2030 target is considered critical by CARB on the path to obtaining an even

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[31] California Air Resource Board, 2017. *California's 2017 Climate Change Scoping Plan: The Strategy for Achieving California's 2030 Greenhouse Gas Targets.* November. Web: https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017.pdf

deeper GHG emissions target of 80 percent below 1990 levels by 2050, as directed in Executive Order S-3-05. The Scoping Plan outlines the suite of policy measures, regulations, planning efforts, and investments in clean technologies and infrastructure, providing a blueprint to continue driving down GHG emissions and obtain the statewide goals.

The new Scoping Plan establishes a strategy that will reduce GHG emissions in California to meet the 2030 target (note that the AB 32 Scoping Plan only addressed 2020 targets and a long-term goal). Key features of this plan are:

- Cap and Trade program places a firm limit on 80 percent of the State's emissions;
- Achieving a 50-percent Renewable Portfolio Standard by 2030 (currently at about 29 percent statewide);
- Increase energy efficiency in existing buildings;
- Develop fuels with an 18-percent reduction in carbon intensity;
- Develop more high-density, transit-oriented housing;
- Develop walkable and bikeable communities;
- Greatly increase the number of electric vehicles on the road and reduce oil demand in half;
- Increase zero-emissions transit so that 100 percent of new buses are zero emissions;
- Reduce freight-related emissions by transitioning to zero emissions where feasible and near-zero emissions with renewable fuels everywhere else; and
- Reduce "super pollutants" by reducing methane and hydrofluorocarbons or HFCs by 40 percent.

In the updated Scoping Plan, CARB recommends statewide targets of no more than 6 metric tons (MT) CO_2e per capita (statewide) by 2030 and no more than 2 metric tons CO_2e per capita by 2050. The statewide per capita targets account for all emissions sectors in the State, statewide population forecasts, and the statewide reductions necessary to achieve the 2030 statewide target under SB 32 and the longer-term State emissions reduction goal of 80 percent below 1990 levels by 2050.

Executive Order B-55-18 – Carbon Neutrality

In 2018, a new statewide goal was established to achieve carbon neutrality as soon as possible, but no later than 2045, and to maintain net negative emissions thereafter. CARB and other relevant state agencies are tasked with establishing sequestration targets and create policies/programs that would meet this goal.

Senate Bill 375 – California's Regional Transportation and Land Use Planning Efforts (2008)

California enacted legislation (SB 375) to expand the efforts of AB 32 by controlling indirect GHG emissions caused by urban sprawl. SB 375 provides incentives for local governments and applicants to implement new conscientiously planned growth patterns. This includes incentives for creating attractive, walkable, and sustainable communities and revitalizing existing communities. The legislation also allows applicants to bypass certain environmental reviews under CEQA if they build projects consistent with the new sustainable community strategies. Development of more alternative transportation options that would reduce vehicle trips and miles traveled, along with traffic congestion, would be encouraged. SB 375 enhances CARB's ability to reach the AB 32 goals by directing the agency in developing regional GHG emission reduction targets to be achieved from the transportation sector for 2020 and 2035. CARB works with the metropolitan planning organizations (e.g. Association of Bay Area Governments [ABAG] and Metropolitan Transportation Commission [MTC]) to align their regional transportation, housing, and land use plans to reduce vehicle miles traveled and demonstrate the region's ability to attain its GHG reduction targets. A similar process is used to reduce transportation emissions of ozone precursor pollutants in the Bay Area.

Senate Bill 350 - Renewable Portfolio Standards

In September 2015, the California Legislature passed SB 350, which increases the states Renewables Portfolio Standard (RPS) for content of electrical generation from the 33 percent target for 2020 to a 50 percent renewables target by 2030.

Senate Bill 100 – Current Renewable Portfolio Standards

In September 2018, SB 100 was signed by Governor Brown to revise California's RPS program goals, furthering California's focus on using renewable energy and carbon-free power sources for its energy needs. The bill would require all California utilities to supply a specific percentage of their retail sales from renewable resources by certain target years. By December 31, 2024, 44 percent of the retails sales would need to be from renewable energy sources, by December 31, 2026 the target would be 40 percent, by December 31, 2017 the target would be 52 percent, and by December 31, 2030 the target would be 60 percent. By December 31, 2045, all California utilities would be required to supply retail electricity that is 100 percent carbon-free and sourced from eligible renewable energy resource to all California end-use customers.

California Building Standards Code – Title 24 Part 11 & Part 6

The California Green Building Standards Code (CALGreen Code) is part of the California Building Standards Code under Title 24, Part 11.[32] The CALGreen Code encourages sustainable construction standards that involve planning/design, energy efficiency, water efficiency resource efficiency, and environmental quality. These green building standard codes are mandatory statewide and are applicable to residential and non-residential developments. The most recent CALGreen Code (2019 California Building Standard Code) was effective as of January 1, 2020.

The California Building Energy Efficiency Standards (California Energy Code) is under Title 24, Part 6 and is overseen by the California Energy Commission (CEC). This code includes design requirements to conserve energy in new residential and non-residential developments, while being cost effective for homeowners. This Energy Code is enforced and verified by cities during the planning and building permit process. The current energy efficiency standards (2019 Energy Code) replaced the 2016 Energy Code as of January 1,2020. Under the 2019 standards, single-family homes are predicted to be 53 percent more efficient than homes built under the 2016 standard due more stringent energy-efficiency standards and mandatory installation of solar photovoltaic

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[32] See: https://www.dgs.ca.gov/BSC/Resources/Page-Content/Building-Standards-Commission-Resources-List-Folder/CALGreen#:~:text=CALGreen%20is%20the%20first%2Din,to%201990%20levels%20by%202020.

systems. For nonresidential developments, it is predicted that these buildings will use 30 percent less energy due to lightening upgrades.[33]

Federal and Statewide GHG Emissions

The U.S. EPA reported that in 2018, total gross nationwide GHG emissions were 6,676.6 million metric tons (MMT) carbon dioxide equivalent (CO_2e).[34] These emissions were lower than peak levels of 7,416 MMT that were emitted in 2007. CARB updates the statewide GHG emission inventory on an annual basis where the latest inventory includes 2000 through 2017 emissions.[35] In 2017, GHG emissions from statewide emitting activities were 424 MMT. The 2017 emissions have decreased by 14 percent since peak levels in 2004 and are 7 MMT below the 1990 emissions level and the State's 2020 GHG limit. Per capita GHG emissions in California have dropped from a 2001 peak of 14.1 MT per person to 10.7 MT per person in 2017. The most recent Bay Area emission inventory was computed for the year 2011.[36] The Bay Area GHG emission were 87 MMT. As a point of comparison, statewide emissions were about 444 MMT in 2011

City of East Palo Final Climate Action Plan (CAP)

On December 2011, the City of East Palo Alto adopted the City of East Palo Alto Final Climate Action Plan Twenty-Three Actions to Address Our Changing Climate.[37] The CAP is document that includes goals and actions that the City of East Palo Alto can take to reduce their GHG emissions. The City's emission reduction goal is to reduce GHG emissions 15 percent below the baseline 2005 levels by 2020. This CAP is considered a qualified GHG Reduction Strategy. The CAP does not list specific project-level targets or thresholds. However, the following measures from the CAP are applicable to the project.

4.1.1.2 Measures E-1.2.: Establish a green building policy for new commercial construction and major renovation based on CAL Green, LEED, and/or other green building standards

Measure Description: Implementing a green building ordinance, such as CALGreen, LEED, or similar, promotes energy-efficient workplaces that cause fewer GHG emissions. The following Bay Area Climate Collaboratives recommended adoption and implementation pathway for local governments are recommended.

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[33] See: https://www.energy.ca.gov/sites/default/files/2020-03/Title_24_2019_Building_Standards_FAQ_ada.pdf

[34] United States Environmental Protection Agency, 2020. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2018*. April. Web: https://www.epa.gov/sites/production/files/2020-04/documents/us-ghg-inventory-2020-main-text.pdf

[35] CARB. 2019. *2019 Edition, California Greenhouse Gas Emission Inventory: 2000 – 2017*. Web: https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2017/ghg_inventory_trends_00-17.pdf

[36] BAAQMD. 2015. *Bay Area Emissions Inventory Summary Report: Greenhouse Gases Base Year 2011*. January. Web: http://www.baaqmd.gov/~/media/files/planning-and-research/emission-inventory/by2011_ghgsummary.pdf accessed Nov. 26, 2019.

[37] City of East Palo Alto, 2011. *City of East Palo Alto Final Climate Action Plan Twenty-Three Actions to Address Our Changing Climate*. December. Web: http://www.ci.east-palo-alto.ca.us/documentcenter/view/748

1. Prioritize education and enforcement of the CALGreen mandatory provisions. Allow rating-system documentation as compliance of directly compatible mandatory CALGreen measures.

2. Where a local leadership standard is desired, continue to apply the LEED rating systems. File an application to the CEC and submit findings to the California Building Standards Commission as appropriate and required by law for any ordinance that includes standards in excess of California's building- and energy-code baselines.

3. Should a local government adopt a CALGreen Tier, also accept third-party certified LEED or GreenPoint Rated requirements in lieu of the Tier requirements. In other words, green building certification at a given level should be accepted as fulfilling local green building requirements above and beyond the CALGreen mandatory measures.

4.2.1.2 Measures TL-1.2: Continue to implement Ravenswood/4 Corners TOD Strategy

Measure Description: Transit-oriented developments (TOD) seek to build residences, commercial spaces, including offices and retail, and parks that facilitate transit use. TODs can be very beneficial to a community in that they can provide a myriad of transportation benefits that improve mobility, increase public safety, reduce VMTs, reduce air pollution, and conserve open spaces

The City's CAP does not have a specific metric ton GHG threshold for project-level construction or operation. Therefore, the BAAQMD's CEQA Air Quality Guideline's thresholds are used.

<u>BAAQMD GHG Significance Thresholds</u>

The BAAQMD's CEQA Air Quality Guidelines do not use quantified thresholds for projects that are in a jurisdiction with a qualified GHG reductions plan (i.e., a Climate Action Plan). The plan has to address emissions associated with the period that the project would operate (e.g., beyond year 2020). For quantified emissions, the guidelines recommended a GHG threshold of 1,100 metric tons or 4.6 metric tons (MT) per capita. These thresholds were developed based on meeting the 2020 GHG targets set in the scoping plan that addressed AB 32. Development of the project would occur beyond 2020, so a threshold that addresses a future target is appropriate.

Although BAAQMD has not published a quantified threshold for 2030 yet, this assessment uses a "Substantial Progress" efficiency metric of 2.8 MT CO_2e/year/service population and a bright-line threshold of 660 MT CO_{2e}/year based on the GHG reduction goals of EO B-30-15. The service population metric of 2.8 is calculated for 2030 based on the 1990 inventory and the projected 2030 statewide population and employment levels. [38] The 2030 bright-line threshold is a 40 percent reduction of the 2020 1,100 MT CO_{2e}/year threshold. Evidence published by the State indicates the AB 32 goal of reducing statewide GHG emissions to 1990 levels was met prior to 2020. Current State plans are to further reduce emissions to 40% below 1990 levels by 2030. Assuming statewide

[38] Bay Area Air Quality Management District, 2016. *CLE International 12th Annual Super-Conference CEQA Guidelines, Case Law and Policy Update*. December.

emissions are at 1990 levels or lower in 2020, it would be logical to reduce the BAAQMD-recommended threshold for meeting the AB 32 threshold by 40% to develop a threshold for 2030.

Impact: Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

GHG emissions associated with development of the proposed project would occur over the short-term from construction activities, consisting primarily of emissions from equipment exhaust and worker and vendor trips. There would also be long-term operational emissions associated with operating of the generator. Emissions for the proposed project are discussed below and were analyzed using the methodology recommended in the BAAQMD CEQA Air Quality Guidelines.

<u>CalEEMod Modeling</u>

CalEEMod was used to predict GHG emissions from operation of the site assuming full build-out of the project. The project land use types and size and other project-specific information were input to the model, as described above within the operational period emissions. CalEEMod output is included in *Attachment 2*.

<u>Service Population Emissions</u>

The project service population efficiency rate is based on the number of future full-time employees/adult students. Based on information provided by the project applicant, there would be a total of 440 full-time employees/adult students. This employee count was used to calculate the per capita emissions.

<u>Construction Emissions</u>

GHG emissions associated with construction were computed to be 508 MT of CO_2e for the total construction period. These are the emissions from on-site operation of construction equipment, vendor and hauling truck trips, and worker trips. Neither the City nor BAAQMD have an adopted threshold of significance for construction related GHG emissions, though BAAQMD recommends quantifying emissions and disclosing that GHG emissions would occur during construction. BAAQMD also encourages the incorporation of best management practices to reduce GHG emissions during construction where feasible and applicable.

<u>Operational Emissions</u>

The CalEEMod model, along with the project vehicle trip generation rates, was used to estimate daily emissions associated with operation of the fully-developed site under the proposed project. As shown in Table 9, the net annual emissions resulting from operation of the proposed project are predicted to be 914 MT of CO_2e in 2023 and 848 MT of CO_2e in 2030. The service population emission for the year 2023 and 2030 are predicted to be 2.55 and 2.35 MT/CO_{2e}/year/service population, respectively.

To be considered an exceedance of the threshold, the project emissions must exceed both the GHG significance threshold in metric tons per year and the service population significance threshold in the future year of 2030. As shown in Table 9, the project would not exceed the per service population threshold of 2.8 MT of CO_2e/year/service population in 2030 but would exceed the annual emissions bright-line threshold of 660 MT CO_2e/year in 2030. Therefore, the project would not be in exceedance for GHG emissions.

Table 9. Annual Project GHG Emissions (CO_2e) in Metric Tons and Per Capita

Source Category	Existing Land Use		Proposed Project	
	2023	**2030**	**2023**	**2030**
Area	0	0	0	0
Energy Consumption	16	16	266	266
Mobile	185	165	799	714
Solid Waste Generation	3	3	44	44
Water Usage	3	3	11	11
Total (MT CO_{2e}/year)	207	187	1,120	1,035
Net Emissions			**914 MT CO_{2e}/year**	**848 MT CO_{2e}/year**
Significance Threshold				***660 MT CO_2e/year***
Service Population Emissions (MT CO_{2e}/year/service population)			2.55	2.35
Significance Threshold				***2.8 in 2030***
Exceeds both thresholds?				*No*

Supporting Documentation

Attachment 1 is the methodology used to compute community risk impacts, including the methods to compute lifetime cancer risk from exposure to project emissions.

Attachment 2 includes the CalEEMod output for project construction and operational criteria air pollutant and GHG emissions. The operational outputs for existing and 2030 uses are also included in this attachment. Also included are any modeling assumptions.

Attachment 3 includes the EMFAC2017 emissions modeling. The input files for these calculations are voluminous and are available upon request in digital format.

Attachment 4 is the construction health risk assessment. AERMOD dispersion modeling files for this assessment, which are quite voluminous, are available upon request and would be provided in digital format.

Attachment 5 includes the cumulative community risk calculations, modeling results, and health risk calculations from sources affecting the project site and project MEI.

Attachment 1: Health Risk Calculation Methodology

A health risk assessment (HRA) for exposure to Toxic Air Contaminates (TACs) requires the application of a risk characterization model to the results from the air dispersion model to estimate potential health risk at each sensitive receptor location. The State of California Office of Environmental Health Hazard Assessment (OEHHA) and California Air Resources Board (CARB) develop recommended methods for conducting health risk assessments. The most recent OEHHA risk assessment guidelines were published in February of 2015.[39] These guidelines incorporate substantial changes designed to provide for enhanced protection of children, as required by State law, compared to previous published risk assessment guidelines. CARB has provided additional guidance on implementing OEHHA's recommended methods.[40] This HRA used the 2015 OEHHA risk assessment guidelines and CARB guidance. The BAAQMD has adopted recommended procedures for applying the newest OEHHA guidelines as part of Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants.[41] Exposure parameters from the OEHHA guidelines and the recent BAAQMD HRA Guidelines were used in this evaluation.

Cancer Risk

Potential increased cancer risk from inhalation of TACs is calculated based on the TAC concentration over the period of exposure, inhalation dose, the TAC cancer potency factor, and an age sensitivity factor to reflect the greater sensitivity of infants and children to cancer causing TACs. The inhalation dose depends on a person's breathing rate, exposure time and frequency and duration of exposure. These parameters vary depending on the age, or age range, of the persons being exposed and whether the exposure is considered to occur at a residential location or other sensitive receptor location.

The current OEHHA guidance recommends that cancer risk be calculated by age groups to account for different breathing rates and sensitivity to TACs. Specifically, they recommend evaluating risks for the third trimester of pregnancy to age zero, ages zero to less than two (infant exposure), ages two to less than 16 (child exposure), and ages 16 to 70 (adult exposure). However, CARB and the BAAQMD recommend the use of a residential exposure duration of 30 years for sources with long-term emissions (e.g., roadways). For workers, assumed to be adults, a 25-year exposure period is recommended by the BAAQMD. For school children a 9-year exposure period is recommended by the BAAQMD.

Age sensitivity factors (ASFs) associated with the different types of exposure are an ASF of 10 for the third trimester and infant exposures, an ASF of 3 for a child exposure, and an ASF of 1 for an adult exposure. Also associated with each exposure type are different breathing rates, expressed as liters per kilogram of body weight per day (L/kg-day) or liters per kilogram of body weight per

[39] OEHHA, 2015. *Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*. Office of Environmental Health Hazard Assessment. February.
[40] CARB, 2015. *Risk Management Guidance for Stationary Sources of Air Toxics*. July 23.
[41] BAAQMD, 2016. *BAAQMD Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines*. December 2016.

8-hour period for the case of worker or school child exposures. As recommended by the BAAQMD for residential exposures, 95th percentile breathing rates are used for the third trimester and infant exposures, and 80th percentile breathing rates for child and adult exposures. For children at schools and daycare facilities, BAAQMD recommends using the 95th percentile 8-hour breathing rates for moderate intensity.

Under previous OEHHA and BAAQMD HRA guidance, residential receptors are assumed to be at their home 24 hours a day, or 100 percent of the time. In the 2015 Risk Assessment Guidance, OEHHA includes adjustments to exposure duration to account for the fraction of time at home (FAH), which can be less than 100 percent of the time, based on updated population and activity statistics. The FAH factors are age-specific and are: 0.85 for third trimester of pregnancy to less than 2 years old, 0.72 for ages 2 to less than 16 years, and 0.73 for ages 16 to 70 years. Use of the FAH factors is allowed by the BAAQMD if there are no schools in the project vicinity have a cancer risk of one in a million or greater assuming 100 percent exposure (FAH = 1.0).

Functionally, cancer risk is calculated using the following parameters and formulas:

Cancer Risk (per million) = $CPF \times \text{Inhalation Dose} \times ASF \times ED/AT \times FAH \times 10^6$

Where:

CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = $C_{air} \times DBR^* \times A \times (EF/365) \times 10^{-6}$

Where:

C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
8HrBR = 8-hour breathing rate (L/kg body weight-8 hours)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

* An 8-hour breathing rate (8HrBR) is used for worker and school child exposures.

The health risk parameters used in this evaluation are summarized as follows:

Parameter	*Exposure Type →* / *Age Range →*	Infant		Child	Adult
		3rd Trimester	**0<2**	**2 < 16**	**16 - 30**
DPM Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$		1.10E+00	1.10E+00	1.10E+00	1.10E+00
Daily Breathing Rate (L/kg-day) 80th Percentile Rate		273	758	572	261
Daily Breathing Rate (L/kg-day) 95th Percentile Rate		361	1,090	745	335
8-hour Breathing Rate (L/kg-8 hours) 95th Percentile Rate		-	1,200	520	240
Inhalation Absorption Factor		1	1	1	1
Averaging Time (years)		70	70	70	70
Exposure Duration (years)		0.25	2	14	14**
Exposure Frequency (days/year)*		350	350	350	350**
Age Sensitivity Factor		10	10	3	1
Fraction of Time at Home (FAH)		0.85-1.0	0.85-1.0	0.72-1.0	0.73*

* Exposure Frequency can change dependent on the type of receptors (i.e. residential, worker, school, daycare). For worker exposures (adult), the exposure duration and frequency are 25 years 250 days/year and FAH is not applicable.

Non-Cancer Hazards

Non-cancer health risk is usually determined by comparing the predicted level of exposure to a chemical to the level of exposure that is not expected to cause any adverse effects (reference exposure level), even to the most susceptible people. Potential non-cancer health hazards from TAC exposure are expressed in terms of a hazard index (HI), which is the ratio of the TAC concentration to a reference exposure level (REL). OEHHA has defined acceptable concentration levels for contaminants that pose non-cancer health hazards. TAC concentrations below the REL are not expected to cause adverse health impacts, even for sensitive individuals. The total HI is calculated as the sum of the HIs for each TAC evaluated and the total HI is compared to the BAAQMD significance thresholds to determine whether a significant non-cancer health impact from a project would occur.

Typically, for residential projects located near roadways with substantial TAC emissions, the primary TAC of concern with non-cancer health effects is diesel particulate matter (DPM). For DPM, the chronic inhalation REL is 5 micrograms per cubic meter ($\mu g/m^3$).

Annual $PM_{2.5}$ Concentrations

While not a TAC, fine particulate matter ($PM_{2.5}$) has been identified by the BAAQMD as a pollutant with potential non-cancer health effects that should be included when evaluating potential community health impacts under the California Environmental Quality Act (CEQA). The thresholds of significance for $PM_{2.5}$ (project level and cumulative) are in terms of an increase in the annual average concentration. When considering $PM_{2.5}$ impacts, the contribution from all sources of $PM_{2.5}$ emissions should be included. For projects with potential impacts from nearby local roadways, the $PM_{2.5}$ impacts should include those from vehicle exhaust emissions, $PM_{2.5}$ generated from vehicle tire and brake wear, and fugitive emissions from re-suspended dust on the roads.

Attachment 2: CalEEMod Modeling Inputs and Outputs

Attachment 3: EMFAC2017 Calculations

Attachment 4: Construction and Operation Health Risk Calculations

Construction Emissions and Health Risk Calculations

JobTrain, East Palo Alto, CA

DPM Emissions and Modeling Emission Rates - Unmitigated

Construction Year	Activity	DPM (ton/year)	Area Source	DPM Emissions (lb/yr)	DPM Emissions (lb/hr)	DPM Emissions (g/s)	Modeled Area (m^2)	DPM Emission Rate ($g/s/m^2$)
2021	Construction	0.0454	CON_DPM	90.8	0.02764	3.48E-03	15781	2.21E-07
2022	Construction	0.0474	CON_DPM	94.8	0.02886	3.64E-03	15781	2.30E-07
Total		***0.0928***		***185.6***	***0.0565***	***0.0071***		

Construction Hours		
hr/day =	9	(7am - 4pm)
days/yr =	365	
hours/year =	3285	

JobTrain, East Palo Alto, CA

PM2.5 Fugitive Dust Emissions for Modeling - Unmitigated

Construction Year	Activity	Area Source	PM2.5 Emissions (ton/year)	PM2.5 Emissions (lb/yr)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (g/s)	Modeled Area (m^2)	PM2.5 Emission Rate $g/s/m^2$
2021	Construction	CON_FUG	0.0580	116.0	0.03531	4.45E-03	15,781	2.82E-07
2022	Construction	CON_FUG	0.0007	1.4	0.00043	5.37E-05	15,781	3.40E-09
Total			***0.0587***	***117.4***	***0.0357***	***0.0045***		

Construction Hours		
hr/day =	9	(7am - 4pm)
days/yr =	365	
hours/year =	3285	

DPM Construction Emissions and Modeling Emission Rates - With Mitigation

Construction Year	Activity	DPM (ton/year)	Area Source	DPM Emissions (lb/yr)	DPM Emissions (lb/hr)	DPM Emissions (g/s)	Modeled Area (m^2)	DPM Emission Rate ($g/s/m^2$)
2021	Construction	0.0145	CON_DPM	29.0	0.00883	1.11E-03	15781	7.05E-08
2022	Construction	0.0406	CON_DPM	81.2	0.02472	3.11E-03	15781	1.97E-07
Total		***0.0551***		***110.2***	***0.0335***	***0.0042***		

Construction Hours

hr/day =	9	(7am - 4pm)
days/yr =	365	
hours/year =	3285	

PM2.5 Fugitive Dust Construction Emissions for Modeling - With Mitigation

Construction Year	Activity	Area Source	PM2.5 Emissions (ton/year)	PM2.5 Emissions (lb/yr)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (g/s)	Modeled Area (m^2)	PM2.5 Emission Rate $g/s/m^2$
2021	Construction	CON_FUG	0.0258	51.6	0.01571	1.98E-03	15,781	1.25E-07
2022	Construction	CON_FUG	0.0000	0.0	0.00000	0.00E+00	15,781	0.00E+00
Total			***0.0258***	***51.6***	***0.0157***	***0.0020***		

Construction Hours

hr/day =	9	(7am - 4pm)
days/yr =	365	
hours/year =	3285	

JobTrain, East Palo Alto, CA - Construction Health Impact Summary

Maximum Impacts at MEI Location - Without Mitigation

Emissions Year	Maximum Concentrations		Cancer Risk (per million) Infant/Child	Hazard Index (-)	Maximum Annual PM2.5 Concentration ($\mu g/m^3$)
	Exhaust PM10/DPM ($\mu g/m^3$)	Fugitive PM2.5 ($\mu g/m^3$)			
2021	0.0178	0.0239	3.16	0.004	0.04
2022	0.0185	0.0003	3.04	0.004	0.02
Total	-	-	**6.20**	-	-
Maximum	0.0185	0.0239	**-**	**0.004**	**0.04**

Maximum Impacts at EPA Center Arts

Construction Year	Unmitigated Emissions				
	Maximum Concentrations		Child Cancer Risk (per million)	Hazard Index (-)	Maximum Annual PM2.5 Concentration ($\mu g/m^3$)
	Exhaust PM2.5/DPM ($\mu g/m^3$)	Fugitive PM2.5 ($\mu g/m^3$)			
2021	0.0252	0.0331	1.58	0.005	0.06
2022	0.0262	0.0004	1.64	0.005	0.03
Total	-	-	**3.22**	-	-
Maximum	0.0262	0.0331	**-**	**0.005**	**0.06**

JobTrain, East Palo Alto, CA - Construction Impacts - Without Mitigation
Maximum DPM Cancer Risk and PM2.5 Calculations From Construction
Impacts at Off-Site MEI Location - 1.5 meter receptor height

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Values

	Infant/Child			Adult
Age -->	**3rd Trimester**	**0 - 2**	**2 - 16**	**16 - 30**
Parameter				
ASF =	10	10	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00	1.10E+00
DBR* =	361	1090	572	261
A =	1	1	1	1
EF =	350	350	350	350
AT =	70	70	70	70
FAH =	1.00	1.00	1.00	0.73

* 95th percentile breathing rates for infants and 80th percentile for children and adults

Construction Cancer Risk by Year - Maximum Impact Receptor Location

			Infant/Child - Exposure Information			Infant/Child	Adult - Exposure Information			Adult
	Exposure				Age	Cancer	Modeled		Age	Cancer
Exposure	Duration		DPM Conc (ug/m3)		Sensitivity	Risk	DPM Conc (ug/m3)		Sensitivity	Risk
Year	(years)	Age	Year	Annual	Factor	(per million)	Year	Annual	Factor	(per million)
0	0.25	-0.25 - 0*	2021	0.0178	10	0.24	2021	0.0178	-	-
1	1	0 - 1	2021	0.0178	10	2.92	2021	0.0178	1	0.05
2	1	1 - 2	2022	0.0185	10	3.04	2022	0.0185	1	0.05
3	1	2 - 3		0.0000	3	0.00		0.0000	1	0.00
4	1	3 - 4		0.0000	3	0.00		0.0000	1	0.00
5	1	4 - 5		0.0000	3	0.00		0.0000	1	0.00
6	1	5 - 6		0.0000	3	0.00		0.0000	1	0.00
7	1	6 - 7		0.0000	3	0.00		0.0000	1	0.00
8	1	7 - 8		0.0000	3	0.00		0.0000	1	0.00
9	1	8 - 9		0.0000	3	0.00		0.0000	1	0.00
10	1	9 - 10		0.0000	3	0.00		0.0000	1	0.00
11	1	10 - 11		0.0000	3	0.00		0.0000	1	0.00
12	1	11 - 12		0.0000	3	0.00		0.0000	1	0.00
13	1	12 - 13		0.0000	3	0.00		0.0000	1	0.00
14	1	13 - 14		0.0000	3	0.00		0.0000	1	0.00
15	1	14 - 15		0.0000	3	0.00		0.0000	1	0.00
16	1	15 - 16		0.0000	3	0.00		0.0000	1	0.00
17	1	16-17		0.0000	1	0.00		0.0000	1	0.00
18	1	17-18		0.0000	1	0.00		0.0000	1	0.00
19	1	18-19		0.0000	1	0.00		0.0000	1	0.00
20	1	19-20		0.0000	1	0.00		0.0000	1	0.00
21	1	20-21		0.0000	1	0.00		0.0000	1	0.00
22	1	21-22		0.0000	1	0.00		0.0000	1	0.00
23	1	22-23		0.0000	1	0.00		0.0000	1	0.00
24	1	23-24		0.0000	1	0.00		0.0000	1	0.00
25	1	24-25		0.0000	1	0.00		0.0000	1	0.00
26	1	25-26		0.0000	1	0.00		0.0000	1	0.00
27	1	26-27		0.0000	1	0.00		0.0000	1	0.00
28	1	27-28		0.0000	1	0.00		0.0000	1	0.00
29	1	28-29		0.0000	1	0.00		0.0000	1	0.00
30	1	29-30		0.0000	1	0.00		0.0000	1	0.00
Total Increased Cancer Risk						**6.2**				**0.10**

* Third trimester of pregnancy

Exposure Year	Maximum		
	Hazard Index	**Fugitive PM2.5**	**Total PM2.5**
1	0.0036	0.0239	0.0417
2	0.0037	0.0003	0.0188

JobTrain, East Palo Alto, CA - Construction Impacts - Without Mitigation
Maximum DPM Cancer Risk and PM2.5 Calculations From Construction
Impacts at EPA Center Arts (13 years and older) - 1.5 meters - Child Exposure

Student Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)

Inhalation Dose = C_{air} x SAF x 8-Hr BR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
SAF = Student Adjustment Factor (unitless)
= (24 hrs/9 hrs) x (7 days/5 days) = 3.73
8-Hr BR = Eight-hour breathing rate (L/kg body weight-per 8 hrs)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Values

	Infant	**School Child**	**Adult**
Age -->	**0 - <2**	**2 - <16**	**16 - 30**
Parameter			
ASF =	10	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00
8-Hr BR* =	1200	520	240
A =	1	1	1
EF =	250	250	250
AT =	70	70	70
SAF =	1.00	3.73	1.00

* 95th percentile 8-hr breathing rates for moderate intensity activities

Construction Cancer Risk by Year - Maximum Impact Receptor Location

			Child - Exposure Information			**Child**
Exposure Year	**Exposure Duration (years)**	**Age**	**DPM Conc (ug/m3) Year**	**DPM Conc (ug/m3) Annual**	**Age* Sensitivity Factor**	**Cancer Risk (per million)**
1	1	13 - 14	2021	0.0252	3	1.6
2	1	14 - 15	2022	0.0262	3	1.6
3	1			0.0000	3	0.0
4	1			0.0000	3	0.0
5	1			0.0000	3	0.0
6	1			0.0000	3	0.0
7	1			0.0000	3	0.0
8	1			0.0000	3	0.0
9	1			0.0000	3	0.0
Total Increased Cancer Risk						**3.22**

* Children assumed to be 13 years of age or older with 2 years of Construction Exposure

	Maximum	
Hazard Index	**Fugitive PM2.5**	**Total PM2.5**
0.0050	0.0331	0.0582
0.0052	0.0004	0.0266

Project Emergency Generator Emissions and Health Risk Calculations

JobTrain, E. Palo Alto, CA

Standby Emergency Generator Impacts

Off-site Sensitive Receptors

MEI Location =1.5 meter receptor height

DPM Emission Rates		
	DPM Emissions per Generator	
	Max Daily	Annual
Source Type	(lb/day)	(lb/year)
100-kW, 134-hp Generator	0.004	1.62
CalEEMod DPM Emissions	8.10E-04	tons/year

Modeling Information		
Model	AERMOD	
Source	Diesel Generator Engine	
Source Type	Point	
Meteorological Data	2013-2017 Moffett Federal Airfield Meterological Data	
Point Source Stack Parameters		
Generator Engine Size (hp)	134	
		roof mechanical enclosure
Stack Height (ft)	72.00	release assumed
Stack Diameter (ft)**	0.60	
Exhaust Gas Flowrate (CFM)*	2527.73	
Stack Exit Velocity (ft/sec)**	149.00	
Exhaust Temperature (˚F)**	872.00	
Emissions Rate (lb/hr)	0.000185	

* AERMOD default

**BAAQMD default generator parameters

JobTrain, E. Palo Alto, CA - Cancer Risks from Project Operation
Project Emergency Generator
Impacts at Off-Site Receptors- 1.5m MEI Receptor Heights
Impact at Project MEI (28-year Exposure)

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(\text{mg/kg-day})^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

	Infant/Child			Adult
Age -->	3rd Trimester	0 - 2	2 - 16	16 - 30
Parameter				
ASF =	10	10	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00	1.10E+00
DBR* =	361	1090	572	261
A =	1	1	1	1
EF =	350	350	350	350
AT =	70	70	70	70
FAH =	1.00	1.00	1.00	0.73

* 95th percentile breathing rates for infants and 80th percentile for children and adults

Construction Cancer Risk by Year - Maximum Impact Receptor Location

			Infant/Child - Exposure Information			Infant/Child				
Exposure Year	Exposure Duration (years)	Age	DPM Conc (ug/m3) Year	Annual	Age Sensitivity Factor	Cancer Risk (per million)		Hazard Index	Fugitive PM2.5	Total PM2.5
0	0.25	-0.25 - 0*	2021	0.0000	10	0.000				
1	1	0 - 1	2021	0.0000	10	0.000				
2	1	1 - 2	2022	0.0000	10	0.000				
3	1	2 - 3	2023	0.0001	3	0.002		0.00002	0.0001	0.0002
4	1	3 - 4	2024	0.0001	3	0.002		0.00002	0.0001	0.0002
5	1	4 - 5	2025	0.0001	3	0.002		0.00002	0.0001	0.0002
6	1	5 - 6	2026	0.0001	3	0.002		0.00002	0.0001	0.0002
7	1	6 - 7	2027	0.0001	3	0.002		0.00002	0.0001	0.0002
8	1	7 - 8	2028	0.0001	3	0.002		0.00002	0.0001	0.0002
9	1	8 - 9	2029	0.0001	3	0.002		0.00002	0.0001	0.0002
10	1	9 - 10	2030	0.0001	3	0.002		0.00002	0.0001	0.0002
11	1	10 - 11	2031	0.0001	3	0.002		0.00002	0.0001	0.0002
12	1	11 - 12	2032	0.0001	3	0.002		0.00002	0.0001	0.0002
13	1	12 - 13	2033	0.0001	3	0.002		0.00002	0.0001	0.0002
14	1	13 - 14	2034	0.0001	3	0.002		0.00002	0.0001	0.0002
15	1	14 - 15	2035	0.0001	3	0.002		0.00002	0.0001	0.0002
16	1	15 - 16	2036	0.0001	3	0.002		0.00002	0.0001	0.0002
17	1	16-17	2037	0.0001	1	0.000		0.00002	0.0001	0.0002
18	1	17-18	2038	0.0001	1	0.000		0.00002	0.0001	0.0002
19	1	18-19	2039	0.0001	1	0.000		0.00002	0.0001	0.0002
20	1	19-20	2040	0.0001	1	0.000		0.00002	0.0001	0.0002
21	1	20-21	2041	0.0001	1	0.000		0.00002	0.0001	0.0002
22	1	21-22	2042	0.0001	1	0.000		0.00002	0.0001	0.0002
23	1	22-23	2043	0.0001	1	0.000		0.00002	0.0001	0.0002
24	1	23-24	2044	0.0001	1	0.000		0.00002	0.0001	0.0002
25	1	24-25	2045	0.0001	1	0.000		0.00002	0.0001	0.0002
26	1	25-26	2046	0.0001	1	0.000		0.00002	0.0001	0.0002
27	1	26-27	2047	0.0001	1	0.000		0.00002	0.0001	0.0002
28	1	27-28	2048	0.0001	1	0.000		0.00002	0.0001	0.0002
29	1	28-29	2049	0.0001	1	0.000		0.00002	0.0001	0.0002
30	1	29-30	2050	0.0001	1	0.000		0.00002	0.0001	0.0002
Total Increased Cancer Risk						**0.03**	Max	**0.00002**	**0.0001**	**0.0002**

* Third trimester of pregnancy

JobTrain, E. Palo Alto, CA - Cancer Risks from Project Operation
Project Emergency Generator
Impacts at Off-Site EPA Center Arts Child Exposure- 1.5m MEI Receptor Heights
Impact at Project MEI (7-year Exposure)

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
SAF = Student Adjustment Factor (unitless)
= (24 hrs/9 hrs) x (7 days/5 days) = 3.73
8-Hr BR = Eight-hour breathing rate (L/kg body weight-per 8 hrs)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

	Infant/Child			Adult
Age -->	**3rd Trimester**	**0 - 2**	**2 - 16**	**16 - 30**
Parameter				
ASF =	10	10	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00	1.10E+00
DBR* =	361	1200	520	240
A =	1	1	1	1
EF =	250	250	250	250
AT =	70	70	70	70
FAH =	1.00	1.00	3.73	1.00

* 95th percentile 8-hr breathing rates for moderate intensity activities

Construction Cancer Risk by Year - Maximum Impact Receptor Location

Exposure Year	Exposure Duration (years)	Age	Infant/Child - Exposure Information: DPM Conc (ug/m3) Year	Annual	Age Sensitivity Factor	Infant/Child Cancer Risk (per million)		Hazard Index	Fugitive PM2.5	Total PM2.5
1	1	7 - 8	2021	0.0000	3	0.00				
2	1	8 - 9	2022	0.0000	3	0.00				
3	1	9 - 10	2023	0.0001	3	0.01		0.00002	0.0001	0.0002
4	1	10 - 11	2024	0.0001	3	0.01		0.00002	0.0001	0.0002
5	1	11 - 12	2025	0.0001	3	0.01		0.00002	0.0001	0.0002
6	1	12 - 13	2026	0.0001	3	0.01		0.00002	0.0001	0.0002
7	1	13 - 14	2027	0.0001	3	0.01		0.00002	0.0001	0.0002
8	1	14 - 15	2028	0.0001	3	0.01		0.00002	0.0001	0.0002
9	1	15 - 16	2029	0.0001	3	0.01		0.00002	0.0001	0.0002
Total Increased Cancer Risk						**0.04**	**Max**	**0.00002**	**0.0001**	**0.0002**

* Older children at EPA Center Arts

Attachment 5: Community Risk Screening and Calculations

CT-EMFAC2017 Emissions Factors for Bay Road and Pulgas Avenue

File Name:	JobTrain - San Mateo (SF) - 2021 - Annual.EF
CT-EMFAC2017 Version:	1.0.2.27401
Run Date:	2/10/2021 12:04
Area:	San Mateo (SF)
Analysis Year:	2021
Season:	Annual

===

Vehicle Category	VMT Fraction Across Category	Diesel VMT Fraction Within Category	Gas VMT Fraction Within Category
Truck 1	0.018	0.46	0.54
Truck 2	0.013	0.871	0.114
Non-Truck	0.969	0.016	0.967

===

Road Type:	Major/Collector	
Silt Loading Factor:	CARB	0.032 g/m2
Precipitation Correction:	CARB	P = 60 day: N = 365 days

===

Fleet Average Running Exhaust Emission Factors (grams/veh-mile)

Pollutant Name	<= 5 mph	10 mph	15 mph	20 mph	25 mph	30 mph	35 mph
PM2.5	0.011611	0.007822	0.005344	0.003815	0.002936	0.002402	0.002075
TOG	0.265499	0.174765	0.116329	0.08138	0.061424	0.048957	0.040957
Diesel PM	0.0025	0.002091	0.001535	0.001145	0.000965	0.000868	0.000817

===

Fleet Average Running Loss Emission Factors (grams/veh-hour)

Pollutant Name	Emission Factor
TOG	1.313494

===

Fleet Average Tire Wear Factors (grams/veh-mile)

Pollutant Name	Emission Factor
PM2.5	0.002045

===

Fleet Average Brake Wear Factors (grams/veh-mile)

Pollutant Name	Emission Factor
PM2.5	0.016783

===

Fleet Average Road Dust Factors (grams/veh-mile)

Pollutant Name	Emission Factor
PM2.5	0.014693

============================END=====================================

Bay Road Traffic Emissions and Health Risk Calculations

Traffic Data Year = *2040*

Caltrans AADT (2017) & Truck %s (2018)	AADT Total
Cumlative + Project Bay Rd	22,606

Percent of Total Vehicles

Traffic Increase per Year (%) = *1.00%*

JobTrain, East Palo Alto, CA - On- and Off-Site Residential
Cumulative Operation - Bay Road
DPM Modeling - Roadway Links, Traffic Volumes, and DPM Emissions
Year = 2021

Road Link	Description	Direction	No. Lanes	Link Length (m)	Link Length (mi)	Link Width (m)	Link Width (ft)	Release Height (m)	Average Speed (mph)	Average Vehicles per Day
DPM_EB_BAY	Bay Road Eastbound	EB	2	565.3	0.35	13.3	43.7	3.4	25	11,303
DPM_WB_BAY	Bay Road Westbound	WB	2	582.8	0.36	13.3	43.7	3.4	25	11,303
									Total	22,606

Emission Factors

Speed Category	1	2	3	4
Travel Speed (mph)	25			
Emissions per Vehicle (g/VMT)	0.00097			

2021 Hourly Traffic Volumes and DPM Emissions - DPM_EB_BAY

Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s
1	3.85%	435	4.10E-05	9	6.57%	742	6.99E-05	17	6.60%	746	7.02E-05
2	3.18%	360	3.39E-05	10	8.24%	932	8.77E-05	18	4.09%	462	4.35E-05
3	2.35%	265	2.50E-05	11	6.06%	685	6.45E-05	19	2.38%	269	2.53E-05
4	1.01%	114	1.07E-05	12	7.24%	818	7.70E-05	20	1.21%	136	1.28E-05
5	1.01%	114	1.07E-05	13	6.73%	761	7.17E-05	21	3.05%	345	3.24E-05
6	2.18%	246	2.32E-05	14	6.57%	742	6.99E-05	22	5.06%	572	5.38E-05
7	4.72%	534	5.03E-05	15	5.90%	666	6.28E-05	23	3.55%	401	3.78E-05
8	3.58%	405	3.81E-05	16	4.22%	477	4.49E-05	24	0.67%	76	7.13E-06
								Total		11,303	

2021 Hourly Traffic Volumes Per Direction and DPM Emissions - DPM_WB_BAY

Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile
1	3.85%	435	4.23E-05	9	6.57%	742	7.20E-05	17	6.60%	746	7.24E-05
2	3.18%	360	3.49E-05	10	8.24%	932	9.04E-05	18	4.09%	462	4.48E-05
3	2.35%	265	2.57E-05	11	6.06%	685	6.65E-05	19	2.38%	269	2.61E-05
4	1.01%	114	1.10E-05	12	7.24%	818	7.94E-05	20	1.21%	136	1.32E-05
5	1.01%	114	1.10E-05	13	6.73%	761	7.39E-05	21	3.05%	345	3.34E-05
6	2.18%	246	2.39E-05	14	6.57%	742	7.20E-05	22	5.06%	572	5.55E-05
7	4.72%	534	5.18E-05	15	5.90%	666	6.47E-05	23	3.55%	401	3.90E-05
8	3.58%	405	3.93E-05	16	4.22%	477	4.63E-05	24	0.67%	76	7.35E-06
								Total		11,303	

JobTrain, East Palo Alto, CA - On- and Off-Site Residential
Cumulative Operation - Bay Road
PM2.5 Modeling - Roadway Links, Traffic Volumes, and PM2.5 Emissions
Year = 2021

Road Link	Description	Direction	No. Lanes	Link Length (m)	Link Length (mi)	Link Width (m)	Link Width (ft)	Release Height (m)	Average Speed (mph)	Average Vehicles per Day
PM2.5_EB_BAY	Bay Road Eastbound	EB	2	565.3	0.35	13.3	44	1.3	25	11,303
PM2.5_WB_BAY	Bay Road Westbound	WB	2	582.8	0.36	13.3	44	1.3	25	11,303
									Total	22,606

Emission Factors - PM2.5

Speed Category	1	2	3	4
Travel Speed (mph)	25			
Emissions per Vehicle (g/VMT)	0.002936			

2021 Hourly Traffic Volumes and PM2.5 Emissions - PM2.5_EB_BAY

Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s
1	1.12%	127	3.64E-05	9	7.12%	805	2.30E-04	17	7.43%	840	2.41E-04
2	0.42%	47	1.35E-05	10	4.38%	495	1.42E-04	18	8.23%	931	2.67E-04
3	0.37%	42	1.20E-05	11	4.65%	526	1.51E-04	19	5.72%	647	1.85E-04
4	0.17%	19	5.52E-06	12	5.89%	666	1.91E-04	20	4.31%	487	1.39E-04
5	0.45%	51	1.46E-05	13	6.17%	698	2.00E-04	21	3.25%	367	1.05E-04
6	0.85%	96	2.76E-05	14	6.05%	684	1.96E-04	22	3.31%	374	1.07E-04
7	3.73%	422	1.21E-04	15	7.06%	798	2.29E-04	23	2.48%	280	8.03E-05
8	7.77%	878	2.51E-04	16	7.18%	812	2.33E-04	24	1.87%	211	6.05E-05
								Total		11,303	

2021 Hourly Traffic Volumes Per Direction and PM2.5 Emissions - PM2.5_WB_BAY

Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile
1	1.12%	127	3.75E-05	9	7.12%	805	2.38E-04	17	7.43%	840	2.48E-04
2	0.42%	47	1.39E-05	10	4.38%	495	1.46E-04	18	8.23%	931	2.75E-04
3	0.37%	42	1.24E-05	11	4.65%	526	1.55E-04	19	5.72%	647	1.91E-04
4	0.17%	19	5.70E-06	12	5.89%	666	1.97E-04	20	4.31%	487	1.44E-04
5	0.45%	51	1.50E-05	13	6.17%	698	2.06E-04	21	3.25%	367	1.09E-04
6	0.85%	96	2.85E-05	14	6.05%	684	2.02E-04	22	3.31%	374	1.11E-04
7	3.73%	422	1.25E-04	15	7.06%	798	2.36E-04	23	2.48%	280	8.28E-05
8	7.77%	878	2.59E-04	16	7.18%	812	2.40E-04	24	1.87%	211	6.24E-05
								Total		11,303	

JobTrain, East Palo Alto, CA - On- and Off-Site Residential
Cumulative Operation - Bay Road
TOG Exhaust Modeling - Roadway Links, Traffic Volumes, and TOG Exhaust Emissions
Year = 2021

Road Link	Description	Direction	No. Lanes	Link Length (m)	Link Length (mi)	Link Width (m)	Link Width (ft)	Release Height (m)	Average Speed (mph)	Average Vehicles per Day
TEXH_EB_BAY	Bay Road Eastbound	EB	2	565.3	0.35	13.3	44	1.3	25	11,303
TEXH_WB_BAY	Bay Road Westbound	WB	2	582.8	0.36	13.3	44	1.3	25	11,303
									Total	22,606

Emission Factors - TOG Exhaust

Speed Category	1	2	3	4
Travel Speed (mph)	25			
Emissions per Vehicle (g/VMT)	0.06142			

2021 Hourly Traffic Volumes and TOG Exhaust Emissions - TEXH_EB_BAY

Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s
1	1.12%	127	7.62E-04	9	7.12%	805	4.82E-03	17	7.43%	840	5.04E-03
2	0.42%	47	2.82E-04	10	4.38%	495	2.97E-03	18	8.23%	931	5.58E-03
3	0.37%	42	2.52E-04	11	4.65%	526	3.15E-03	19	5.72%	647	3.88E-03
4	0.17%	19	1.16E-04	12	5.89%	666	3.99E-03	20	4.31%	487	2.92E-03
5	0.45%	51	3.05E-04	13	6.17%	698	4.18E-03	21	3.25%	367	2.20E-03
6	0.85%	96	5.78E-04	14	6.05%	684	4.10E-03	22	3.31%	374	2.24E-03
7	3.73%	422	2.53E-03	15	7.06%	798	4.78E-03	23	2.48%	280	1.68E-03
8	7.77%	878	5.26E-03	16	7.18%	812	4.87E-03	24	1.87%	211	1.27E-03
								Total		11,303	

2021 Hourly Traffic Volumes Per Direction and TOG Exhaust Emissions - TEXH_WB_BAY

Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile
1	1.12%	127	7.85E-04	9	7.12%	805	4.97E-03	17	7.43%	840	5.19E-03
2	0.42%	47	2.90E-04	10	4.38%	495	3.06E-03	18	8.23%	931	5.75E-03
3	0.37%	42	2.60E-04	11	4.65%	526	3.25E-03	19	5.72%	647	4.00E-03
4	0.17%	19	1.19E-04	12	5.89%	666	4.12E-03	20	4.31%	487	3.01E-03
5	0.45%	51	3.15E-04	13	6.17%	698	4.31E-03	21	3.25%	367	2.27E-03
6	0.85%	96	5.96E-04	14	6.05%	684	4.23E-03	22	3.31%	374	2.31E-03
7	3.73%	422	2.61E-03	15	7.06%	798	4.93E-03	23	2.48%	280	1.73E-03
8	7.77%	878	5.42E-03	16	7.18%	812	5.02E-03	24	1.87%	211	1.30E-03
								Total		11,303	

JobTrain, East Palo Alto, CA - On- and Off-Site Residential
Cumulative Operation - Bay Road
TOG Evaporative Emissions Modeling - Roadway Links, Traffic Volumes, and TOG Evaporative Emissions
Year = 2021

Road Link	Description	Direction	No. Lanes	Link Length (m)	Link Length (mi)	Link Width (m)	Link Width (ft)	Release Height (m)	Average Speed (mph)	Average Vehicles per Day
TEVAP_EB_BAY	Bay Road Eastbound	EB	2	565.3	0.35	13.3	44	1.3	25	11,303
TEVAP_WB_BAY	Bay Road Westbound	WB	2	582.8	0.36	13.3	44	1.3	25	11,303
									Total	22,606

Emission Factors - PM2.5 - Evaporative TOG

Speed Category	1	2	3	4
Travel Speed (mph)	25			
Emissions per Vehicle per Hour (g/hour)	1.31349			
Emissions per Vehicle per Mile (g/VMT)	0.05254			

2021 Hourly Traffic Volumes and TOG Evaporative Emissions - TEVAP_EB_BAY

Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s
1	1.12%	127	6.52E-04	9	7.12%	805	4.12E-03	17	7.43%	840	4.31E-03
2	0.42%	47	2.41E-04	10	4.38%	495	2.54E-03	18	8.23%	931	4.77E-03
3	0.37%	42	2.15E-04	11	4.65%	526	2.69E-03	19	5.72%	647	3.32E-03
4	0.17%	19	9.89E-05	12	5.89%	666	3.41E-03	20	4.31%	487	2.49E-03
5	0.45%	51	2.61E-04	13	6.17%	698	3.58E-03	21	3.25%	367	1.88E-03
6	0.85%	96	4.94E-04	14	6.05%	684	3.51E-03	22	3.31%	374	1.92E-03
7	3.73%	422	2.16E-03	15	7.06%	798	4.09E-03	23	2.48%	280	1.44E-03
8	7.77%	878	4.50E-03	16	7.18%	812	4.16E-03	24	1.87%	211	1.08E-03
								Total		11,303	

2021 Hourly Traffic Volumes Per Direction and TOG Evaporative Emissions - TEVAP_WB_BAY

Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile
1	1.12%	127	6.72E-04	9	7.12%	805	4.25E-03	17	7.43%	840	4.44E-03
2	0.42%	47	2.48E-04	10	4.38%	495	2.62E-03	18	8.23%	931	4.92E-03
3	0.37%	42	2.22E-04	11	4.65%	526	2.78E-03	19	5.72%	647	3.42E-03
4	0.17%	19	1.02E-04	12	5.89%	666	3.52E-03	20	4.31%	487	2.57E-03
5	0.45%	51	2.69E-04	13	6.17%	698	3.69E-03	21	3.25%	367	1.94E-03
6	0.85%	96	5.10E-04	14	6.05%	684	3.61E-03	22	3.31%	374	1.98E-03
7	3.73%	422	2.23E-03	15	7.06%	798	4.22E-03	23	2.48%	280	1.48E-03
8	7.77%	878	4.64E-03	16	7.18%	812	4.29E-03	24	1.87%	211	1.12E-03
								Total		11,303	

JobTrain, East Palo Alto, CA - On- and Off-Site Residential
Cumulative Operation - Bay Road
Fugitive Road PM2.5 Modeling - Roadway Links, Traffic Volumes, and Fugitive Road PM2.5 Emissions
Year = 2021

Road Link	Description	Direction	No. Lanes	Link Length (m)	Link Length (mi)	Link Width (m)	Link Width (ft)	Release Height (m)	Average Speed (mph)	Average Vehicles per Day
FUG_EB_BAY	Bay Road Eastbound	EB	2	565.3	0.35	13.3	44	1.3	25	11,303
FUG_WB_BAY	Bay Road Westbound	WB	2	582.8	0.36	13.3	44	1.3	25	11,303
									Total	22,606

Emission Factors - Fugitive PM2.5

Speed Category	1	2	3	4
Travel Speed (mph)	25			
Tire Wear - Emissions per Vehicle (g/VMT)	0.00205			
Brake Wear - Emissions per Vehicle (g/VMT)	0.01678			
Road Dust - Emissions per Vehicle (g/VMT)	0.01469			
Total Fugitive PM2.5 - Emissions per Vehicle (g/VMT)	0.03352			

2021 Hourly Traffic Volumes and Fugitive PM2.5 Emissions - FUG_EB_BAY

Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s
1	1.12%	127	4.16E-04	9	7.12%	805	2.63E-03	17	7.43%	840	2.75E-03
2	0.42%	47	1.54E-04	10	4.38%	495	1.62E-03	18	8.23%	931	3.04E-03
3	0.37%	42	1.37E-04	11	4.65%	526	1.72E-03	19	5.72%	647	2.12E-03
4	0.17%	19	6.31E-05	12	5.89%	666	2.18E-03	20	4.31%	487	1.59E-03
5	0.45%	51	1.67E-04	13	6.17%	698	2.28E-03	21	3.25%	367	1.20E-03
6	0.85%	96	3.15E-04	14	6.05%	684	2.24E-03	22	3.31%	374	1.22E-03
7	3.73%	422	1.38E-03	15	7.06%	798	2.61E-03	23	2.48%	280	9.17E-04
8	7.77%	878	2.87E-03	16	7.18%	812	2.66E-03	24	1.87%	211	6.91E-04
								Total		11,303	

2021 Hourly Traffic Volumes Per Direction and Fugitive PM2.5 Emissions - FUG_WB_BAY

Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile
1	1.12%	127	4.29E-04	9	7.12%	805	2.71E-03	17	7.43%	840	2.83E-03
2	0.42%	47	1.58E-04	10	4.38%	495	1.67E-03	18	8.23%	931	3.14E-03
3	0.37%	42	1.42E-04	11	4.65%	526	1.77E-03	19	5.72%	647	2.18E-03
4	0.17%	19	6.50E-05	12	5.89%	666	2.25E-03	20	4.31%	487	1.64E-03
5	0.45%	51	1.72E-04	13	6.17%	698	2.35E-03	21	3.25%	367	1.24E-03
6	0.85%	96	3.25E-04	14	6.05%	684	2.31E-03	22	3.31%	374	1.26E-03
7	3.73%	422	1.42E-03	15	7.06%	798	2.69E-03	23	2.48%	280	9.45E-04
8	7.77%	878	2.96E-03	16	7.18%	812	2.74E-03	24	1.87%	211	7.12E-04
								Total		11,303	

JobTrain, East Palo Alto, CA - Bay Road Traffic - TACs & PM2.5
AERMOD Risk Modeling Parameters and Maximum Concentrations
at Construction Residential MEI Receptor (1.5 meter receptor height)

Emission Year	2021
Receptor Information	Construction Residential MEI receptor
Number of Receptors	1
Receptor Height	1.5 meters
Receptor Distances	At Construction Residential MEI location
Meteorological Conditions	
BAQMD Moffett Airfield Met Data	2013-2017
Land Use Classification	Urban
Wind Speed	Variable
Wind Direction	Variable

Construction Residential MEI Cancer Risk Maximum Concentrations

Meteorological	Concentration (μg/m3)*		
Data Years	DPM	Exhaust TOG	Evaporative TOG
2013-2017	0.0049	0.3582	0.3063

Construction Residential MEI PM2.5 Maximum Concentrations

Meteorological	PM2.5 Concentration (μg/m3)*		
Data Years	Total PM2.5	Fugitive PM2.5	Vehicle PM2.5
2013-2017	0.2128	0.1957	0.0171

JobTrain, East Palo Alto, CA - Bay Road Traffic Cancer Risk
Impacts at Construction Residential MEI - 1.5 meter receptor height
30 Year Residential Exposure

Cancer Risk Calculation Method

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Cancer Potency Factors $(mg/kg\text{-}day)^{-1}$

TAC	CPF
DPM	1.10E+00
Vehicle TOG Exhaust	6.28E-03
Vehicle TOG Evaporative	3.70E-04

Values

	Infant/Child			Adult
Age -->	**3rd Trimester**	**0 - 2**	**2 - 16**	**16 - 30**
Parameter				
ASF =	10	10	3	1
DBR* =	361	1090	572	261
A =	1	1	1	1
EF =	350	350	350	350
AT =	70	70	70	70
FAH =	1.00	1.00	1.00	0.73

* 95th percentile breathing rates for infants and 80th percentile for children and adults

Construction Cancer Risk by Year - Maximum Impact Receptor Location

Maximum - Exposure Information					Concentration (ug/m3)			Cancer Risk (per million)			
Exposure Year	Exposure Duration (years)	Age	Year	Age Sensitivity Factor	DPM	Exhaust TOG	Evaporative TOG	DPM	Exhaust TOG	Evaporative TOG	TOTAL
0	0.25	-0.25 - 0*	2021	10	0.0049	0.3582	0.3063	0.066	0.028	0.0014	0.10
1	1	0 - 1	2021	10	0.0049	0.3582	0.3063	0.797	0.336	0.0169	1.15
2	1	1 - 2	2022	10	0.0049	0.3582	0.3063	0.797	0.336	0.0169	1.15
3	1	2 - 3	2023	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
4	1	3 - 4	2024	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
5	1	4 - 5	2025	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
6	1	5 - 6	2026	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
7	1	6 - 7	2027	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
8	1	7 - 8	2028	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
9	1	8 - 9	2029	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
10	1	9 - 10	2030	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
11	1	10 - 11	2031	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
12	1	11 - 12	2032	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
13	1	12 - 13	2033	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
14	1	13 - 14	2034	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
15	1	14 - 15	2035	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
16	1	15 - 16	2036	3	0.0049	0.3582	0.3063	0.125	0.053	0.0027	0.18
17	1	16-17	2037	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
18	1	17-18	2038	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
19	1	18-19	2039	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
20	1	19-20	2040	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
21	1	20-21	2041	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
22	1	21-22	2042	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
23	1	22-23	2043	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
24	1	23-24	2044	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
25	1	24-25	2045	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
26	1	25-26	2046	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
27	1	26-27	2047	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
28	1	27-28	2048	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
29	1	28-29	2049	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
30	1	29-30	2050	1	0.0049	0.3582	0.3063	0.014	0.006	0.0003	0.02
Total Increased Cancer Risk								3.61	1.522	0.077	**5.2**

* Third trimester of pregnancy

Hazard Index	Maximum Fugitive PM2.5	Total PM2.5
0.0010	0.20	0.21

JobTrain, East Palo Alto, CA - Bay Road Traffic - TACs & PM2.5
AERMOD Risk Modeling Parameters and Maximum Concentrations
On-Site 1st Floor Daycare Child (3-5 years old) Receptors (1 meter receptor height)

Emission Year	2021
Receptor Information	Maximum On-Site Receptor
Number of Receptors	108
Receptor Height	1 meter
Receptor Distances	7 meter grid spacing
Meteorological Conditions	
BAQMD Moffett Airfield Met Data	2013-2017
Land Use Classification	Urban
Wind Speed	Variable
Wind Direction	Variable

Construction School MEI Cancer Risk Maximum Concentrations

Meteorological Data Years	Concentration (μg/m3)*		
	DPM	Exhaust TOG	Evaporative TOG
2013-2017	0.0009	0.0488	0.0417

Construction School MEI PM2.5 Maximum Concentrations

Meteorological Data Years	PM2.5 Concentration (μg/m3)*		
	Total PM2.5	Fugitive PM2.5	Vehicle PM2.5
2013-2017	0.0290	0.0267	0.0023

JobTrain, East Palo Alto, CA - Bay Road Traffic Cancer Risk
Impacts at On-Site 1st Floor Daycare Child Receptors - 1 meter receptor height
3 Year Daycare Child (3-5 years old) Exposure

Cancer Risk Calculation Method

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
SAF = Student Adjustment Factor (unitless)
= (24 hrs/9 hrs) x (7 days/5 days) = 3.73
8-Hr BR = Eight-hour breathing rate (L/kg body weight-per 8 hrs)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Cancer Potency Factors $(mg/kg\text{-}day)^{-1}$

TAC	CPF
DPM	1.10E+00
Vehicle TOG Exhaust	6.28E-03
Vehicle TOG Evaporative	3.70E-04

Values

	Infant/Child			Adult
Age -->	3rd Trimester	0 - 2	2 - 16	16 - 30
Parameter				
ASF =	10	10	3	1
8-Hr BR* =	361	1200	520	240
A =	1	1	1	1
EF =	250	250	250	250
AT =	70	70	70	70
FAH =	1.00	1.00	3.73	1.00

* 95th percentile 8-hr breathing rates for moderate intensity activities

Construction Cancer Risk by Year - Maximum Impact Receptor Location

Maximum - Exposure Information					Concentration (ug/m3)			Cancer Risk (per million)						
Exposure Year	Exposure Duration (years)	Age	Year	Age Sensitivity Factor	DPM	Exhaust TOG	Evaporative TOG	DPM	Exhaust TOG	Evaporative TOG	TOTAL	Hazard Index	Maximum Fugitive PM2.5	Total PM2.5
1	1	3 - 4	2021	3	0.0009	0.0488	0.0417	0.056	0.017	0.0009	0.07	0.0002	0.03	0.03
2	1	4 - 5	2022	3	0.0009	0.0488	0.0417	0.056	0.017	0.0009	0.07			
3	1	5 - 6	2023	3	0.0009	0.0488	0.0417	0.056	0.017	0.0009	0.07			
Total Increased Cancer Risk								0.17	0.052	0.003	**0.22**			

* Children assumed to be 3-5 years old with 3 years of Exposure

Pulgas Avenue Traffic Emissions and Health Risk Calculations

Traffic Data Year = ***2040***

Caltrans AADT (2017) & Truck %s (2018)	AADT Total
Cumlative + Project Plugas Ave	15,372

Percent of Total Vehicles

Traffic Increase per Year (%) = *1.00%*

JobTrain, East Palo Alto, CA - On- and Off-Site Residential
Cumulative Operation - Plugas Avenue
DPM Modeling - Roadway Links, Traffic Volumes, and DPM Emissions 9.6576
Year = 2021

Road Link	Description	Direction	No. Lanes	Link Length (m)	Link Length (mi)	Link Width (m)	Link Width (ft)	Release Height (m)	Average Speed (mph)	Average Vehicles per Day
DPM_NB_PUL	Pulgas Avenue Northbound	NB	1	125.1	0.08	9.7	31.7	3.4	25	7,686
DPM_SB_PUL	Pulgas Avenue Southbound	SB	1	123.6	0.08	9.7	31.7	3.4	25	7,686
									Total	15,372

Emission Factors

Speed Category	1	2	3	4
Travel Speed (mph)	25			
Emissions per Vehicle (g/VMT)	0.00097			

2021 Hourly Traffic Volumes and DPM Emissions - DPM_NB_PUL

Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s
1	3.85%	296	6.17E-06	9	6.57%	505	1.05E-05	17	6.60%	507	1.06E-05
2	3.18%	245	5.10E-06	10	8.24%	633	1.32E-05	18	4.09%	314	6.55E-06
3	2.35%	180	3.76E-06	11	6.06%	466	9.71E-06	19	2.38%	183	3.81E-06
4	1.01%	77	1.61E-06	12	7.24%	556	1.16E-05	20	1.21%	93	1.93E-06
5	1.01%	77	1.61E-06	13	6.73%	518	1.08E-05	21	3.05%	234	4.88E-06
6	2.18%	167	3.49E-06	14	6.57%	505	1.05E-05	22	5.06%	389	8.10E-06
7	4.72%	363	7.56E-06	15	5.90%	453	9.44E-06	23	3.55%	273	5.69E-06
8	3.58%	276	5.74E-06	16	4.22%	324	6.76E-06	24	0.67%	51	1.07E-06
								Total		7,686	

2021 Hourly Traffic Volumes Per Direction and DPM Emissions - DPM_SB_PUL

Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile
1	3.85%	296	6.10E-06	9	6.57%	505	1.04E-05	17	6.60%	507	1.04E-05
2	3.18%	245	5.04E-06	10	8.24%	633	1.30E-05	18	4.09%	314	6.47E-06
3	2.35%	180	3.71E-06	11	6.06%	466	9.59E-06	19	2.38%	183	3.76E-06
4	1.01%	77	1.59E-06	12	7.24%	556	1.14E-05	20	1.21%	93	1.91E-06
5	1.01%	77	1.59E-06	13	6.73%	518	1.07E-05	21	3.05%	234	4.82E-06
6	2.18%	167	3.45E-06	14	6.57%	505	1.04E-05	22	5.06%	389	8.00E-06
7	4.72%	363	7.47E-06	15	5.90%	453	9.33E-06	23	3.55%	273	5.62E-06
8	3.58%	276	5.67E-06	16	4.22%	324	6.68E-06	24	0.67%	51	1.06E-06
								Total		7,686	

JobTrain, East Palo Alto, CA - On- and Off-Site Residential
Cumulative Operation - Plugas Avenue
PM2.5 Modeling - Roadway Links, Traffic Volumes, and PM2.5 Emissions
Year = 2021

Road Link	Description	Direction	No. Lanes	Link Length (m)	Link Length (mi)	Link Width (m)	Link Width (ft)	Release Height (m)	Average Speed (mph)	Average Vehicles per Day
PM2.5_NB_PUL	Pulgas Avenue Northbound	NB	1	125.1	0.08	9.7	32	1.3	25	7,686
PM2.5_SB_PUL	Pulgas Avenue Southbound	SB	1	123.6	0.08	9.7	32	1.3	25	7,686
									Total	15,372

Emission Factors - PM2.5

Speed Category	1	2	3	4
Travel Speed (mph)	25			
Emissions per Vehicle (g/VMT)	0.002936			

2021 Hourly Traffic Volumes and PM2.5 Emissions - PM2.5_NB_PUL

Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s
1	1.12%	86	5.48E-06	9	7.12%	547	3.47E-05	17	7.43%	571	3.62E-05
2	0.42%	32	2.03E-06	10	4.38%	337	2.14E-05	18	8.23%	633	4.01E-05
3	0.37%	29	1.81E-06	11	4.65%	357	2.27E-05	19	5.72%	440	2.79E-05
4	0.17%	13	8.31E-07	12	5.89%	453	2.87E-05	20	4.31%	331	2.10E-05
5	0.45%	35	2.20E-06	13	6.17%	474	3.01E-05	21	3.25%	250	1.58E-05
6	0.85%	66	4.16E-06	14	6.05%	465	2.95E-05	22	3.31%	255	1.61E-05
7	3.73%	287	1.82E-05	15	7.06%	542	3.44E-05	23	2.48%	191	1.21E-05
8	7.77%	597	3.78E-05	16	7.18%	552	3.50E-05	24	1.87%	144	9.10E-06
								Total		7,686	

2021 Hourly Traffic Volumes Per Direction and PM2.5 Emissions - PM2.5_SB_PUL

Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile
1	1.12%	86	5.41E-06	9	7.12%	547	3.43E-05	17	7.43%	571	3.58E-05
2	0.42%	32	2.00E-06	10	4.38%	337	2.11E-05	18	8.23%	633	3.96E-05
3	0.37%	29	1.79E-06	11	4.65%	357	2.24E-05	19	5.72%	440	2.75E-05
4	0.17%	13	8.21E-07	12	5.89%	453	2.84E-05	20	4.31%	331	2.07E-05
5	0.45%	35	2.17E-06	13	6.17%	474	2.97E-05	21	3.25%	250	1.56E-05
6	0.85%	66	4.11E-06	14	6.05%	465	2.91E-05	22	3.31%	255	1.59E-05
7	3.73%	287	1.80E-05	15	7.06%	542	3.40E-05	23	2.48%	191	1.19E-05
8	7.77%	597	3.74E-05	16	7.18%	552	3.46E-05	24	1.87%	144	8.99E-06
								Total		7,686	

JobTrain, East Palo Alto, CA - On- and Off-Site Residential
Cumulative Operation - Plugas Avenue
TOG Exhaust Modeling - Roadway Links, Traffic Volumes, and TOG Exhaust Emissions
Year = 2021

Road Link	Description	Direction	No. Lanes	Link Length (m)	Link Length (mi)	Link Width (m)	Link Width (ft)	Release Height (m)	Average Speed (mph)	Average Vehicles per Day
TEXH_NB_PUL	Pulgas Avenue Northbound	NB	1	125.1	0.08	9.7	32	1.3	25	7,686
TEXH_SB_PUL	Pulgas Avenue Southbound	SB	1	123.6	0.08	9.7	32	1.3	25	7,686
									Total	15,372

Emission Factors - TOG Exhaust

Speed Category	1	2	3	4
Travel Speed (mph)	25			
Emissions per Vehicle (g/VMT)	0.06142			

2021 Hourly Traffic Volumes and TOG Exhaust Emissions - TEXH_NB_PUL

Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s
1	1.12%	86	1.15E-04	9	7.12%	547	7.26E-04	17	7.43%	571	7.58E-04
2	0.42%	32	4.24E-05	10	4.38%	337	4.47E-04	18	8.23%	633	8.39E-04
3	0.37%	29	3.79E-05	11	4.65%	357	4.74E-04	19	5.72%	440	5.83E-04
4	0.17%	13	1.74E-05	12	5.89%	453	6.01E-04	20	4.31%	331	4.39E-04
5	0.45%	35	4.59E-05	13	6.17%	474	6.29E-04	21	3.25%	250	3.31E-04
6	0.85%	66	8.70E-05	14	6.05%	465	6.17E-04	22	3.31%	255	3.38E-04
7	3.73%	287	3.80E-04	15	7.06%	542	7.19E-04	23	2.48%	191	2.53E-04
8	7.77%	597	7.92E-04	16	7.18%	552	7.32E-04	24	1.87%	144	1.90E-04
								Total		7,686	

2021 Hourly Traffic Volumes Per Direction and TOG Exhaust Emissions - TEXH_SB_PUL

Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile
1	1.12%	86	1.13E-04	9	7.12%	547	7.17E-04	17	7.43%	571	7.49E-04
2	0.42%	32	4.19E-05	10	4.38%	337	4.42E-04	18	8.23%	633	8.29E-04
3	0.37%	29	3.75E-05	11	4.65%	357	4.68E-04	19	5.72%	440	5.76E-04
4	0.17%	13	1.72E-05	12	5.89%	453	5.94E-04	20	4.31%	331	4.34E-04
5	0.45%	35	4.54E-05	13	6.17%	474	6.22E-04	21	3.25%	250	3.27E-04
6	0.85%	66	8.59E-05	14	6.05%	465	6.09E-04	22	3.31%	255	3.34E-04
7	3.73%	287	3.76E-04	15	7.06%	542	7.11E-04	23	2.48%	191	2.50E-04
8	7.77%	597	7.82E-04	16	7.18%	552	7.24E-04	24	1.87%	144	1.88E-04
								Total		7,686	

JobTrain, East Palo Alto, CA - On- and Off-Site Residential
Cumulative Operation - Plugas Avenue
TOG Evaporative Emissions Modeling - Roadway Links, Traffic Volumes, and TOG Evaporative Emissions
Year = 2021

Road Link	Description	Direction	No. Lanes	Link Length (m)	Link Length (mi)	Link Width (m)	Link Width (ft)	Release Height (m)	Average Speed (mph)	Average Vehicles per Day
TEVAP_NB_PUL	Pulgas Avenue Northbound	NB	1	125.1	0.08	9.7	32	1.3	25	7,686
TEVAP_SB_PUL	Pulgas Avenue Southbound	SB	1	123.6	0.08	9.7	32	1.3	25	7,686
									Total	15,372

Emission Factors - PM2.5 - Evaporative TOG

Speed Category	1	2	3	4
Travel Speed (mph)	25			
Emissions per Vehicle per Hour (g/hour)	1.31349			
Emissions per Vehicle per Mile (g/VMT)	0.05254			

2021 Hourly Traffic Volumes and TOG Evaporative Emissions - TEVAP_NB_PUL

Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s
1	1.12%	86	9.80E-05	9	7.12%	547	6.21E-04	17	7.43%	571	6.48E-04
2	0.42%	32	3.62E-05	10	4.38%	337	3.82E-04	18	8.23%	633	7.18E-04
3	0.37%	29	3.24E-05	11	4.65%	357	4.06E-04	19	5.72%	440	4.99E-04
4	0.17%	13	1.49E-05	12	5.89%	453	5.14E-04	20	4.31%	331	3.75E-04
5	0.45%	35	3.93E-05	13	6.17%	474	5.38E-04	21	3.25%	250	2.83E-04
6	0.85%	66	7.44E-05	14	6.05%	465	5.28E-04	22	3.31%	255	2.89E-04
7	3.73%	287	3.25E-04	15	7.06%	542	6.15E-04	23	2.48%	191	2.16E-04
8	7.77%	597	6.77E-04	16	7.18%	552	6.26E-04	24	1.87%	144	1.63E-04
								Total		7,686	

2021 Hourly Traffic Volumes Per Direction and TOG Evaporative Emissions - TEVAP_SB_PUL

Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile
1	1.12%	86	9.69E-05	9	7.12%	547	6.13E-04	17	7.43%	571	6.40E-04
2	0.42%	32	3.58E-05	10	4.38%	337	3.78E-04	18	8.23%	633	7.09E-04
3	0.37%	29	3.20E-05	11	4.65%	357	4.01E-04	19	5.72%	440	4.93E-04
4	0.17%	13	1.47E-05	12	5.89%	453	5.08E-04	20	4.31%	331	3.71E-04
5	0.45%	35	3.88E-05	13	6.17%	474	5.32E-04	21	3.25%	250	2.80E-04
6	0.85%	66	7.35E-05	14	6.05%	465	5.21E-04	22	3.31%	255	2.85E-04
7	3.73%	287	3.22E-04	15	7.06%	542	6.08E-04	23	2.48%	191	2.14E-04
8	7.77%	597	6.69E-04	16	7.18%	552	6.19E-04	24	1.87%	144	1.61E-04
								Total		7,686	

JobTrain, East Palo Alto, CA - On- and Off-Site Residential
Cumulative Operation - Plugas Avenue
Fugitive Road PM2.5 Modeling - Roadway Links, Traffic Volumes, and Fugitive Road PM2.5 Emissions
Year = 2021

Road Link	Description	Direction	No. Lanes	Link Length (m)	Link Length (mi)	Link Width (m)	Link Width (ft)	Release Height (m)	Average Speed (mph)	Average Vehicles per Day
FUG_NB_PUL	Pulgas Avenue Northbound	NB	1	125.1	0.08	9.7	32	1.3	25	7,686
FUG_SB_PUL	Pulgas Avenue Southbound	SB	1	123.6	0.08	9.7	32	1.3	25	7,686
									Total	15,372

Emission Factors - Fugitive PM2.5

Speed Category	1	2	3	4
Travel Speed (mph)	25			
Tire Wear - Emissions per Vehicle (g/VMT)	0.00205			
Brake Wear - Emissions per Vehicle (g/VMT)	0.01678			
Road Dust - Emissions per Vehicle (g/VMT)	0.01469			
otal Fugitive PM2.5 - Emissions per Vehicle (g/VMT)	0.03352			

2021 Hourly Traffic Volumes and Fugitive PM2.5 Emissions - FUG_NB_PUL

Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s	Hour	% Per Hour	VPH	g/s
1	1.12%	86	6.26E-05	9	7.12%	547	3.96E-04	17	7.43%	571	4.14E-04
2	0.42%	32	2.31E-05	10	4.38%	337	2.44E-04	18	8.23%	633	4.58E-04
3	0.37%	29	2.07E-05	11	4.65%	357	2.59E-04	19	5.72%	440	3.18E-04
4	0.17%	13	9.49E-06	12	5.89%	453	3.28E-04	20	4.31%	331	2.39E-04
5	0.45%	35	2.51E-05	13	6.17%	474	3.43E-04	21	3.25%	250	1.81E-04
6	0.85%	66	4.75E-05	14	6.05%	465	3.37E-04	22	3.31%	255	1.84E-04
7	3.73%	287	2.08E-04	15	7.06%	542	3.93E-04	23	2.48%	191	1.38E-04
8	7.77%	597	4.32E-04	16	7.18%	552	4.00E-04	24	1.87%	144	1.04E-04
								Total		7,686	

2021 Hourly Traffic Volumes Per Direction and Fugitive PM2.5 Emissions - FUG_SB_PUL

Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile	Hour	% Per Hour	VPH	g/mile
1	1.12%	86	6.18E-05	9	7.12%	547	3.91E-04	17	7.43%	571	4.09E-04
2	0.42%	32	2.28E-05	10	4.38%	337	2.41E-04	18	8.23%	633	4.53E-04
3	0.37%	29	2.04E-05	11	4.65%	357	2.56E-04	19	5.72%	440	3.15E-04
4	0.17%	13	9.38E-06	12	5.89%	453	3.24E-04	20	4.31%	331	2.37E-04
5	0.45%	35	2.48E-05	13	6.17%	474	3.39E-04	21	3.25%	250	1.79E-04
6	0.85%	66	4.69E-05	14	6.05%	465	3.33E-04	22	3.31%	255	1.82E-04
7	3.73%	287	2.05E-04	15	7.06%	542	3.88E-04	23	2.48%	191	1.36E-04
8	7.77%	597	4.27E-04	16	7.18%	552	3.95E-04	24	1.87%	144	1.03E-04
								Total		7,686	

JobTrain, East Palo Alto, CA - Pulgas Avenue Traffic - TACs & PM2.5
AERMOD Risk Modeling Parameters and Maximum Concentrations
at Construction Residential MEI Receptor (1.5 meter receptor height)

Emission Year	2021
Receptor Information	Construction Residential MEI receptor
Number of Receptors	1
Receptor Height	1.5 meters
Receptor Distances	At Construction Residential MEI location
Meteorological Conditions	
BAQMD Moffett Airfield Met Data	2013-2017
Land Use Classification	Urban
Wind Speed	Variable
Wind Direction	Variable

Construction Residential MEI Cancer Risk Maximum Concentrations

Meteorological	Concentration (µg/m3)*		
Data Years	DPM	Exhaust TOG	Evaporative TOG
2013-2017	0.0037	0.2961	0.2531

Construction Residential MEI PM2.5 Maximum Concentrations

Meteorological	PM2.5 Concentration (µg/m3)*		
Data Years	Total PM2.5	Fugitive PM2.5	Vehicle PM2.5
2013-2017	0.1757	0.1616	0.0142

JobTrain, East Palo Alto, CA - Pulgas Avenue Traffic Cancer Risk
Impacts at Construction Residential MEI - 1.5 meter receptor height
30 Year Residential Exposure

Cancer Risk Calculation Method

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Cancer Potency Factors $(mg/kg\text{-}day)^{-1}$

TAC	CPF
DPM	1.10E+00
Vehicle TOG Exhaust	6.28E-03
Vehicle TOG Evaporative	3.70E-04

Values

	Infant/Child			Adult
Age -->	**3rd Trimester**	**0 - 2**	**2 - 16**	**16 - 30**
Parameter				
ASF =	10	10	3	1
DBR* =	361	1090	572	261
A =	1	1	1	1
EF =	350	350	350	350
AT =	70	70	70	70
FAH =	1.00	1.00	1.00	0.73

* 95th percentile breathing rates for infants and 80th percentile for children and adults

Construction Cancer Risk by Year - Maximum Impact Receptor Location

Maximum - Exposure Information					Concentration (ug/m3)			Cancer Risk (per million)			
Exposure Year	**Exposure Duration (years)**	**Age**	**Year**	**Age Sensitivity Factor**	**DPM**	**Exhaust TOG**	**Evaporative TOG**	**DPM**	**Exhaust TOG**	**Evaporative TOG**	**TOTAL**
0	0.25	-0.25 - 0*	2021	10	0.0037	0.2961	0.2531	0.050	0.023	0.0012	0.07
1	1	0 - 1	2021	10	0.0037	0.2961	0.2531	0.604	0.278	0.0140	0.90
2	1	1 - 2	2022	10	0.0037	0.2961	0.2531	0.604	0.278	0.0140	0.90
3	1	2 - 3	2023	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
4	1	3 - 4	2024	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
5	1	4 - 5	2025	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
6	1	5 - 6	2026	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
7	1	6 - 7	2027	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
8	1	7 - 8	2028	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
9	1	8 - 9	2029	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
10	1	9 - 10	2030	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
11	1	10 - 11	2031	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
12	1	11 - 12	2032	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
13	1	12 - 13	2033	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
14	1	13 - 14	2034	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
15	1	14 - 15	2035	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
16	1	15 - 16	2036	3	0.0037	0.2961	0.2531	0.095	0.044	0.0022	0.14
17	1	16-17	2037	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
18	1	17-18	2038	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
19	1	18-19	2039	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
20	1	19-20	2040	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
21	1	20-21	2041	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
22	1	21-22	2042	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
23	1	22-23	2043	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
24	1	23-24	2044	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
25	1	24-25	2045	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
26	1	25-26	2046	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
27	1	26-27	2047	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
28	1	27-28	2048	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
29	1	28-29	2049	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
30	1	29-30	2050	1	0.0037	0.2961	0.2531	0.011	0.005	0.0002	0.02
Total Increased Cancer Risk								2.74	1.258	0.063	**4.1**

* Third trimester of pregnancy

Hazard Index	**Maximum Fugitive PM2.5**	**Total PM2.5**
0.0007	0.16	0.18

JobTrain, East Palo Alto, CA - Pulgas Avenue Traffic - TACs & PM2.5
AERMOD Risk Modeling Parameters and Maximum Concentrations
On-Site 1st Floor Daycare Child (3-5 years old) Receptors (1 meter receptor height)

Emission Year	2021
Receptor Information	Maximum On-Site Receptor
Number of Receptors	108
Receptor Height	1 meter
Receptor Distances	7 meter grid spacing
Meteorological Conditions	
BAQMD Moffett Airfield Met Data	2013-2017
Land Use Classification	Urban
Wind Speed	Variable
Wind Direction	Variable

Construction School MEI Cancer Risk Maximum Concentrations

Meteorological	Concentration (µg/m3)*		
Data Years	DPM	Exhaust TOG	Evaporative TOG
2013-2017	0.0001	0.0075	0.0064

Construction School MEI PM2.5 Maximum Concentrations

Meteorological	PM2.5 Concentration (µg/m3)*		
Data Years	Total PM2.5	Fugitive PM2.5	Vehicle PM2.5
2013-2017	0.0045	0.0041	0.0004

JobTrain, East Palo Alto, CA - Pulgas Avenue Traffic Cancer Risk
Impacts at On-Site 1st Floor Daycare Child Receptors - 1 meter receptor height
3 Year Daycare Child (3-5 years old) Exposure

Cancer Risk Calculation Method

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
SAF = Student Adjustment Factor (unitless)
= (24 hrs/9 hrs) x (7 days/5 days) = 3.73
8-Hr BR = Eight-hour breathing rate (L/kg body weight-per 8 hrs)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Cancer Potency Factors $(mg/kg\text{-}day)^{-1}$

TAC	CPF
DPM	1.10E+00
Vehicle TOG Exhaust	6.28E-03
Vehicle TOG Evaporative	3.70E-04

Values

	Infant/Child			Adult
Age --> Parameter	**3rd Trimester**	**0 - 2**	**2 - 16**	**16 - 30**
ASF =	10	10	3	1
8-Hr BR* =	361	1200	520	240
A =	1	1	1	1
EF =	250	250	250	250
AT =	70	70	70	70
FAH =	1.00	1.00	3.73	1.00

* 95th percentile 8-hr breathing rates for moderate intensity activities

Construction Cancer Risk by Year - Maximum Impact Receptor Location

Maximum - Exposure Information					Concentration (ug/m3)			Cancer Risk (per million)						
Exposure Year	**Exposure Duration (years)**	**Age**	**Year**	**Age Sensitivity Factor**	**DPM**	**Exhaust TOG**	**Evaporative TOG**	**DPM**	**Exhaust TOG**	**Evaporative TOG**	**TOTAL**	**Hazard Index**	**Maximum Fugitive PM2.5**	**Total PM2.5**
1	1	3 - 4	2021	3	0.0001	0.0075	0.0064	0.009	0.003	0.0001	0.01	0.00003	0.004	0.004
2	1	4 - 5	2022	3	0.0001	0.0075	0.0064	0.009	0.003	0.0001	0.01			
3	1	5 - 6	2023	3	0.0001	0.0075	0.0064	0.009	0.003	0.0001	0.01			
Total Increased Cancer Risk								0.03	0.008	0.000	**0.03**			

* Children assumed to be 3-5 years old with 3 years of Exposure

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May 7, 2021

Carolyn Neer, AICP
Project Manager
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San José, CA 95126

Via email: cneer@davidjpowers.com

Subject: 2535 Pulgas Avenue (JobTrain) Sanitary Sewer Scenarios, East Palo Alto, CA Addendum to the Air Quality and Greenhouse Gas Assessment

Dear Carolyn:

In February 2021, *Illingworth & Rodkin, Inc*. drafted an air quality and greenhouse gas (GHG) assessment for the 2535 Pulgas Avenue (JobTrain) office building project in East Palo Alto, California.[1] The applicant is considering two potential scenarios for the sanitary sewer service at the project site. Neither of these scenarios were addressed in the air quality analysis.

The preferred option would be to connect the project sewer to the East Palo Alto Sanitary District (EPASD), which would include connecting to the existing six-inch sanitary sewer main along Pulgas Avenue. The applicant would be paying for improvements downstream along Bay Road and the Bay Trail. These improvements would qualify for a statutory exemption under CEQA and would not require further analysis. If this first option is not feasible, then the second option would be to construct an on-site sanitary sewer treatment plant to serve the office building demand.

This addendum letter discusses the potential impact generated by the second option to construct an on-site sanitary sewer treatment plant.

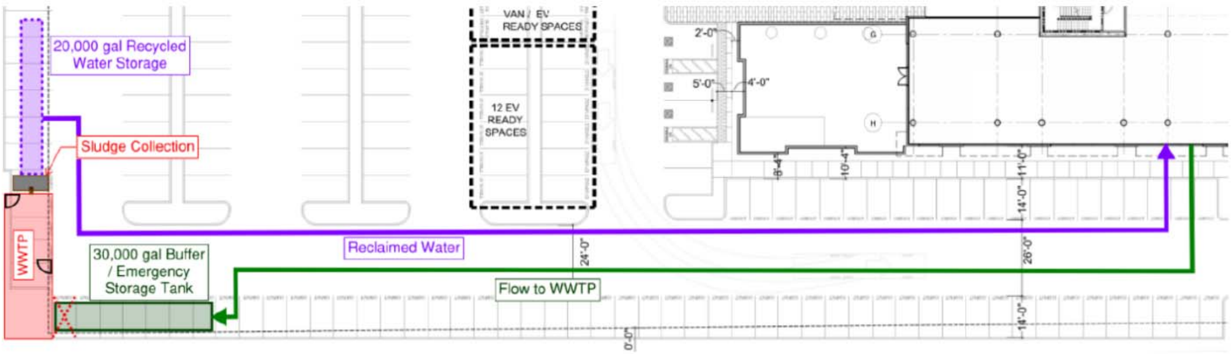
On-Site Sanitary Sewer Treatment Option

The on-site treatment facility would have a treatment capacity of 6,000 gallons per day and would be located in the southwest corner of the project site, as shown in Figure 1. The on-site sanitary sewer plant would have four main components: 1) 30,000-gallon buffer/emergency storage tank; 2) wastewater treatment plant; 3) sludge collector; and 4) 20,000-gallon recycled water storage tank. Two pipes would connect the on-site sanitary sewer treatment plant to the office building

[1] Illingworth & Rodkin, Inc., "JobTrain Air Quality and Greenhouse Gas Assessment," February 17, 2021.

transporting sewage from the office building to the treatment plant and returning processed, reclaimed water from the treatment plant back to the office building. In total, all four components of the sanitary sewer facility would occupy approximately 2,490 square feet and have a maximum height of 23 feet above grade. The maximum depth of excavation necessary to accommodate the on-site sanitary sewer system foundation would be approximately 2 feet below the existing grade. Approximately 15.37 cubic yards of soil would be exported during construction of the on-site sanitary sewer treatment plant foundation.

Figure 1. On-Site Sanitary Sewer Treatment Option



Construction Criteria Air Pollutants

The California Emissions Estimator Model (CalEEMod) Version 2016.3.2 was used to estimate emissions from on-site construction activity, construction vehicle trips, and evaporative emissions. The sanitary sewer option land use types and size, and anticipated construction schedule were input to CalEEMod. The CARB EMission FACtors 2017 (EMFAC2017) model was used to predict emissions from construction traffic, which includes worker travel, vendor trucks, and haul trucks.[2] The CalEEMod model output along with construction inputs are included in *Attachment 1* and EMFAC2017 vehicle emissions modeling outputs are included in *Attachment 2*.

CalEEMod Inputs

Land Use Inputs

The proposed on-site sanitary sewer uses were entered into CalEEMod as described in Table 1.

Table 1. Summary of Sanitary Sewer Land Use Inputs

Project Land Uses	Size	Units	Square Feet (sf)	Acreage
User Defined Industrial	2.5	1,000-sf	2,500	1.0
Other Asphalt Surface	10.0	1,000-sf	10,000	
Note: CalEEMod does not have a land use for a sewer treatment facility or sewer pipeline, so the user defined industrial and other asphalt surface uses were used and sizes were based on provided information.				

[2] See CARB's EMFAC2017 Web Database at https://www.arb.ca.gov/emfac/2017/

Construction Inputs

Pre-manufactured wastewater equipment would be brought to and installed on the site for the on-site sewer system option. The maximum depth of excavation necessary to accommodate the on-site sanitary sewer system foundation would be approximately 2 feet below the existing grade. Approximately 15.37 cubic yards of soil would be exported during construction of the on-site sanitary sewer treatment plant foundation.

CalEEMod computes annual emissions for construction that are based on the project type, size, and acreage. The model provides emission estimates for both on-site and off-site construction activities. On-site activities are primarily made up of construction equipment emissions, while off-site activity includes worker, hauling, and vendor traffic. The construction build-out scenario, including equipment list and schedule, were based on CalEEMod defaults for a project of this type and size.

The sanitary sewer construction equipment worksheet included the CalEEMod default schedule for each phase minus the building exterior and interior phases since the sewer equipment would come pre-manufactured. Within each phase, the quantity of equipment to be used along with the average hours per day and total number of workdays was also based on CalEEMod defaults. The construction schedule assumed that the earliest possible start date would be May 2021 and the sanitary sewer facility would be built out over a period of approximately 2 to 3 months, or approximately 40 construction workdays.

Construction Truck Traffic Emissions

The construction traffic information was combined with EMFAC2017 motor vehicle emissions factors. Construction would produce traffic in the form of worker trips and truck traffic. The traffic-related emissions are based on worker and vendor trip estimates produced by CalEEMod and haul trips that were computed based on the estimate of five trips per day for soil material exported to the site and the estimate of cement and asphalt truck trips. CalEEMod provides daily estimates of worker and vendor trips for each applicable phase. The total trips for those were computed by multiplying the daily trip rate by the number of days in that phase. On-road emission rates from the years 2021 for San Mateo County were used. Table 2 provides the traffic inputs that were combined with the EMFAC2017 emission database to compute vehicle emissions.

Table 2. Construction Traffic Data Used for EMFAC2017 Model Runs

CalEEMod Run/Land Uses and Construction Phase	Trips by Trip Type			Notes
	Total Worker[1]	Total Vendor[1]	Total Haul[2]	
Vehicle mix[1]	63.6% LDA 8.6% LDT1 27.8% LDT2	76.6% MHDT 23.4% HHDT	100% HHDT	
Trip Length (miles)	10.8	7.3	20.0 (Demo/Soil) 7.3 (Cement/Asphalt)	CalEEMod default distance with 5-min truck idle time.
Demolition	260	-	-	CalEEMod default worker trips.
Site Preparation	16	-	-	CalEEMod default worker trips.
Grading	32	-	2	16-cy of export volume. CalEEMod default worker trips.
Trenching	20	-	-	CalEEMod default worker trips.
Paving	130	-	-	CalEEMod default worker trips.

Notes: [1] Based on 2021 EMFAC2017 light-duty vehicle fleet mix for San Mateo County.
[2] Includes grading trips estimated by CalEEMod based on amount of material to be removed.

Summary of Computed Construction Period Emissions

Average daily emissions were annualized for each year of construction by dividing the annual construction emissions by the number of active workdays during that year. Table 3 shows average daily construction emissions of ROG, NO_X, PM_{10} exhaust, and $PM_{2.5}$ fugitive during construction of the project. As indicated in Table 3, predicted construction period emissions would not exceed the BAAQMD significance thresholds.

Table 3. Construction Period Emissions

Year	ROG	NOx	PM_{10} Exhaust	$PM_{2.5}$ Fugitive
Construction Emissions Per Year (Tons)				
2021	0.03	0.29	0.02	0.01
Average Daily Construction Emissions Per Year (pounds/day)				
2021 (40 construction workdays)	1.51	14.56	0.76	0.70
BAAQMD Thresholds (pounds per day)	*54* lbs./day	*54* lbs./day	*82* lbs./day	*54* lbs./day
Exceed Threshold?	No	No	No	No

Construction activities, particularly during site preparation and grading, would temporarily generate fugitive dust in the form of PM_{10} and $PM_{2.5}$. Sources of fugitive dust would include disturbed soils at the construction site and trucks carrying uncovered loads of soils. Unless properly controlled, vehicles leaving the site would deposit mud on local streets, which could be an additional source of airborne dust after it dries. The BAAQMD CEQA Air Quality Guidelines consider these impacts to be less-than-significant if best management practices are implemented to reduce these emissions. The applicant of Mitigation Measure AQ-1 from the original project report would implement BAAQMD-recommended best management practices.

Community Health Risk from Sanitary Sewer Facility Construction

Construction Emissions

The CalEEMod and EMFAC2017 models provided total annual PM_{10} exhaust emissions (assumed to be DPM) for the off-road construction equipment and for exhaust emissions from on-road vehicles, with total emissions from all construction stages as 0.0150 tons (30 pounds). The on-road emissions are a result of haul truck travel during demolition and grading activities, worker travel, and vendor deliveries during construction. A trip length of one mile was used to represent vehicle travel while at or near the construction site. It was assumed that these emissions from on-road vehicles traveling at or near the site would occur at the construction site. Fugitive $PM_{2.5}$ dust emissions were calculated by CalEEMod as 0.0085 tons (17 pounds) for the overall construction period.

Dispersion Modeling

Dispersion modeling for the sanity sewer facility construction was conducted using the same methods in the original air quality analysis. These methods included using the U.S. EPA AERMOD dispersion model was used to predict DPM and $PM_{2.5}$ concentrations at nearby sensitive receptors (residences), using area sources for exhaust emissions of DPM and fugitive $PM_{2.5}$ dust emissions, using Moffett Federal Airfield meteorological data, and using the same sensitive receptors locations.

Summary of Construction Community Risk Impacts

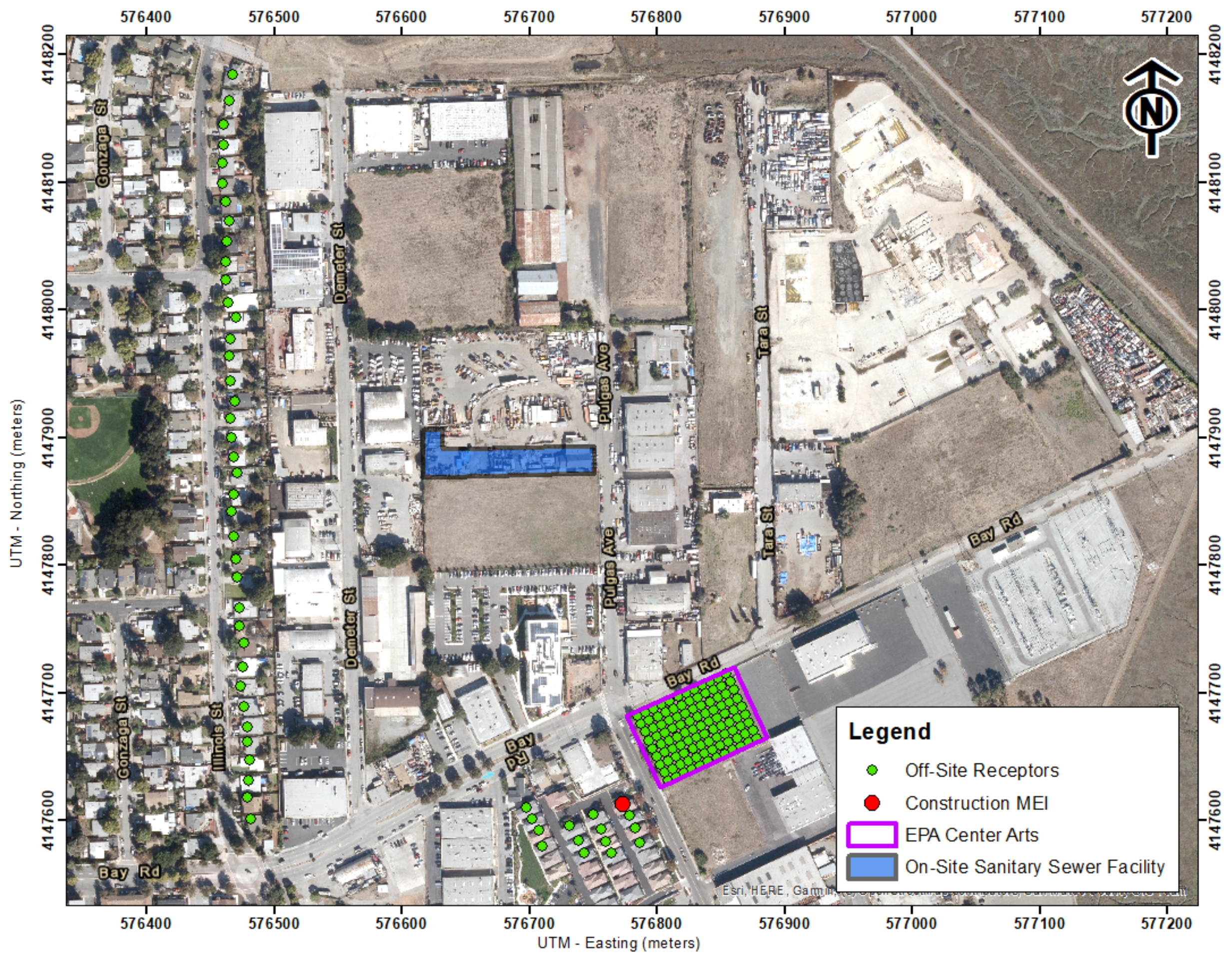
The maximum modeled annual DPM and $PM_{2.5}$ concentrations, were identified at nearby sensitive receptors to find the MEI. Results of this assessment indicated that the MEI most affected by sewer sanitary facility construction was located at the same MEI as was found for the original project construction (i.e., a single-family residence to the south of the project site along Pulgas Avenue). The location of the MEI and nearby sensitive receptors are shown in Figure 2. Table 4 lists the community risks from construction at the location of the residential MEI. *Attachment 3* to this report includes the emission calculations used for the construction modeling and the cancer risk calculations.

Additionally, modeling was conducted to predict the cancer risks, non-cancer health hazards, and maximum $PM_{2.5}$ concentrations associated with construction activities at the nearby art center. The maximum increased cancer risks were adjusted using child exposure parameters. The uncontrolled cancer risk, $PM_{2.5}$ concentration, and HI at the nearby art center would not exceed their respective BAAQMD single-source significance thresholds, as shown in Table 4.

Table 4. Construction Risk Impacts at the Offsite Project MEI

Source		Cancer Risk (per million)	Annual $PM_{2.5}$ ($\mu g/m^3$)	Hazard Index
Sewer Construction	Unmitigated	1.32 (infant)	0.01	<0.01
	BAAQMD Single-Source Threshold	***10***	***0.3***	***1.0***
Exceed Threshold?	Unmitigated	*No*	*No*	*No*
Most Affected Nearby Child – EPA Center Arts Child Receptor				
Sewer Construction	Unmitigated	0.64 (child)	0.02	<0.01
BAAQMD Single-Source Threshold		***10***	***0.3***	***1.0***
Exceed Threshold?	Unmitigated	*No*	*No*	*No*

Figure 2. Sanitary Sewer Facility Construction Site, Locations of Off-Site Sensitive Receptors, and TAC Impacts



Combined Health Risk from Sanitary Sewer Facility and Project

The community health risk from the sanitary sewer construction and the original project construction and operation at the MEI was combined to present to total project health risk impacts. As shown in Table 5, the unmitigated maximum increased cancer risks, maximum $PM_{2.5}$

concentration, and health hazard indexes from construction and operation activities of the total project at the project MEI do not exceed their respective BAAQMD single-source thresholds.

Table 5. Community Risk Impacts at the Offsite Project MEI

Source		Cancer Risk (per million)	Annual $PM_{2.5}$ ($\mu g/m^3$)	Hazard Index
Sewer Construction	Unmitigated	1.32 (infant)	0.01	<0.01
Project Construction and Operation	Unmitigated	6.23 (infant)	0.04	<0.01
Total Project	Unmitigated	7.55 (infant)	0.05	<0.02
	BAAQMD Single-Source Threshold	***10***	***0.3***	***1.0***
Exceed Threshold?		*No*	*No*	*No*
Most Affected Nearby Child – EPA Center Arts Child Receptor				
Sewer Construction	Unmitigated	0.64 (child)	0.02	<0.01
Project Construction and Operation	Unmitigated	3.26 (infant)	0.03	<0.01
Total Project	Unmitigated	3.90 (infant)	0.05	<0.02
BAAQMD Single-Source Threshold		***10***	***0.3***	***1.0***
Exceed Threshold?		*No*	*No*	*No*

Table 6 reports both the total project and cumulative community risk impacts at the sensitive receptors most affected by the project with sewer treatment (i.e., the MEI). Without mitigation, the total project's community risk from project activities would not exceed the single-source maximum increased cancer risk, $PM_{2.5}$ concentration, or HI thresholds. In addition, the combined unmitigated cancer risk, $PM_{2.5}$ concentration, and HI values would not exceed their respective cumulative thresholds.

Table 6. Cumulative Community Risk Impacts from Combined TAC Sources at MEI

Source		Cancer Risk (per million)	$PM_{2.5}$ concentration ($\mu g/m^3$)	Hazard Index
Total Project Impacts				
Total Project	Unmitigated	7.55 (infant)	0.05	<0.02
	BAAQMD Single-Source Threshold	***10***	***0.3***	***1.0***
Exceed Threshold?		*No*	*No*	*No*
Cumulative Impacts				
Bay Road, 22,606 ADT		5.21 (infant)	0.21	<0.01
Pulgas Avenue, 15,372 ADT		4.06 (infant)	0.18	<0.01
West Bay Sanitary District (Facility ID #21311, Generators), MEI +1,000 feet		0.02	--	--
Cal Spray Inc. (Facility ID #610, Spray booth & abrasives blasting) MEI 300 feet		--	<0.01	<0.01
Sobrato Center for Community Services Mitigated Construction Emissions – MEI 600 feet south		<10.0	<0.3	<1.0
Combined Sources	Unmitigated	26.82 (infant)	<0.75	<1.05
	BAAQMD Cumulative-Source Threshold	***100***	***0.8***	***10.0***
Exceed Threshold?		*No*	*No*	*No*

Operational Criteria Air Pollutant and GHG Emissions

The operational criteria air pollutant and GHG emissions for the on-site sanitary sewer treatment plant would be negligible compared to the main office project. The sanity sewer facility would not have any combustion sources that would emit criteria pollutant or GHG emissions, and any potential volatile organic compounds (VOCs) associated with the sanity sewer facility would be minimal compared to the main office project. In addition, the sanity sewer facility would not produce vehicle trips or mobile GHG emissions separately from the main office project and the other GHG emissions (i.e., waste, water) would already be accounted for in the main office building's emissions.

Odors

The proposed on-site sanitary sewer treatment plant would be a small, enclosed facility that would only serve to treat the one proposed project office building. The new pre-manufactured wastewater equipment would be equipped with modern technology that would minimize the release of any odors and the proposed sewer treatment plant does not include any lagoons, exposed treatment water, or biosolid piles that would emit odors. In addition, given that the wind direction would be coming from the north-northwest and the closest sensitive receptors are approximately 450 feet west and 650 feet south, any odors from the proposed sanity sewer facility would disperse to levels that would not be objectionable to those sensitive receptors. Therefore, the proposed on-site sanitary sewer treatment plant project would not include any sources of significant odors that would cause complaints from surrounding uses.

♦ ♦ ♦

This concludes the assessment for air quality and health risk impacts due to the second option to construct an on-site sanitary sewer treatment plant for the JobTrain project. Please feel free to contact us with any questions on the analysis or if we can be of further assistance.

Sincerely,

Casey Divine

Casey Divine
Consultant
Illingworth & Rodkin, Inc.

(I&R #19-138)

Supporting Documentation

Attachment 1 includes the CalEEMod output for project construction criteria air pollutant emissions. Also included are any modeling assumptions.

Attachment 2 includes the EMFAC2017 emissions modeling. The input files for these calculations are voluminous and are available upon request in digital format.

Attachment 3 includes the construction health risk assessment. AERMOD dispersion modeling files for this assessment, which are quite voluminous, are available upon request and would be provided in digital format.

Attachment 1: CalEEMod Modeling Inputs and Outputs

Air Quality/Noise Construction Information Data Request

Project Name: Jobtrain Sewer Treatment

Complete ALL Portions in Yellow

See Equipment Type TAB for type, horsepower and load factor

Project Size
- ____ Dwelling Units ____1 total project acres disturbed
- ____ s.f. residential
- 2500 s.f. User Defined Industrial (Sewer System)
- 10000 s.f. Other Asphalt Surface (Pipeline to building)
- ____ s.f. other, specify:
- ____ s.f. parking garage ____ spaces
- ____ s.f. parking lot ____ spaces

Construction Hours ____ am to ____ pm

Pile Driving? Y/N?

Project include on-site GENERATOR OR FIRE PUMP during project OPERATION? Y/N? ____

IF YES (if BOTH separate values) -->

Kilowatts/Horsepower: ________

Fuel Type: ___________

Location in project (Plans Desired if Available):

DO NOT MULTIPLY EQUIPMENT HOURS/DAY BY THE QUANTITY OF EQUIPMENT

Quantity	Description	HP	Load Factor	Hours/day	Total Work Days	Avg. Hours per day	HP Annual Hours	Comments
	Demolition	**Start Date:**	5/3/2021	**Total phase:**	20			**Overall Import/Export Volumes**
		End Date:	5/28/2021					
1	Concrete/Industrial Saws	81	0.73	8	20	8	9461	**Demolition Volume**
	Excavators	158	0.38			0	0	Square footage of buildings to be demolished
1	Rubber-Tired Dozers	247	0.4	8	20	8	15808	(*or* total tons to be hauled)
3	Tractors/Loaders/Backhoes	97	0.37	8	20	8	17227	_?_ square feet *or*
	Other Equipment?							_?_ Hauling volume (tons)
								Any pavement demolished and hauled? _?_ tons
	Site Preparation	**Start Date:**	5/29/2021	**Total phase:**	2			
		End Date:	6/1/2021					
1	Graders	187	0.41	8	2	8	1227	
1	Rubber Tired Dozers	247	0.4	7	2	7	1383	
1	Tractors/Loaders/Backhoes	97	0.37	8	2	8	574	
	Other Equipment?							
	Grading / Excavation	**Start Date:**	6/2/2021	**Total phase:**	4			
		End Date:	6/7/2021					**Soil Hauling Volume**
	Excavators	158	0.38			0	0	Export volume = _16_ cubic yards?
1	Graders	187	0.41	6	4	6	1840	Import volume = _?_ cubic yards?
1	Rubber Tired Dozers	247	0.4	6	4	6	2371	
	Concrete/Industrial Saws	81	0.73			0	0	
1	Tractors/Loaders/Backhoes	97	0.37	7	4	7	1005	
	Other Equipment?							
	Trenching/Foundation	**Start Date:**	6/8/2021	**Total phase:**	4			
		End Date:	6/11/2021					
1	Tractor/Loader/Backhoe	97	0.37	8	4	8	1148	
1	Excavators	158	0.38	8	4	8	1921	
	Other Equipment?							
	Building - Exterior	**Start Date:**		**Total phase:**				**Cement Trucks? _?_ Total Round-Trips**
		End Date:						
	Cranes	231	0.29			#DIV/0!	0	Electric? (Y/N) ___ Otherwise assumed diesel
	Forklifts	89	0.2			#DIV/0!	0	Liquid Propane (LPG)? (Y/N) ___ Otherwise Assumed diesel
	Generator Sets	84	0.74			#DIV/0!	0	Or temporary line power? (Y/N) ___
	Tractors/Loaders/Backhoes	97	0.37			#DIV/0!	0	
	Welders	46	0.45			#DIV/0!	0	
	Other Equipment?							
Building - Interior/Architectural Coating		**Start Date:**		**Total phase:**				
		End Date:						
	Air Compressors	78	0.48			#DIV/0!	0	
	Aerial Lift	62	0.31			#DIV/0!	0	
	Other Equipment?							
	Paving	**Start Date:**	6/12/2021	**Total phase:**	10			
		Start Date:	6/25/2021					
1	Cement and Mortar Mixers	9	0.56	6	10	6	302	
1	Pavers	130	0.42	6	10	6	3276	**Asphalt? ___ cubic yards or ____ round trips?**
1	Paving Equipment	132	0.36	8	10	8	3802	
1	Rollers	80	0.38	7	10	7	2128	
1	Tractors/Loaders/Backhoes	97	0.37	8	10	8	2871	
	Other Equipment?							
	Additional Phases	**Start Date:**		**Total phase:**				
		Start Date:						
						#DIV/0!	0	
						#DIV/0!	0	
						#DIV/0!	0	
						#DIV/0!	0	
						#DIV/0!	0	

Equipment types listed in "Equipment Types" worksheet tab.

Equipment listed in this sheet is to provide an example of inputs

Complete one sheet for each project component

It is assumed that water trucks would be used during grading

Add or subtract phases and equipment, as appropriate

Modify horsepower or load factor, as appropriate

Construction Criteria Air Pollutants						
Unmitigated	ROG	NOX	PM10 Exhaust	PM2.5 Exhaust	**CO2e**	
Year	Tons				MT	
Construction Equipment						
2021	0.0297	0.2905	0.015	0.0139	34.152	
EMFAC						
2021	0.0004	0.0006	0.0003	0.0001	1.47	
Total Construction Emissions by Year						
2021	0.03	0.29	0.02	0.01	35.62	
	Total Construction Emissions					
Tons	0.03	0.29	0.02	0.01	35.62	
Pounds/Workdays	*Average Daily Emissions*				Workdays	
2021	1.51	14.56	0.76	0.70		**40**
Threshold - lbs/day	**54.0**	**54.0**	**82.0**	**54.0**		
	Total Construction Emissions					
Pounds	1.51	14.56	0.76	0.70	0.00	
Average	1.51	14.56	0.76	0.70	0.00	40.00
Threshold - lbs/day	**54.0**	**54.0**	**82.0**	**54.0**		

OnSite Sewer Treatment JobTrain 2535 Pulgas Ave, E Palo Alto

San Mateo County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Industrial	1.00	User Defined Unit	1.00	2,500.00	0
Other Asphalt Surfaces	10.00	1000sqft	0.23	10,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	70
Climate Zone	5			**Operational Year**	2023
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	138	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - PCE 2018 Co2 Intensity rate w/ 90% PCE & 10% PGE = 138

Land Use - Provided land use description - 2,500sf sewer system, esimtaed 10,000-sf pipeline to building

Construction Phase - Default construction scheudle - pre-manufacture treatment system - no building const exterior / interior

Off-road Equipment -

Off-road Equipment - Default construction equipment & hours

Off-road Equipment -

Off-road Equipment -

Off-road Equipment -

Off-road Equipment - Trenching added

Grading - grading = 16cy export

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblGrading	MaterialExported	0.00	16.00
tblLandUse	LandUseSquareFeet	0.00	2,500.00
tblLandUse	LotAcreage	0.00	1.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	138

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.0297	0.2905	0.2248	3.9000e-004	0.0175	0.0150	0.0324	8.4900e-003	0.0139	0.0224	0.0000	33.9258	33.9258	9.0500e-003	0.0000	34.1520
Maximum	**0.0297**	**0.2905**	**0.2248**	**3.9000e-004**	**0.0175**	**0.015**	**0.0324**	**8.4900e-003**	**0.0139**	**0.0224**	**0.0000**	**33.9258**	**33.9258**	**9.0500e-003**	**0.0000**	**34.152**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Year	tons/yr										MT/yr					
2021	0.0297	0.2905	0.2248	3.9000e-004	0.0175	0.0150	0.0324	8.4900e-003	0.0139	0.0224	0.0000	33.9257	33.9257	9.0500e-003	0.0000	34.1520
Maximum	**0.0297**	**0.2905**	**0.2248**	**3.9000e-004**	**0.0175**	**0.0150**	**0.0324**	**8.4900e-003**	**0.0139**	**0.0224**	**0.0000**	**33.9257**	**33.9257**	**9.0500e-003**	**0.0000**	**34.1520**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**5-3-2021**	**8-2-2021**	0.3125	0.3125
		Highest	0.3125	0.3125

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0119	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-004	2.0000e-004	0.0000	0.0000	2.1000e-004
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0119**	**0.0000**	**1.0000e-004**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**2.0000e-004**	**2.0000e-004**	**0.0000**	**0.0000**	**2.1000e-004**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0119	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-004	2.0000e-004	0.0000	0.0000	2.1000e-004
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0119**	**0.0000**	**1.0000e-004**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**2.0000e-004**	**2.0000e-004**	**0.0000**	**0.0000**	**2.1000e-004**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	5/3/2021	5/28/2021	5	20	
2	Site Preparation	Site Preparation	5/29/2021	6/1/2021	5	2	
3	Grading	Grading	6/2/2021	6/7/2021	5	4	
4	Trenching	Trenching	6/8/2021	6/11/2021	5	4	
5	Paving	Paving	6/12/2021	6/25/2021	5	10	

Acres of Grading (Site Preparation Phase): 1

Acres of Grading (Grading Phase): 1.5

Acres of Paving: 0.23

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Rubber Tired Dozers	1	8.00	247	0.40
Demolition	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Site Preparation	Graders	1	8.00	187	0.41
Site Preparation	Rubber Tired Dozers	1	7.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Grading	Graders	1	6.00	187	0.41
Grading	Rubber Tired Dozers	1	6.00	247	0.40
Grading	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Paving	Cement and Mortar Mixers	1	6.00	9	0.56
Paving	Pavers	1	6.00	130	0.42
Paving	Paving Equipment	1	8.00	132	0.36
Paving	Rollers	1	7.00	80	0.38
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Trenching	Excavators	1	8.00	158	0.38
Trenching	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	5	13.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	3	8.00	0.00	2.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	5	13.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

Trenching	2	5.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0199	0.1970	0.1449	2.4000e-004		0.0104	0.0104		9.7100e-003	9.7100e-003	0.0000	21.0713	21.0713	5.3900e-003	0.0000	21.2060
Total	**0.0199**	**0.1970**	**0.1449**	**2.4000e-004**		**0.0104**	**0.0104**		**9.7100e-003**	**9.7100e-003**	**0.0000**	**21.0713**	**21.0713**	**5.3900e-003**	**0.0000**	**21.2060**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	2.2000e-004	2.3400e-003	1.0000e-005	1.0200e-003	1.0000e-005	1.0300e-003	2.7000e-004	1.0000e-005	2.8000e-004	0.0000	0.8219	0.8219	1.0000e-005	0.0000	0.8223
Total	**3.3000e-004**	**2.2000e-004**	**2.3400e-003**	**1.0000e-005**	**1.0200e-003**	**1.0000e-005**	**1.0300e-003**	**2.7000e-004**	**1.0000e-005**	**2.8000e-004**	**0.0000**	**0.8219**	**0.8219**	**1.0000e-005**	**0.0000**	**0.8223**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0199	0.1970	0.1449	2.4000e-004		0.0104	0.0104		9.7100e-003	9.7100e-003	0.0000	21.0713	21.0713	5.3900e-003	0.0000	21.2060
Total	**0.0199**	**0.1970**	**0.1449**	**2.4000e-004**		**0.0104**	**0.0104**		**9.7100e-003**	**9.7100e-003**	**0.0000**	**21.0713**	**21.0713**	**5.3900e-003**	**0.0000**	**21.2060**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.3000e-004	2.2000e-004	2.3400e-003	1.0000e-005	1.0200e-003	1.0000e-005	1.0300e-003	2.7000e-004	1.0000e-005	2.8000e-004	0.0000	0.8219	0.8219	1.0000e-005	0.0000	0.8223
Total	**3.3000e-004**	**2.2000e-004**	**2.3400e-003**	**1.0000e-005**	**1.0200e-003**	**1.0000e-005**	**1.0300e-003**	**2.7000e-004**	**1.0000e-005**	**2.8000e-004**	**0.0000**	**0.8219**	**0.8219**	**1.0000e-005**	**0.0000**	**0.8223**

3.3 Site Preparation - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Fugitive Dust					5.8000e-003	0.0000	5.8000e-003	2.9500e-003	0.0000	2.9500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.5600e-003	0.0174	7.5600e-003	2.0000e-005		7.7000e-004	7.7000e-004		7.0000e-004	7.0000e-004	0.0000	1.5118	1.5118	4.9000e-004	0.0000	1.5241
Total	**1.5600e-003**	**0.0174**	**7.5600e-003**	**2.0000e-005**	**5.8000e-003**	**7.7000e-004**	**6.5700e-003**	**2.9500e-003**	**7.0000e-004**	**3.6500e-003**	**0.0000**	**1.5118**	**1.5118**	**4.9000e-004**	**0.0000**	**1.5241**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	1.0000e-005	1.4000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0506	0.0506	0.0000	0.0000	0.0506
Total	**2.0000e-005**	**1.0000e-005**	**1.4000e-004**	**0.0000**	**6.0000e-005**	**0.0000**	**6.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0506**	**0.0506**	**0.0000**	**0.0000**	**0.0506**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					5.8000e-003	0.0000	5.8000e-003	2.9500e-003	0.0000	2.9500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.5600e-003	0.0174	7.5600e-003	2.0000e-005		7.7000e-004	7.7000e-004		7.0000e-004	7.0000e-004	0.0000	1.5118	1.5118	4.9000e-004	0.0000	1.5241

Total	**1.5600e-003**	**0.0174**	**7.5600e-003**	**2.0000e-005**	**5.8000e-003**	**7.7000e-004**	**6.5700e-003**	**2.9500e-003**	**7.0000e-004**	**3.6500e-003**	**0.0000**	**1.5118**	**1.5118**	**4.9000e-004**	**0.0000**	**1.5241**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.0000e-005	1.0000e-005	1.4000e-004	0.0000	6.0000e-005	0.0000	6.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0506	0.0506	0.0000	0.0000	0.0506
Total	**2.0000e-005**	**1.0000e-005**	**1.4000e-004**	**0.0000**	**6.0000e-005**	**0.0000**	**6.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0506**	**0.0506**	**0.0000**	**0.0000**	**0.0506**

3.4 Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					9.8300e-003	0.0000	9.8300e-003	5.0500e-003	0.0000	5.0500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.5800e-003	0.0287	0.0127	3.0000e-005		1.2800e-003	1.2800e-003		1.1700e-003	1.1700e-003	0.0000	2.4767	2.4767	8.0000e-004	0.0000	2.4968
Total	**2.5800e-003**	**0.0287**	**0.0127**	**3.0000e-005**	**9.8300e-003**	**1.2800e-003**	**0.0111**	**5.0500e-003**	**1.1700e-003**	**6.2200e-003**	**0.0000**	**2.4767**	**2.4767**	**8.0000e-004**	**0.0000**	**2.4968**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	1.0000e-005	3.0000e-004	1.4000e-004	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0821	0.0821	1.0000e-005	0.0000	0.0824
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.0000e-005	3.0000e-005	2.9000e-004	0.0000	1.3000e-004	0.0000	1.3000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1012	0.1012	0.0000	0.0000	0.1012
Total	**5.0000e-005**	**3.3000e-004**	**4.3000e-004**	**0.0000**	**1.5000e-004**	**0.0000**	**1.5000e-004**	**3.0000e-005**	**0.0000**	**4.0000e-005**	**0.0000**	**0.1833**	**0.1833**	**1.0000e-005**	**0.0000**	**0.1836**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					9.8300e-003	0.0000	9.8300e-003	5.0500e-003	0.0000	5.0500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.5800e-003	0.0287	0.0127	3.0000e-005		1.2800e-003	1.2800e-003		1.1700e-003	1.1700e-003	0.0000	2.4767	2.4767	8.0000e-004	0.0000	2.4968
Total	**2.5800e-003**	**0.0287**	**0.0127**	**3.0000e-005**	**9.8300e-003**	**1.2800e-003**	**0.0111**	**5.0500e-003**	**1.1700e-003**	**6.2200e-003**	**0.0000**	**2.4767**	**2.4767**	**8.0000e-004**	**0.0000**	**2.4968**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	1.0000e-005	3.0000e-004	1.4000e-004	0.0000	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0000	1.0000e-005	0.0000	0.0821	0.0821	1.0000e-005	0.0000	0.0824
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.0000e-005	3.0000e-005	2.9000e-004	0.0000	1.3000e-004	0.0000	1.3000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.1012	0.1012	0.0000	0.0000	0.1012
Total	**5.0000e-005**	**3.3000e-004**	**4.3000e-004**	**0.0000**	**1.5000e-004**	**0.0000**	**1.5000e-004**	**3.0000e-005**	**0.0000**	**4.0000e-005**	**0.0000**	**0.1833**	**0.1833**	**1.0000e-005**	**0.0000**	**0.1836**

3.5 Trenching - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	8.3000e-004	8.1000e-003	0.0111	2.0000e-005		4.3000e-004	4.3000e-004		4.0000e-004	4.0000e-004	0.0000	1.4535	1.4535	4.7000e-004	0.0000	1.4652
Total	**8.3000e-004**	**8.1000e-003**	**0.0111**	**2.0000e-005**		**4.3000e-004**	**4.3000e-004**		**4.0000e-004**	**4.0000e-004**	**0.0000**	**1.4535**	**1.4535**	**4.7000e-004**	**0.0000**	**1.4652**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	2.0000e-005	1.8000e-004	0.0000	8.0000e-005	0.0000	8.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0632	0.0632	0.0000	0.0000	0.0633

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Total	**3.0000e-005**	**2.0000e-005**	**1.8000e-004**	**0.0000**	**8.0000e-005**	**0.0000**	**8.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0632**	**0.0632**	**0.0000**	**0.0000**	**0.0633**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	8.3000e-004	8.1000e-003	0.0111	2.0000e-005		4.3000e-004	4.3000e-004		4.0000e-004	4.0000e-004	0.0000	1.4535	1.4535	4.7000e-004	0.0000	1.4652
Total	**8.3000e-004**	**8.1000e-003**	**0.0111**	**2.0000e-005**		**4.3000e-004**	**4.3000e-004**		**4.0000e-004**	**4.0000e-004**	**0.0000**	**1.4535**	**1.4535**	**4.7000e-004**	**0.0000**	**1.4652**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-005	2.0000e-005	1.8000e-004	0.0000	8.0000e-005	0.0000	8.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0632	0.0632	0.0000	0.0000	0.0633
Total	**3.0000e-005**	**2.0000e-005**	**1.8000e-004**	**0.0000**	**8.0000e-005**	**0.0000**	**8.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0632**	**0.0632**	**0.0000**	**0.0000**	**0.0633**

3.6 Paving - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	3.8700e-003	0.0387	0.0443	7.0000e-005		2.0800e-003	2.0800e-003		1.9100e-003	1.9100e-003	0.0000	5.8825	5.8825	1.8600e-003	0.0000	5.9291
Paving	3.0000e-004					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**4.1700e-003**	**0.0387**	**0.0443**	**7.0000e-005**		**2.0800e-003**	**2.0800e-003**		**1.9100e-003**	**1.9100e-003**	**0.0000**	**5.8825**	**5.8825**	**1.8600e-003**	**0.0000**	**5.9291**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	1.1000e-004	1.1700e-003	0.0000	5.1000e-004	0.0000	5.1000e-004	1.4000e-004	0.0000	1.4000e-004	0.0000	0.4109	0.4109	1.0000e-005	0.0000	0.4111
Total	**1.7000e-004**	**1.1000e-004**	**1.1700e-003**	**0.0000**	**5.1000e-004**	**0.0000**	**5.1000e-004**	**1.4000e-004**	**0.0000**	**1.4000e-004**	**0.0000**	**0.4109**	**0.4109**	**1.0000e-005**	**0.0000**	**0.4111**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Off-Road	3.8700e-003	0.0387	0.0443	7.0000e-005		2.0800e-003	2.0800e-003		1.9100e-003	1.9100e-003	0.0000	5.8825	5.8825	1.8600e-003	0.0000	5.9291
Paving	3.0000e-004					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**4.1700e-003**	**0.0387**	**0.0443**	**7.0000e-005**		**2.0800e-003**	**2.0800e-003**		**1.9100e-003**	**1.9100e-003**	**0.0000**	**5.8825**	**5.8825**	**1.8600e-003**	**0.0000**	**5.9291**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.7000e-004	1.1000e-004	1.1700e-003	0.0000	5.1000e-004	0.0000	5.1000e-004	1.4000e-004	0.0000	1.4000e-004	0.0000	0.4109	0.4109	1.0000e-005	0.0000	0.4111
Total	**1.7000e-004**	**1.1000e-004**	**1.1700e-003**	**0.0000**	**5.1000e-004**	**0.0000**	**5.1000e-004**	**1.4000e-004**	**0.0000**	**1.4000e-004**	**0.0000**	**0.4109**	**0.4109**	**1.0000e-005**	**0.0000**	**0.4111**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Asphalt Surfaces	0.00	0.00	0.00		
User Defined Industrial	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
User Defined Industrial	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Other Asphalt Surfaces	0.470625	0.050338	0.265549	0.140745	0.017339	0.006996	0.024054	0.006595	0.004215	0.003104	0.009159	0.000488	0.000793
User Defined Industrial	0.470625	0.050338	0.265549	0.140745	0.017339	0.006996	0.024054	0.006595	0.004215	0.003104	0.009159	0.000488	0.000793

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0119	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-004	2.0000e-004	0.0000	0.0000	2.1000e-004
Unmitigated	0.0119	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-004	2.0000e-004	0.0000	0.0000	2.1000e-004

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	1.5100e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0104					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-004	2.0000e-004	0.0000	0.0000	2.1000e-004
Total	**0.0119**	**0.0000**	**1.0000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-004**	**2.0000e-004**	**0.0000**	**0.0000**	**2.1000e-004**

Mitigated

SubCategory	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Architectural Coating	1.5100e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0104					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.0000e-005	0.0000	1.0000e-004	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-004	2.0000e-004	0.0000	0.0000	2.1000e-004
Total	**0.0119**	**0.0000**	**1.0000e-004**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-004**	**2.0000e-004**	**0.0000**	**0.0000**	**2.1000e-004**

7.0 Water Detail

7.1 Mitigation Measures Water

Category	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e

Land Use	Mgal	MT/yr			
Other Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
User Defined Industrial	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Other Asphalt Surfaces	0 / 0	0.0000	0.0000	0.0000	0.0000
User Defined Industrial	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000

Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000
User Defined Industrial	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Attachment 2: EMFAC2021 Calculations

CalEEMod Construction Inputs

Phase	CalEEMod WORKER TRIPS	CalEEMod VENDOR TRIPS	Total Worker Trips	Total Vendor Trips	CalEEMod HAULING TRIPS	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class	*Worker VMT*	*Vendor VMT*	*Hauling VMT*
Demolition	13	0	260	0	0	10.8	7.3	20	LD_Mix	HDT_Mix	HHDT	2808	0	0
Site Preparation	8	0	16	0	0	10.8	7.3	20	LD_Mix	HDT_Mix	HHDT	172.8	0	0
Grading	8	0	32	0	2	10.8	7.3	20	LD_Mix	HDT_Mix	HHDT	345.6	0	40
Trenching	5	0	20	0	0	10.8	7.3	20	LD_Mix	HDT_Mix	HHDT	216	0	0
Paving	13	0	130	0	0	10.8	7.3	7.3	LD_Mix	HDT_Mix	HHDT	1404	0	0

Number of Days Per Year					
2021	5/3/21	6/25/21	54	**40**	
			54	**40**	***Total Workdays***

Phase	Start Date	End Date	Days/Week	Workdays
Demolition	5/3/2021	5/28/2021	5	20
Site Preparation	5/29/2021	6/1/2021	5	2
Grading	6/2/2021	6/7/2021	5	4
Trenching	6/8/2021	6/11/2021	5	4
Paving	6/12/2021	6/25/2021	5	10

Summary of Construction Traffic Emissions (EMFAC2017)

Pollutants YEAR	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	NBio- CO2
						Tons					*Metric Tons*
Criteria Pollutants											
2021	0.0004	0.0006	0.0049	0.0000	0.0016	0.0003	0.0019	0.0002	0.0001	0.0004	1.4664
Toxic Air Contaminants (1 Mile Trip Length)											
2021	0.0004	0.0002	0.0016	0.0000	0.0002	0.00002	0.0002	0.00002	0.0000	0.0000	0.1590

Adjustment Factors for EMFAC2017 Gasoline Light Duty Vehicles						
Year	NOx Exhaust	TOG Evaporative	TOG Exhaust	PM Exhaust	CO Exhaust	CO2 Exhaust
NA	1	1	1	1	1	1
2021	1.0002	1.0001	1.0002	1.0009	1.0005	1.0023
2022	1.0004	1.0003	1.0004	1.0018	1.0014	1.0065
2023	1.0007	1.0006	1.0007	1.0032	1.0027	1.0126
2024	1.0012	1.0010	1.0011	1.0051	1.0044	1.0207
2025	1.0018	1.0016	1.0016	1.0074	1.0065	1.0309
2026	1.0023	1.0022	1.0020	1.0091	1.0083	1.0394
2027	1.0028	1.0028	1.0024	1.0105	1.0102	1.0475
2028	1.0034	1.0035	1.0028	1.0117	1.0120	1.0554
2029	1.0040	1.0042	1.0032	1.0129	1.0138	1.0629
2030	1.0047	1.0051	1.0037	1.0142	1.0156	1.0702
2031	1.0054	1.0061	1.0042	1.0155	1.0173	1.0770
2032	1.0061	1.0072	1.0047	1.0169	1.0189	1.0834
2033	1.0068	1.0083	1.0052	1.0182	1.0204	1.0893
2034	1.0075	1.0095	1.0058	1.0196	1.0218	1.0947
2035	1.0081	1.0108	1.0063	1.0210	1.0232	1.0997
2036	1.0088	1.0121	1.0069	1.0223	1.0244	1.1041
2037	1.0094	1.0134	1.0074	1.0236	1.0255	1.1080
2038	1.0099	1.0148	1.0079	1.0248	1.0265	1.1114
2039	1.0104	1.0161	1.0085	1.0259	1.0274	1.1143
2040	1.0109	1.0174	1.0090	1.0270	1.0281	1.1168
2041	1.0113	1.0186	1.0095	1.0279	1.0288	1.1189
2042	1.0116	1.0198	1.0099	1.0286	1.0294	1.1207
2043	1.0119	1.0207	1.0103	1.0293	1.0299	1.1221
2044	1.0122	1.0216	1.0106	1.0299	1.0303	1.1233
2045	1.0124	1.0225	1.0109	1.0303	1.0306	1.1243
2046	1.0125	1.0233	1.0111	1.0308	1.0309	1.1251
2047	1.0127	1.0240	1.0113	1.0311	1.0311	1.1258
2048	1.0128	1.0246	1.0115	1.0314	1.0313	1.1263
2049	1.0128	1.0252	1.0116	1.0316	1.0315	1.1268
2050	1.0129	1.0257	1.0117	1.0318	1.0316	1.1272
Enter Year: 2021	**1.0002**	**1.0001**	**1.0002**	**1.0009**	**1.0005**	**1.0023**

*PM Exhaust off model factor is only applied to the PM Exhaust emissions not start/idle

The off-model adjustment factors need to be applied only to emissions from gasoline light duty vehicles (LDA, LDT1, LDT2 and MDV). Please note that the adjustment factors are by calendar year and includes all model years.

Enter NA in the date field if adjustments do not apply

Source: EMFAC2017 (v1.0.3) Emission Rates
Region Type: County
Region: San Mateo
Calendar Year: 2021
Season: Annual
Vehicle Classification: EMFAC2007 Categories
Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HOTSOAK and RUNLOSS, g/vehicle/day for IDLEX, RESTLOSS and DIURN

Region	Calendar Y	Vehicle Cat	Model Yea	Speed	Fuel	Population	VMT	Trips	NOx_RUNE	NOx_IDLEX	NOx_STRE	PM2.5_RU	PM2.5_IDL	PM2.5_STR	PM2.5_PM	PM2.5_PM	PM10_RUN	PM10_IDLE	PM10_STR	PM10_PMT	PM10_PMI	CO2_RUNE	CO2_IDLEX	CO2_STRE	CH4_RUNE	CH4_IDLEX	CH4_STRE	N2O_RUNE	N2O_IDLE	N2O_STRE	ROG_RUNE	ROG_IDLE	ROG_STRE	ROG_HOTS	ROG_RUNL	ROG_REST	ROG_DIUR	TOG_RUNE	TOG_IDLEX	TOG_STRE	TOG_HOTS	TOG_RUNL	TOG_RESTL	TOG_DIUR	CO_RUNEX	CO_IDLEX	CO_STREX	SOx_RUNE	SOx_IDLEX	SOx_STREX
San Mateo	2021	HHDT	Aggregate	Aggregate	Gasoline	2.532598	446.2471	50.67223	2.831271	0	0.014402	0.000799	0	0.00028	0.005	0.02646	0.000869	0	0.000305	0.02	0.06174	2041.498	0	48.50991	0.069466	0	0.000634	0.125196	0	0.000703	0.313104	0	0.003318	0.033772	0.156198	0.009032	0.014039	0.456881	0	0.003633	0.033772	0.156198	0.009032	0.014039	27.20392	0	6.457416	0.020202	0	0.00048
San Mateo	2021	HHDT	Aggregate	Aggregate	Diesel	1208.92	106361.1	10410.36	4.822382	51.44394	2.018739	0.057811	0.0743	0	0.008684	0.025532	0.060425	0.077659	0	0.034738	0.059576	1696.123	8387.493	0	0.006761	0.152113	0	0.266607	1.318397	0	0.14557	3.274961	0	0	0	0	0	0.165721	3.728293	0	0	0	0	0	0.533324	39.73895	0	0.016024	0.079241	0
San Mateo	2021	HHDT	Aggregate	Aggregate	Natural Ga	126.7771	5162.202	494.4307	1.346704	21.87477	0	0.004478	0.023163	0	0.009	0.02646	0.004681	0.02421	0	0.036	0.06174	3198.242	4155.154	0	3.391872	1.217623	0	0.651982	0.847055	0	0.128536	0.036371	0	0	0	0	0	3.552887	1.264291	0	0	0	0	0	10.85713	18.88665	0	0	0	0
San Mateo	2021	LDA	Aggregate	Aggregate	Gasoline	281462.2	8895614	1335477	0.041188	0	0.206593	0.001321	0	0.001823	0.002	0.01575	0.001437	0	0.001982	0.008	0.03675	261.7459	0	56.03422	0.00242	0	0.05694	0.004497	0	0.02671	0.0096	0	0.26575	0.102145	0.223773	0.177057	0.178303	0.014005	0	0.290961	0.102145	0.223773	0.177057	0.178303	0.629866	0	2.423839	0.00259	0	0.000555
San Mateo	2021	LDA	Aggregate	Aggregate	Diesel	3049.017	96691.52	14406.99	0.080533	0	0	0.00664	0	0	0.002	0.01575	0.006941	0	0	0.008	0.03675	206.756	0	0	0.000628	0	0	0.032499	0	0	0.01353	0	0	0	0	0	0	0.015403	0	0	0	0	0	0	0.197747	0	0	0.001955	0	0
San Mateo	2021	LDA	Aggregate	Aggregate	Electricity	6731.919	227344.6	33418.54	0	0	0	0	0	0	0.002	0.01575	0	0	0	0.008	0.03675	0	0	0	0	0	0	0	0	0	0	0	0	0.004888	0	0.003128	0.012002	0	0	0	0.004888	0	0.003128	0.012002	0	0	0	0	0	0
San Mateo	2021	LDT1	Aggregate	Aggregate	Gasoline	38946.93	1231961	184643.5	0.074829	0	0.232267	0.00173	0	0.002249	0.002	0.01575	0.001881	0	0.002446	0.008	0.03675	298.0115	0	63.64168	0.003883	0	0.064322	0.006178	0	0.027593	0.016693	0	0.311613	0.130491	0.49711	0.245108	0.266151	0.024337	0	0.341175	0.130491	0.49711	0.245108	0.266151	0.882128	0	2.463111	0.002949	0	0.00063
San Mateo	2021	LDT1	Aggregate	Aggregate	Diesel	17.13189	301.423	58.6119	1.07976	0	0	0.146404	0	0	0.002	0.01575	0.153024	0	0	0.008	0.03675	411.4568	0	0	0.008976	0	0	0.064675	0	0	0.193251	0	0	0	0	0	0	0.220004	0	0	0	0	0	0	1.066027	0	0	0.00389	0	0
San Mateo	2021	LDT1	Aggregate	Aggregate	Electricity	251.7812	8876.24	1265.331	0	0	0	0	0	0	0.002	0.01575	0	0	0	0.008	0.03675	0	0	0	0	0	0	0	0	0	0	0	0	0.004888	0	0.003128	0.012002	0	0	0	0.004888	0	0.003128	0.012002	0	0	0	0	0	0
San Mateo	2021	LDT2	Aggregate	Aggregate	Gasoline	124776.5	3966360	596103.2	0.062716	0	0.27794	0.001421	0	0.001831	0.002	0.01575	0.001546	0	0.001992	0.008	0.03675	320.7249	0	69.62036	0.00302	0	0.068545	0.005582	0	0.032265	0.012029	0	0.317083	0.093491	0.332713	0.20043	0.187904	0.017545	0	0.347165	0.093491	0.332713	0.20043	0.187904	0.726684	0	2.914491	0.003174	0	0.000689
San Mateo	2021	LDT2	Aggregate	Aggregate	Diesel	914.3532	32249.65	4526.673	0.038254	0	0	0.004445	0	0	0.002	0.01575	0.004646	0	0	0.008	0.03675	279.7984	0	0	0.000617	0	0	0.04398	0	0	0.013286	0	0	0	0	0	0	0.015125	0	0	0	0	0	0	0.1127	0	0	0.002645	0	0
San Mateo	2021	LDT2	Aggregate	Aggregate	Electricity	1346.583	38287.31	6798.974	0	0	0	0	0	0	0.002	0.01575	0	0	0	0.008	0.03675	0	0	0	0	0	0	0	0	0	0	0	0	0.004888	0	0.003128	0.012002	0	0	0	0.004888	0	0.003128	0.012002	0	0	0	0	0	0
San Mateo	2021	LHDT1	Aggregate	Aggregate	Gasoline	8540.807	294678.5	127245.3	0.187228	0.038379	0.505697	0.002085	0	0.000366	0.002	0.03276	0.002267	0	0.000398	0.008	0.07644	1004.048	120.6229	18.95963	0.008807	0.123181	0.022764	0.011803	0.003232	0.040953	0.041578	0.439849	0.113884	0.095412	0.680616	0.01934	0.031725	0.060671	0.641827	0.124688	0.095412	0.680616	0.01934	0.031725	0.759022	3.757129	1.735062	0.009936	0.001194	0.000188
San Mateo	2021	LHDT1	Aggregate	Aggregate	Diesel	5376.148	207067.4	67625.18	1.203322	1.956837	0	0.017312	0.026832	0	0.003	0.03276	0.018095	0.028045	0	0.012	0.07644	539.0996	131.3706	0	0.006669	0.005098	0	0.084739	0.02065	0	0.143572	0.10976	0	0	0	0	0	0.163447	0.124954	0	0	0	0	0	0.556151	0.909745	0	0.005096	0.001242	0
San Mateo	2021	LHDT2	Aggregate	Aggregate	Gasoline	1180.837	40135.48	17592.71	0.209415	0.037867	0.513103	0.002029	0	0.000335	0.002	0.03822	0.002206	0	0.000365	0.008	0.08918	1145.87	138.6775	21.56691	0.007822	0.121399	0.022475	0.013634	0.003082	0.040307	0.034698	0.43401	0.112191	0.097486	0.716672	0.018746	0.03105	0.050631	0.633306	0.122834	0.097486	0.716672	0.018746	0.03105	0.627609	3.757621	1.759131	0.011339	0.001372	0.000213
San Mateo	2021	LHDT2	Aggregate	Aggregate	Diesel	2043.518	78128.83	25704.89	0.896184	1.934519	0	0.01684	0.026954	0	0.003	0.03822	0.017601	0.028173	0	0.012	0.08918	604.2541	210.1577	0	0.00626	0.005098	0	0.09498	0.033034	0	0.134779	0.10976	0	0	0	0	0	0.153437	0.124954	0	0	0	0	0	0.517242	0.909745	0	0.005712	0.001987	0
San Mateo	2021	MCY	Aggregate	Aggregate	Gasoline	15514.81	143935.1	31029.62	1.157112	0	0.273312	0.001926	0	0.003224	0.001	0.00504	0.00206	0	0.003423	0.004	0.01176	213.2371	0	61.23009	0.332174	0	0.26158	0.066746	0	0.015551	2.234514	0	1.982543	0.597211	2.102478	0.780635	1.269203	2.770018	0	2.157734	0.597211	2.102478	0.780635	1.269203	19.39604	0	9.137382	0.00211	0	0.000606
San Mateo	2021	MDV	Aggregate	Aggregate	Gasoline	75621.55	2430141	358800.7	0.073488	0	0.331739	0.001469	0	0.002007	0.002	0.01575	0.001597	0	0.002182	0.008	0.03675	385.661	0	84.65965	0.003574	0	0.080266	0.006245	0	0.034644	0.015383	0	0.393988	0.107459	0.357118	0.239762	0.221965	0.02189	0	0.431332	0.107459	0.357118	0.239762	0.221965	0.801832	0	3.32077	0.003816	0	0.000838
San Mateo	2021	MDV	Aggregate	Aggregate	Diesel	2032.67	73375.01	10021.82	0.035146	0	0	0.003798	0	0	0.002	0.01575	0.003969	0	0	0.008	0.03675	364.5115	0	0	0.000441	0	0	0.057296	0	0	0.009496	0	0	0	0	0	0	0.010811	0	0	0	0	0	0	0.167682	0	0	0.003446	0	0
San Mateo	2021	MDV	Aggregate	Aggregate	Electricity	499.1085	14927.81	2561.27	0	0	0	0	0	0	0.002	0.01575	0	0	0	0.008	0.03675	0	0	0	0	0	0	0	0	0	0	0	0	0.004888	0	0.003128	0.012002	0	0	0	0.004888	0	0.003128	0.012002	0	0	0	0	0	0
San Mateo	2021	MH	Aggregate	Aggregate	Gasoline	1012.604	10475.38	101.3009	0.289108	0	0.33309	0.001533	0	0.000361	0.003	0.05586	0.001668	0	0.000393	0.012	0.13034	1724.952	0	25.35093	0.011174	0	0.031557	0.020013	0	0.036673	0.047014	0	0.129981	0.060707	1.482955	0.025377	0.060699	0.068602	0	0.142312	0.060707	1.482955	0.025377	0.060699	1.179087	0	2.932267	0.01707	0	0.000251
San Mateo	2021	MH	Aggregate	Aggregate	Diesel	369.5217	3896.478	36.95217	3.264603	0	0	0.055349	0	0	0.004	0.05586	0.057851	0	0	0.016	0.13034	1008.352	0	0	0.003968	0	0	0.158499	0	0	0.085434	0	0	0	0	0	0	0.09726	0	0	0	0	0	0	0.283679	0	0	0.009533	0	0
San Mateo	2021	MHDT	Aggregate	Aggregate	Gasoline	909.4785	54174.65	18196.85	0.499638	0.088488	0.387901	0.001283	0	0.000452	0.003	0.05586	0.001396	0	0.000492	0.012	0.13034	1743.713	537.0347	39.55954	0.015647	0.265774	0.041897	0.024692	0.00754	0.030481	0.076123	1.012741	0.22595	0.080554	0.479357	0.017312	0.028459	0.111078	1.477789	0.247387	0.080554	0.479357	0.017312	0.028459	1.76198	15.11679	5.049643	0.017255	0.005314	0.000391
San Mateo	2021	MHDT	Aggregate	Aggregate	Diesel	4915.917	311965.9	50724.24	2.71336	8.169784	1.490812	0.064641	0.02361	0	0.003	0.05586	0.067563	0.024678	0	0.012	0.13034	1050.501	887.7484	0	0.007414	0.005419	0	0.165124	0.139542	0	0.159621	0.116672	0	0	0	0	0	0.181717	0.132822	0	0	0	0	0	0.466643	2.520172	0	0.009925	0.008387	0
San Mateo	2021	OBUS	Aggregate	Aggregate	Gasoline	304.2296	17885.2	6087.026	0.373215	0.064976	0.307927	0.000981	0	0.000242	0.003	0.05586	0.001067	0	0.000263	0.012	0.13034	1778.4	378.4266	26.1745	0.011826	0.205731	0.029538	0.020024	0.005948	0.026976	0.056096	0.744988	0.147323	0.02347	0.27426	0.015546	0.031094	0.081855	1.087085	0.1613	0.02347	0.27426	0.015546	0.031094	1.246301	5.766914	3.125772	0.017599	0.003745	0.000259
San Mateo	2021	OBUS	Aggregate	Aggregate	Diesel	647.7138	45257.75	5917.718	2.965136	13.24071	1.697521	0.044716	0.043225	0	0.003	0.05586	0.046738	0.04518	0	0.012	0.13034	1215.387	1886.732	0	0.005772	0.033349	0	0.191042	0.296568	0	0.124271	0.718004	0	0	0	0	0	0.141474	0.817393	0	0	0	0	0	0.414399	8.333469	0	0.011482	0.017825	0
San Mateo	2021	SBUS	Aggregate	Aggregate	Gasoline	67.12178	3512.181	268.4871	0.724361	0.92226	0.510251	0.001768	0	0.000731	0.002	0.3192	0.001923	0	0.000795	0.008	0.7448	842.8819	2513.125	51.09537	0.022013	2.438558	0.067417	0.035004	0.088042	0.047324	0.10917	10.57835	0.390084	0.068525	0.560691	0.009267	0.021035	0.159301	15.43591	0.427093	0.068525	0.560691	0.009267	0.021035	2.431511	81.85897	10.64378	0.008341	0.024869	0.000506
San Mateo	2021	SBUS	Aggregate	Aggregate	Diesel	188.8153	5924.999	2178.903	8.563292	46.94516	0.589982	0.047323	0.061412	0	0.003	0.3192	0.049463	0.064189	0	0.012	0.7448	1168.903	3732.651	0	0.00571	0.014172	0	0.183735	0.586721	0	0.122925	0.305124	0	0	0	0	0	0.13994	0.347361	0	0	0	0	0	0.310277	5.196214	0	0.011043	0.035264	0
San Mateo	2021	UBUS	Aggregate	Aggregate	Gasoline	38.24087	926.4432	152.9635	0.286887	0	0.903525	0.00108	0	0.000458	0.00277	0.051797	0.001175	0	0.000498	0.011079	0.120859	2031.064	0	92.5355	0.005471	0	0.108325	0.022311	0	0.06829	0.019963	0	0.534519	0.047942	0.28654	0.008713	0.011861	0.02913	0	0.585231	0.047942	0.28654	0.008713	0.011861	0.346231	0	8.247734	0.020099	0	0.000916
San Mateo	2021	UBUS	Aggregate	Aggregate	Diesel	304.4449	24349.91	1217.78	3.893884	0	0	0.008125	0	0	0.007894	0.031881	0.008492	0	0	0.031575	0.074388	1767.879	0	0	0.243745	0	0	0.277886	0	0	0.003483	0	0	0	0	0	0	0.24876	0	0	0	0	0	0	0.395642	0	0	0.016713	0	0
San Mateo	2021	UBUS	Aggregate	Aggregate	Natural Ga	39.94428	2695.661	159.7771	0.49688	0	0	0.003228	0	0	0.00869	0.027979	0.003374	0	0	0.03476	0.065284	2042.655	0	0	6.540523	0	0	0.416409	0	0	0.093451	0	0	0	0	0	0	6.675083	0	0	0	0	0	0	50.89105	0	0	0	0	0

Attachment 3: Construction Health Risk Calculations

On-Site Sanitary Sewer Facility, JobTrain, East Palo Alto, CA

DPM Emissions and Modeling Emission Rates - Unmitigated

Construction Year	Activity	DPM (ton/year)	Area Source	DPM Emissions (lb/yr)	DPM Emissions (lb/hr)	DPM Emissions (g/s)	Modeled Area (m^2)	DPM Emission Rate ($g/s/m^2$)
2021	Construction	0.0150	CON_DPM	30.0	0.00915	1.15E-03	3076	3.75E-07

Construction Hours

hr/day =	9	(7am - 4pm)
days/yr =	365	
hours/year =	3285	

On-Site Sanitary Sewer Facility, JobTrain, East Palo Alto, CA

PM2.5 Fugitive Dust Emissions for Modeling - Unmitigated

Construction Year	Activity	Area Source	PM2.5 Emissions (ton/year)	PM2.5 Emissions (lb/yr)	PM2.5 Emissions (lb/hr)	PM2.5 Emissions (g/s)	Modeled Area (m^2)	PM2.5 Emission Rate $g/s/m^2$
2021	Construction	CON_FUG	0.0085	17.0	0.00518	6.53E-04	3,076	2.12E-07

Construction Hours

hr/day =	9	(7am - 4pm)
days/yr =	365	
hours/year =	3285	

On-Site Sanitary Sewer Facility, JobTrain, East Palo Alto, CA
- Construction Health Impact Summary

Maximum Impacts at MEI Location - Without Mitigation

Emissions Year	Maximum Concentrations		Cancer Risk (per million) Infant/Child	Hazard Index (-)	Maximum Annual PM2.5 Concentration (µg/m³)
	Exhaust PM10/DPM (µg/m³)	Fugitive PM2.5 (µg/m³)			
2021	0.0075	0.0044	1.32	0.001	0.01

Maximum Impacts at EPA Center Arts

Construction Year	Unmitigated Emissions				
	Maximum Concentrations		Child Cancer Risk (per million)	Hazard Index (-)	Maximum Annual PM2.5 Concentration (µg/m³)
	Exhaust PM2.5/DPM (µg/m³)	Fugitive PM2.5 (µg/m³)			
2021	0.0102	0.0058	0.64	0.002	0.02

On-Site Sanitary Sewer Facility, JobTrain, East Palo Alto, CA - Construction Impacts - Without Mitigation
Maximum DPM Cancer Risk and PM2.5 Calculations From Construction
Impacts at Off-Site MEI Location - 1.5 meter receptor height

Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x FAH x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)
FAH = Fraction of time spent at home (unitless)

Inhalation Dose = C_{air} x DBR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Values

	Infant/Child			Adult
Age -->	**3rd Trimester**	**0 - 2**	**2 - 16**	**16 - 30**
Parameter				
ASF =	10	10	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00	1.10E+00
DBR* =	361	1090	572	261
A =	1	1	1	1
EF =	350	350	350	350
AT =	70	70	70	70
FAH =	1.00	1.00	1.00	0.73

* 95th percentile breathing rates for infants and 80th percentile for children and adults

Construction Cancer Risk by Year - Maximum Impact Receptor Location

			Infant/Child - Exposure Information			Infant/Child	Adult - Exposure Information			Adult			
	Exposure				Age	Cancer	Modeled		Age	Cancer		Maximum	
Exposure	Duration		DPM Conc (ug/m3)		Sensitivity	Risk	DPM Conc (ug/m3)		Sensitivity	Risk	Hazard	Fugitive	Total
Year	(years)	Age	Year	Annual	Factor	(per million)	Year	Annual	Factor	(per million)	Index	PM2.5	PM2.5
0	0.25	-0.25 - 0*	2021	0.0075	10	0.10	2021	0.0075	-	-			
1	1	0 - 1	2021	0.0075	10	1.22	2021	0.0075	1	0.02	0.0015	0.0044	0.0119
2	1	1 - 2		0.0000	10	0.00		0.0000	1	0.00			
3	1	2 - 3		0.0000	3	0.00		0.0000	1	0.00			
4	1	3 - 4		0.0000	3	0.00		0.0000	1	0.00			
5	1	4 - 5		0.0000	3	0.00		0.0000	1	0.00			
6	1	5 - 6		0.0000	3	0.00		0.0000	1	0.00			
7	1	6 - 7		0.0000	3	0.00		0.0000	1	0.00			
8	1	7 - 8		0.0000	3	0.00		0.0000	1	0.00			
9	1	8 - 9		0.0000	3	0.00		0.0000	1	0.00			
10	1	9 - 10		0.0000	3	0.00		0.0000	1	0.00			
11	1	10 - 11		0.0000	3	0.00		0.0000	1	0.00			
12	1	11 - 12		0.0000	3	0.00		0.0000	1	0.00			
13	1	12 - 13		0.0000	3	0.00		0.0000	1	0.00			
14	1	13 - 14		0.0000	3	0.00		0.0000	1	0.00			
15	1	14 - 15		0.0000	3	0.00		0.0000	1	0.00			
16	1	15 - 16		0.0000	3	0.00		0.0000	1	0.00			
17	1	16-17		0.0000	1	0.00		0.0000	1	0.00			
18	1	17-18		0.0000	1	0.00		0.0000	1	0.00			
19	1	18-19		0.0000	1	0.00		0.0000	1	0.00			
20	1	19-20		0.0000	1	0.00		0.0000	1	0.00			
21	1	20-21		0.0000	1	0.00		0.0000	1	0.00			
22	1	21-22		0.0000	1	0.00		0.0000	1	0.00			
23	1	22-23		0.0000	1	0.00		0.0000	1	0.00			
24	1	23-24		0.0000	1	0.00		0.0000	1	0.00			
25	1	24-25		0.0000	1	0.00		0.0000	1	0.00			
26	1	25-26		0.0000	1	0.00		0.0000	1	0.00			
27	1	26-27		0.0000	1	0.00		0.0000	1	0.00			
28	1	27-28		0.0000	1	0.00		0.0000	1	0.00			
29	1	28-29		0.0000	1	0.00		0.0000	1	0.00			
30	1	29-30		0.0000	1	0.00		0.0000	1	0.00			
Total Increased Cancer Risk						**1.3**				**0.02**			

* Third trimester of pregnancy

On-Site Sanitary Sewer Facility, JobTrain, East Palo Alto, CA - Construction Impacts - Without Mitigation
Maximum DPM Cancer Risk and PM2.5 Calculations From Construction
Impacts at EPA Center Arts (13 years and older) - 1.5 meters - Child Exposure

Student Cancer Risk (per million) = CPF x Inhalation Dose x ASF x ED/AT x 1.0E6

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
ASF = Age sensitivity factor for specified age group
ED = Exposure duration (years)
AT = Averaging time for lifetime cancer risk (years)

Inhalation Dose = C_{air} x SAF x 8-Hr BR x A x (EF/365) x 10^{-6}

Where: C_{air} = concentration in air ($\mu g/m^3$)
SAF = Student Adjustment Factor (unitless)
= (24 hrs/9 hrs) x (7 days/5 days) = 3.73
8-Hr BR = Eight-hour breathing rate (L/kg body weight-per 8 hrs)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
10^{-6} = Conversion factor

Values

	Infant	School Child	Adult
Age -->	0 - <2	2 - <16	16 - 30
Parameter			
ASF =	10	3	1
CPF =	1.10E+00	1.10E+00	1.10E+00
8-Hr BR* =	1200	520	240
A =	1	1	1
EF =	250	250	250
AT =	70	70	70
SAF =	1.00	3.73	1.00

* 95th percentile 8-hr breathing rates for moderate intensity activities

Construction Cancer Risk by Year - Maximum Impact Receptor Location

			Child - Exposure Information			Child
Exposure Year	Exposure Duration (years)	Age	DPM Conc (ug/m3) Year	Annual	Age* Sensitivity Factor	Cancer Risk (per million)
1	1	13 - 14	2021	0.0102	3	0.6
2	1			0.0000	3	0.0
3	1			0.0000	3	0.0
4	1			0.0000	3	0.0
5	1			0.0000	3	0.0
6	1			0.0000	3	0.0
7	1			0.0000	3	0.0
8	1			0.0000	3	0.0
9	1			0.0000	3	0.0
Total Increased Cancer Risk						**0.6**

* Children assumed to be 13 years of age or older with 2 years of Construction Exposure

Maximum		
Hazard Index	Fugitive PM2.5	Total PM2.5
0.0020	0.0058	0.0160

Tree Management Experts
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Emerson Collective
Attn: Lorenzo Brooks
555 Bryant Street
Palo Alto, CA 94301

RE: 2535 Pulgas Street, East Palo Alto, CA

Date: 11/20/2020

ARBORIST REPORT

Arborist Report

1. Complete a Tree Inventory, per the Planning Department:

   A certified arborist should conduct a tree inventory for the project site and assess tree health and structural condition. The tree inventory and assessment should include the following:
   - Assessment of all trees on the project site and in the adjacent public right of way which are within thirty feet of the area proposed for development, and trees located on adjacent property with canopies overhanging the project site (East Palo Alto Municipal Code Chapter 8.10)
   - Identify the species, including common and scientific name
   - Measure the diameter at breast height (54") to the nearest whole inch
   - Determine if the tree meets the City's criteria for protected status
   - Prepare a data table for all surveyed trees

2. We will also locate the trees using GPS and prepare a map showing tree locations.
3. All protected status trees will also have an aluminum tree tag installed and the tree tag number placed in our data table.

Background

We were contacted to conduct a tree inventory of the trees on and around the property at 2535 Pulgas Street, East Palo Alto. The site is currently a mostly undeveloped lot used for trucking and vehicle storage as well as other associated uses.

Findings

We visited the site on November 17, 2020 and completed the tree survey that day. A total of (14) trees met the criteria of the scope. Eight (8) of these surveyed trees were determined to be Protected Trees. Complete data for the inventoried trees can be found in the attached data table. Along with the data available in the data table, tree locations were noted in the field using GPS coordinates and used to overlay the surveyed trees on a site survey dated 10/19/2020 prepared by BKF Engineers. Aerial imagery downloaded from the US Geological

Survey was also included in the map to provide better context for the tree locations. Some trees on private property were near the fence-line, but the fence was missing or smashed, so their ownership is uncertain.

Trees on the subject property, on adjacent properties with canopies overhanging the subject property, and within 30 feet of the subject property in the public right-of-way were surveyed. All trees that were accessible were tagged with a 1-1/4" circular numbered tree tag. Several of the trees were not tagged because they were inaccessible, either being in locked parts of the subject property or on adjacent properties. Two trees noted on the survey were not included in our inventory as they were either shrubs (coyote brush) or small coppice sprouts from a stump (fig).

As related by East Palo Alto planning staff, a Protected Tree is a tree of at least 40" circumference when measured 24" above grade. In addition, any trees in the public right-of-way are also Protected Trees. Protected Trees normally require a removal permit approved by the city, unless they pose an imminent hazard, must be removed for utility right-of-way management, or are approved for removal as part of the planning process.

None of the Protected trees on private property are in a condition that warrants their preservation in case of conflicts with planned construction. The street trees are all fruiting species that have likely grown as volunteers from discarded pits/seeds and are of a size where they can easily be replaced in-kind or better with new plantings during future construction.

Recommendations

None of the trees on site that were surveyed were of particular note in terms of their suitability for preservation. The trees have not been managed for aesthetics, health or structure at all. They exhibit a host of structural and cultural issues associated with volunteer trees growing in urban landscapes and do not stand out as particularly attractive specimens.

Examining historic aerial photography shows the land was used as agricultural fields in 1948 and since then has been used for what appears to be nursery operations and this current use. The tidal marsh that the land consisted of before infill did not grow trees, so any trees that have grown in the area since then have either been planted or volunteered from migrating seeds.

We recommend that the existing trees on site and adjacent street trees be removed. If owners of trees on neighboring properties are amenable, the inventoried trees on those properties should also be removed. Current preliminary plans show at least 50 trees planned for planting as part of the project. These deliberate plantings that can be managed from planting to maturity will provide much greater benefits to the property than the unmanaged collection currently on site.

3109 Sacramento Street
San Francisco, CA 94115

Member, American Society of Consulting Arborists
Certified Arborists, Tree Risk Assessment Qualified

cell 415.606.3610 email Roy@treemanagementexperts.com

Assumptions and Limiting Conditions

1. Any legal description provided to the consultant is assumed to be correct. Title and ownership of all property considered are assumed to be good and marketable. No responsibility is assumed for matters legal in character. Any and all property is appraised or evaluated as though free and clear, under responsible ownership and competent management.
2. It is assumed that any property is not in violation of any applicable codes, ordinances, statutes or other governmental regulations.
3. Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible. The consultant can neither guarantee nor be responsible for the accuracy of information provided by others.
4. Various diagrams, sketches and photographs in this report are intended as visual aids and are not to scale, unless specifically stated as such on the drawing. These communication tools in no way substitute for nor should be construed as surveys, architectural or engineering drawings.
5. Loss or alteration of any part of this report invalidates the entire report.
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7. This report is confidential and to be distributed only to the individual or entity to whom it is addressed. Any or all of the contents of this report may be conveyed to another party only with the express prior written or verbal consent of the consultant. Such limitations apply to the original report, a copy, facsimile, scanned image or digital version thereof.
8. This report represents the opinion of the consultant. In no way is the consultant's fee contingent upon a stipulated result, the occurrence of a subsequent event, nor upon any finding to be reported.
9. The consultant shall not be required to give testimony or to attend court by reason of this report unless subsequent contractual arrangements are made, including payment of an additional fee for such services as described in the fee schedule, an agreement or a contract.
10. Information contained in this report reflects observations made only to those items described and only reflects the condition of those items at the time of the site visit. Furthermore, the inspection is limited to visual examination of items and elements at the site, unless expressly stated otherwise. There is no expressed or implied warranty or guarantee that problems or deficiencies of the plants or property inspected may not arise in the future.

Disclosure Statement

Arborists are tree specialists who use their education, knowledge, training, and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. Clients may choose to accept or disregard the recommendations of the arborist, or to seek additional advice.

Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not fully understand. Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specified period of time. Likewise, remedial treatments, like any medicine, cannot be guaranteed.

Tree Management Experts

Consulting Arborists

3109 Sacramento Street
San Francisco, CA 94115

Member, American Society of Consulting Arborists
Certified Arborists, Tree Risk Assessment Qualified

cell 415.606.3610 email Roy@treemanagementexperts.com

Treatment, pruning, and removal of trees may involve considerations beyond the scope of the arborist's services such as property boundaries, property ownership, site lines, disputes between neighbors, and other issues. An arborist cannot take such considerations into account unless complete and accurate information is disclosed to the arborist. An arborist should then be expected to reasonably rely upon the completeness and accuracy of the information provided.

Trees can be managed, but they cannot be controlled. To live near trees is to accept some degree of risk. The only way to eliminate all risk associated with trees is to eliminate the trees.

Certification of Performance

I, Roy C. Leggitt, III, Certify:

- That we have inspected the trees and/or property evaluated in this report. We have stated findings accurately, insofar as the limitations of the Assignment and within the extent and context identified by this report;
- That we have no current or prospective interest in the vegetation or any real estate that is the subject of this report, and have no personal interest or bias with respect to the parties involved;
- That the analysis, opinions and conclusions stated herein are original and are based on current scientific procedures and facts and according to commonly accepted arboricultural practices;
- That no significant professional assistance was provided, except as indicated by the inclusion of another professional report within this report;
- That compensation is not contingent upon the reporting of a predetermined conclusion that favors the cause of the client or any other party.

I am a member in good standing of the American Society of Consulting Arborists and a member and Certified Arborist with the International Society of Arboriculture.

I have attained professional training in all areas of knowledge asserted through this report by completion of a Bachelor of Science degree in Plant Science, by routinely attending pertinent professional conferences and by reading current research from professional journals, books and other media.

I have rendered professional services in a full-time capacity in the field of horticulture and arboriculture for more than 30 years.

Signed: Roy C. Leggitt, III

Certified Arborist WE-0564A

Date: 11/20/2020

Tree Management Experts
Consulting Arborists
3109 Sacramento Street
San Francisco, CA 94115
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Certified Arborists, Tree Risk Assessment Qualified
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Certification of Performance

I, Aaron Wang, Certify:

- That we have inspected the trees and/or property evaluated in this report. We have stated findings accurately, insofar as the limitations of the Assignment and within the extent and context identified by this report;
- That we have no current or prospective interest in the vegetation or any real estate that is the subject of this report, and have no personal interest or bias with respect to the parties involved;
- That the analysis, opinions and conclusions stated herein are original and are based on current scientific procedures and facts and according to commonly accepted arboricultural practices;
- That no significant professional assistance was provided, except as indicated by the inclusion of another professional report within this report;
- That compensation is not contingent upon the reporting of a predetermined conclusion that favors the cause of the client or any other party.

I am a member and Certified Arborist with the International Society of Arboriculture.

I have attained professional training in all areas of knowledge asserted through this report by completion of a Bachelor of Science degree in Forestry and Natural Resources, by routinely attending pertinent professional conferences and by reading current research from professional journals, books and other media.

I have rendered professional services in a full time capacity in the field of horticulture and arboriculture for more than 7 years.

Signed: ______________
Certified Arborist MW-5597A

Date: 11/20/2020

Tree #	Tag #	Common Name	Botanic Name	Diameter @ 54"	Diameter @ 24"	Circumference @ 24"	Height	Spread	Health	Structure	Ownership	Protected Tree	Notes
1	801	lemon	*Citrus limon*	5	6	18.8	10	10	Poor	Poor	Private		
2	802	coast live oak	*Quercus agrifolia*	18	20	62.8	30	40	Good	Very Poor	Private	X	vertical split in trunk
3	803	Italian buckthorn	*Rhamnus alaternus*	3	4	12.6	10	10	Poor	Poor	Private		
4	N/A	coast live oak	*Quercus agrifolia*	16	19	59.7	30	40	Good	Poor	Private	X	on adjacent property
5	804	Italian buckthorn	*Rhamnus alaternus*	12	14	44.0	20	20	Fair	Poor	Private	X	possibly on adjacent property
6	805	coast live oak	*Quercus agrifolia*	18	21	66.0	25	25	Good	Poor	Private	X	on adjacent property
7	806	coast live oak	*Quercus agrifolia*	3	4	12.6	15	15	Good	Good	Private		on adjacent property
8	N/A	coast live oak	*Quercus agrifolia*	5	6	18.8	15	15	Good	Good	Private		on adjacent property
9	N/A	Japanese zelkova	*Zelkova serrata*	16	19	59.7	35	45	Good	Poor	Private	X	
10	807	peach	*Prunus persica*	3	5	15.7	15	15	Fair	Poor	Private		
11	808	edible fig	*Ficus carica*	6	7	22.0	15	15	Good	Fair	Public	X	along public ROW
12	809	avocado	*Persea americana*	2	3	9.4	10	10	Good	Good	Public	X	along public ROW
13	810	peach	*Prunus persica*	2	3	9.4	10	10	Fair	Fair	Public	X	along public ROW
14	N/A	texas privet	*Ligustrum lucidum*	7	8	25.1	25	20	Fair	Poor	Private		possibly on adjacent property

2535 Pulgas Tree Locations

PROJECT

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

DESIGN ARCHITECTS

WM+P
WILLIAM McDONOUGH + PARTNERS
ARCHITECTURE AND COMMUNITY PLANNING
700 E. JEFFERSON ST.
CHARLOTTESVILLE, VA 22902
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1731 Technology Drive, Suite 750
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255 SHORELINE DR, SUITE 200
REDWOOD CITY, CA 94065

STATUS

PLANNING APPLICATION

ISSUE

MARK	DATE	DESCRIPTION
	06/12/2020	100% PLANNING APPLICATION
	10/19/2020	RESUBMITTAL APPLICATION

PROJECT NO: 2019-0112
DRAWN BY: CLB
CHECK BY: LKY

SHEET TITLE / SHEET NUMBER

EXISTING TOPO

C1.1

NOT FOR CONSTRUCTION

Geotechnical Evaluation

Job Training Center
2535 Pulgas Avenue
East Palo Alto, California

Sycamore Real Estate Investments

2555 Pulgas Avenue, Building A | East Palo Alto, California 94303

May 28, 2020 | Project No. 403645001

Geotechnical | Environmental | Construction Inspection & Testing | Forensic Engineering & Expert Witness

Geophysics | Engineering Geology | Laboratory Testing | Industrial Hygiene | Occupational Safety | Air Quality | GIS

Ninyo & Moore

Geotechnical & Environmental Sciences Consultants

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

May 28, 2020
Project No. 403645001

Mr. Lorenzo Brooks
Sycamore Real Estate Investments
2555 Pulgas Avenue, Building A
East Palo Alto, California 94303

Subject: Geotechnical Evaluation
Job Training Center
2535 Pulgas Avenue
East Palo Alto, California

Dear Mr. Brooks:

In accordance with your authorization, Ninyo & Moore performed a geotechnical evaluation for the design and construction of Project Thunder, a proposed job training center, on a 4-acre lot at 2535 Pulgas Avenue in East Palo Alto, California. Ninyo & Moore previously performed a geotechnical evaluation on the subject property and the adjacent parcel to the south for a job training center at 2519 Pulgas Avenue. This report presents the findings and conclusions from our previous evaluation, and our geotechnical recommendations for the job training center and related improvements now proposed for 2535 Pulgas Avenue.

As an integral part of our role as the geotechnical engineer-of-record, we request the opportunity to review the construction plans before they go to bid and to provide follow-up construction observation and testing services.

Ninyo & Moore appreciates the opportunity to be of service to you on this project.

Sincerely,
NINYO & MOORE

Gerardo Lopez, EIT
Senior Staff Engineer

Peter Connolly, PE, GE
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
PETER C. CONNOLLY
GE2707
GEO TECHNICAL
STATE OF CALIFORNIA
May 28,2020

GL/PCC/gvr

Distribution: (1) Addressee (via e-mail)

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APPENDICES

1 INTRODUCTION

In accordance with your authorization, we have performed a geotechnical evaluation for a proposed job training center on a 4-acre lot at 2535 Pulgas Avenue in East Palo Alto, California (Figure 1). This report presents the findings and conclusions from our evaluation, and our geotechnical recommendations for design and construction of the proposed improvements.

2 SCOPE OF SERVICES

Our scope of services consisted of the following:

- Review of readily available geologic and seismic literature pertinent to the project area including geologic maps and reports, regional fault maps, and seismic hazard maps.
- Performance of a site reconnaissance to observe the general site conditions and to mark the proposed locations for subsurface exploration.
- Coordination with Underground Service Alert to locate the underground utilities in the vicinity of the proposed exploratory boring.
- Performance of a private utility survey to further evaluate the exploration locations for conflicts with underground utilities.
- Procurement of a boring permit from San Mateo County Environmental Health Services.
- Subsurface exploration consisting of five hollow-stem auger borings, and six cone penetrometer test (CPT) soundings. A representative of Ninyo & Moore logged the subsurface conditions exposed in the borings and collected bulk soil samples for laboratory testing.
- Performance of percolation testing at one location to evaluate the infiltration characteristics of the near-surface soil for design of a storm water management system.
- Performance of a geophysical survey utilizing MAM techniques to evaluate subsurface variations in shear wave velocity.
- Laboratory testing on selected soil samples to evaluate in-place soil moisture content and density, grain size distribution, fines content, Atterberg limits, expansion index, consolidation characteristics, soil corrosivity, shear strength, and compressive strength.
- Compilation and engineering analysis of the field and laboratory data, and the findings from our background review.
- Preparation of this report presenting the findings and conclusions from our evaluation, and our geotechnical recommendations for design and construction of the project.

Ninyo & Moore previously performed a Phase I and Phase II Environmental Site Assessment for the site (Ninyo & Moore, 2019 & 2020).

3 SITE DESCRIPTION

The site consists of one rectangular parcel at 2535 Pulgas Avenue that covers approximately 4 acres. The site is bounded to the east by Pulgas Avenue, to the north by an undeveloped parcel and a light industrial property, to the west by commercial yards, and to the south by an undeveloped property (Figure 2). The site is currently developed as a yard for a trucking company with a few small buildings and paved areas for storage. The ground elevation on site ranges between approximately 12 feet above mean sea level (MSL) at the southwestern corner to about 9 feet above MSL in the northeastern quadrant of the site (Google, 2019) with an overall average gradient of approximately ½ percent across the site down to the northwest although large portions of the site, including the areas along the northern margin of the site, are flat or slope down to the southwest. The grade on site is generally consistent with the grade on the adjacent parcels and streets.

4 PROJECT DESCRIPTION

The new job training center will consist of a 4-story building with a footprint area of approximately 25,000 square feet constructed within a foot or two of the existing grade. The building will be located near the eastern edge of the site (Figure 2). Ancillary project improvements may consist of an 8,000-square foot carpentry space adjacent to the northeast corner of the proposed building, a 2,500-square foot play area adjacent to the southwest corner of the building, surface parking with double stackers, and a transformer.

5 FIELD EXPLORATION AND LABORATORY TESTING

Our field exploration for this study included a site reconnaissance and subsurface exploration that consisted of five borings, six CPT soundings, one percolation test, and a geophysical survey. The approximate locations of the borings and soundings are shown on Figure 2. Prior to commencing the subsurface exploration, USA was notified for field marking of the existing utilities and a drilling permit was obtained from San Mateo County Health Services. A private utility survey by electro-magnetic scanning was performed and the exploration locations were initially hand-excavated to a depth of about 5 feet to check for underground utilities.

Borings B-4 and B-5 were drilled on November 11, 2019. Borings B-1, B-2, and B-3 were drilled on November 12, 2019. The borings were drilled with hollow stem auger to depths of up to approximately 50 feet below the ground surface. A representative of Ninyo & Moore logged the subsurface conditions exposed in the borings, and collected bulk and relatively undisturbed soil samples from the borings. The samples were then transported to our geotechnical laboratory for testing. The borings were backfilled in accordance with the boring permit requirements shortly after drilling. Detailed logs of the borings are presented in Appendix A.

The excavated soil generated during the drilling was collected in drums left on site. Soil samples collected from the drums were analytically tested for waste characterization. The results of the analytical testing are reported under separate cover.

The CPT soundings were performed on November 11, 2019 and November 26, 2019 using a truck-mounted rig with a 20-ton reaction capacity. After hand excavation to a depth of 5 feet to check for underground utilities, the soundings were pushed to depths of up to approximately 101 feet below the ground surface. Cone tip resistance, sleeve friction, and pore pressure were electronically measured and recorded at vertical intervals of approximately 2 inches while the cone was advanced. The normalized soil behavior type (Qtn) and soil behavior type index (I_c) and corresponding soil behavior for the subsurface materials encountered was assessed using correlations (Robertson, 2009 & 1990, respectively) based on the cone penetration data and sleeve friction. The CPT sounding logs are presented in Appendix B.

Laboratory testing of soil samples recovered from the borings included tests to evaluate in-situ soil moisture content and density, particle size distribution, Atterberg limits, expansion index, fines content, direct shear strength, triaxial shear strength, consolidation characteristics, soil corrosivity, and unconfined compressive strength. The results of the in-situ moisture content and density tests are presented on the boring logs in Appendix A. The results of the other laboratory tests are presented in Appendix C.

A percolation test was performed on November 22, 2019 at the location shown on Figure 2. The percolation test results and procedures utilized are presented in Appendix D. The test hole was backfilled with the soil cuttings after testing.

A seismic survey using passive surface wave techniques was performed at the site on November 22, 2019. The purpose of the study was to evaluate seismic site characterization and the variation in shear wave velocity with depth for the subsurface materials. The passive source method included Microtremor Array Measurement (MAM) and consisted of one linear profile of seismic data collection. The passive source method provided a shear wave (S-wave) velocity profile to a depth of approximately 100 feet below the ground surface and the weighted average of the shear wave velocity over that interval (Vs100) for seismic site classification (CBSC, 2019). The location of the seismic survey line is noted on Figure 2. The seismic study results are provided in Appendix E along with a summary of the field methods and analytical procedures utilized. The results indicate that the characteristic Vs100 is approximately 1,246 feet per second with a corresponding seismic site classification of Class C.

6 GEOLOGIC AND SUBSURFACE CONDITIONS

Our findings regarding regional geologic setting, site geology, subsurface stratigraphy, and groundwater conditions are provided in the following sections.

6.1 Regional Geologic Setting

The site is located along the western margin of San Francisco Bay in the Coast Ranges Geomorphic Province of California. The Coast Ranges are comprised of several mountain ranges and structural valleys formed by tectonic processes commonly found around the Circum-Pacific belt. Basement rocks have been sheared, faulted, metamorphosed, and uplifted, and are separated by thick blankets of Cretaceous and Cenozoic sediments that fill structural valleys and line continental margins. The San Francisco Bay Area has several ranges that trend northwest, parallel to major strike-slip faults such as the San Andreas, Hayward, and Calaveras (Figure 3). Major tectonic activity associated with these and other faults within this regional tectonic framework consists primarily of right-lateral, strike-slip movement.

6.2 Site Geology

Regional mapping by Dibblee & Minch (2007) indicates that the site is underlain by alluvial fan deposits of Holocene age consisting of fine-grained sand, silt, and gravel (Figure 4). Regional mapping by Brabb et al., (1998 & 2000) indicate that the site is underlain by basin deposits of Holocene age that are found at the distal edges of alluvial fans and consist of silty clay to clay.

6.3 Subsurface Conditions

The following sections provide a generalized description of the geologic units encountered during our subsurface evaluation. More detailed descriptions are presented on the logs in Appendix A.

6.3.1 Pavement

Borings B-4 and B-5 were drilled through asphalt concrete pavement. The pavement section encountered in these borings consisted of approximately 4 to 4½ inches of asphalt concrete over approximately 2 to 8 inches of aggregate base. Variations in the thickness of the asphalt concrete and aggregate base layers, within and beyond the ranges observed, may be encountered due to past maintenance, utility work, or other factors.

6.3.2 Fill

Fill was encountered in the borings below the pavement section, where present, or from the ground surface to depths that ranged between approximately 1½ feet (Boring B-3) and 6 feet (Boring B-5). The fill, as encountered, generally consisted of brown to dark brown, and olive gray to black, moist, firm to stiff, lean to sandy clay.

6.3.3 Alluvium

Alluvium was encountered in the borings below the fill to the depths explored. The alluvium, as encountered, generally consisted of brown and yellowish brown, moist to wet, firm to hard, lean to sandy clay and fat clay with layers of very loose to very dense sand and clayey sand.

6.4 Groundwater

Groundwater was encountered in the borings during drilling at depths that ranged between approximately 6½ feet (Boring B-2) and 8 feet (Boring B-4) below the ground surface. Groundwater was measured to range between approximately 7½ feet (Boring B-3) and 12 feet (Boring B-4) below the ground surface about 15 minutes after drilling. Groundwater may rise to a higher elevation than was encountered in our exploratory borings due to the short time available for seepage of water into the borings. Based on pore pressure measurements collected during cone penetration testing, the depth to groundwater was estimated to range between approximately 4.7 feet (Sounding CPT-3) and 8.4 feet (Sounding CPT-4) below the ground surface at the time of testing. The groundwater levels estimated from the cone penetration testing correspond to elevations that range between approximately 4 and 5 feet above mean sea level. Regional records indicate that the historic high groundwater levels in the site vicinity are less than 10 feet below the ground surface (CGS, 2006a).

The depth to groundwater within the limits of the study area is subject to spatial variations in topography and the elevation of the phreatic surface. Furthermore, groundwater levels may fluctuate in response to seasonal variations in precipitation, nearby groundwater pumping or dewatering, changes in irrigation practices adjacent to or within the study area, or other factors. In addition, seeps may be encountered at elevations above the observed groundwater levels due to perched groundwater conditions, leaking pipes, preferential drainage, or other factors not evident at the time of our exploration. Piezometers can be installed to further evaluate the depth to groundwater in the study area and fluctuation in groundwater levels over time.

7 GEOLOGIC HAZARDS AND CONSIDERATIONS

This study considered a number of issues relevant to the proposed construction, including seismic hazards, landsliding, settlement of compressible soil layers from static loading, unsuitable materials, excavation considerations, infiltration characteristics, soil corrosivity, and expansive soils. These issues are discussed in the following subsections.

7.1 Seismic Hazards

The seismic hazards considered in this study include the potential for ground rupture due to faulting, seismic ground shaking, liquefaction, dynamic settlement, lateral spreading, and sand boil induced ground subsidence. These potential hazards are discussed in the following subsections.

7.1.1 Historical Seismicity

The site is located in a seismically active region. Figure 3 presents the location of the site relative to the epicenters of historic earthquakes with magnitudes of 5.5 or more from 1800 to 2000. Records of historic ground effects related to seismic activity compiled by Knudsen et al. (2000), indicate that the water level in a monitoring well about 1,500 feet from the site to the southwest rose approximately 1½ feet in response to the 1989 Loma Prieta earthquake (Tinsley et al., 1998). No other ground effects related to historic seismic activity (e.g. liquefaction, sand boils, lateral spreading, ground cracking) have been reported for the site vicinity.

7.1.2 Faulting and Ground Surface Rupture

There are numerous recognized faults in northern California. Selected characteristics, as evaluated by the Working Group on California Earthquake Probabilities (WGCEP, 2013), for recognized and postulated faults (Caltrans, 2019) near the site are presented in Table 1. The fault characteristics in the table are presented in order of decreasing peak ground acceleration (PGA) based on a deterministic seismic hazard analysis utilizing the Chiou & Youngs (2013) and Campbell & Bozorgnia (2013) attenuation relationships.

The site is not located within an Alquist-Priolo Earthquake Fault Zone established by the state geologist (CGS, 1974) to delineate regions of potential ground surface rupture adjacent to active faults. As defined by the California Geological Survey (CGS), active faults are faults that have caused surface displacement within Holocene time, or within approximately the last 11,000 years (CGS, 2018). The closest fault rupture hazard zone is associated with the San Andreas Fault and is approximately 7 miles from the site to the southwest (CGS, 1974).

Table 1 – Parameters for Nearby Faults				
Fault (Segment)	**ID**	**Type**	**Max Moment Magnitude**	**Distance to Site (kilometers)**
San Andreas (Peninsula)	134	Strike Slip	8.0	13.0
Silver Creek	148	Strike Slip	6.9	10.4
San Andreas (Santa Cruz Mts)	158	Strike Slip	8.0	22.6
Cascade Fault	153	Reverse	6.7	10.4
Hayward (South)	137	Strike Slip	7.3	16.6
Monte Vista Shannon	154	Reverse	6.4	11.1
San Gregorio (San Gregorio)	127	Strike Slip	7.4	28.1
Hayward (Southern Extension)	149	Strike Slip	6.7	19.6
San Andreas (North Coast)	80	Strike Slip	8.0	55.9
Hayward (North)	123	Strike Slip	7.3	29.7

Based on our review of the referenced geologic maps, known active faults are not mapped on the site and the site is not located within a fault-rupture hazard zone. Therefore, the probability of damage from surface fault rupture is considered to be low.

7.1.3 Strong Ground Motion

Based on historic activity, the potential for future strong ground motion at the site is considered significant. Seismic design criteria to address ground shaking are provided in Section 9.1. A site-specific ground motion hazard analysis was performed in accordance with Chapter 21 of the American Society of Civil Engineers (ASCE) Standard 7-16 to evaluate the peak ground acceleration (PGA) associated with the Maximum Considered Earthquake Geometric Mean (MCE_G) in accordance with the 2019 California Building Code (CBC). The results of our site-specific ground motion hazard analysis indicate that the MCE_G peak ground acceleration with adjustment for site class effects (PGA_M) is 0.616g. The assumptions and models utilized for this analysis are listed on Figure 5.

7.1.4 Liquefaction and Strain Softening

The strong vibratory motions generated by earthquakes can trigger a rapid loss of shear strength in saturated, loose, granular soils of low plasticity (liquefaction) or in wet, sensitive, cohesive soils (strain softening). Liquefaction and strain softening can result in a loss of foundation bearing capacity or lateral spreading of sloping or unconfined ground. Liquefaction can also generate sand boils leading to subsidence at the ground surface.

Liquefaction (or strain softening) is generally not a concern at depths more than 50 feet below ground surface. The seismic hazard zones for the site vicinity are presented on Figure 6. Regional studies of liquefaction susceptibility (Witter et al., 2006) indicate that the liquefaction susceptibility at the site is very high.

During our subsurface exploration, we encountered sand below the groundwater level. To further evaluate the potential for liquefaction, we performed an analysis in accordance with the method presented by Boulanger and Idriss (2014) using the CPT data collected during our subsurface exploration and the computer program CLiq (GeoLogismiki, 2018). Our analysis considered a PGA of 0.616g corresponding to a Magnitude 8 earthquake on the San Andreas fault and a groundwater level of 7 feet below the existing ground surface. Based on characteristics provided by Bray & Sancio (2006) and the result of our laboratory index testing, the fine-grained soil (silt and clay) encountered at the site is not consistent with soil considered to be susceptible to liquefaction. Therefore, soil with a behavior type index (Ic) of 2.4 or less, consistent with sand and silty sand, was evaluated for susceptibility to liquefaction and related hazards. The results of our analysis, presented in Appendix F, indicate, based on a safety factor against liquefaction of less than one, that thin layers of sand and silty sand between approximately 25 and 38 feet below the ground surface will liquefy under the considered ground motion along with a few, very thin, scattered layers between 7 and 25 feet. Based on the distribution and relative thickness of the liquefiable layers, we do not regard reduction in foundation bearing capacity due to liquefaction as a design consideration for shallow foundations. Other consequences of liquefaction, including dynamic settlement, sand-boil-induced ground subsidence, and lateral spreading, are addressed in the following sections.

The cohesive soils encountered during our subsurface exploration are not particularly sensitive based on the observed moisture content and estimates of undrained and remolded shear strength from CPT tip resistance and sleeve friction, respectively, below the depth of hand excavation. As such we do not regard seismically induced strain-softening behavior as a design consideration.

7.1.5 Dynamic Settlement

The strong vibratory motion associated with earthquakes can also dynamically compact loose granular soil leading to surficial settlements. Dynamic settlement is not limited to the near surface environment and may occur in both dry and saturated sand and silt. Cohesive soil is not typically susceptible to dynamic settlement.

We evaluated the potential for dynamic settlement due to liquefaction of saturated soil using the computer program CLiq (GeoLogismiki, 2018) to evaluate the CPT data collected during our field investigation with the methodology of Boulanger and Idriss (2014). Our analysis considered a Magnitude 8.0 earthquake producing a PGA of 0.616g and a groundwater level of 7 feet below the ground surface. The results of our analysis, presented in Appendix F, indicate that the free-field total dynamic settlement following the considered seismic event will be approximately 2 inches. Differential dynamic settlement is estimated to be about 1 inch over a horizontal distance of approximately 30 feet. Recommendations for shallow foundations are provided.

7.1.6 Sand Boil Induced Ground Subsidence

Sand boils that occur when liquefied, near-surface soil escapes to the ground surface, can result in ground subsidence due to loss of material that is in addition to dynamic settlement. The Liquefaction Potential Index (LPI) described by Iwasaki et al (1978) was computed from the results of our liquefaction analysis with the CPT data to evaluate the potential for surface manifestation of liquefaction such as sand boils. The computed values of the LPI, presented in Appendix F, indicate that the potential for surface manifestation of liquefaction or sand boils is low with an LPI of approximately 5 or less.

7.1.7 Lateral Spreading

In addition to vertical displacements, seismic ground shaking can induce horizontal displacements as surficial soil deposits spread laterally by floating atop liquefied subsurface layers. Lateral spreading can occur on sloping ground or on flat ground adjacent to an exposed face. A free-face condition does not exist near the proposed improvements and the ground slope on site is relatively gentle and inconsistent with areas of flat ground or a reversed gradient. Consequently, we do not regard lateral spreading as a design consideration.

7.2 Landsliding and Slope Stability

The site is relatively flat with little topographic variation and the proposed project does not include the construction significant slopes. Based on the existing topography, we do not regard slope stability or landsliding of existing slopes as a design consideration for this project.

7.3 Static Settlement

The findings from our subsurface exploration indicate that the site is generally underlain by firm to hard clay with thin layers of very loose to very dense sand. Static settlement may be a concern for structures supported on shallow footings where the sustained loads are moderate. Recommendations for shallow footings are provided along with recommendations for ground improvement to mitigate static settlement where a reduction in the estimated static settlement is desired. Alternative recommendations for mat foundations to mitigate static settlement are also provided.

7.4 Unsuitable Materials

Fill materials that were not placed and compacted under the observation of a geotechnical engineer, or fill materials lacking documentation of such observation, are considered undocumented fill. Undocumented fill is generally unsuitable as a bearing material below foundations due to the potential for differential settlement resulting from variable support characteristics or the potential inclusion of deleterious materials. Undocumented fill was encountered in the borings to depths that ranged between approximately 1½ feet (Boring B-3) and 6 feet (Boring B-5) below the ground surface. The depth of fill may vary within and beyond the observed range due to past grading activity. Recommendations for subgrade observation and remedial grading are provided to check foundation excavations for unsuitable materials and mitigate poor bearing conditions related to undocumented fill. Alternatively, ground improvement to mitigate static settlement under foundations can also mitigate poor or variable bearing conditions related to undocumented fill.

Soil containing roots or other organic matter are not suitable as fill or subgrade material below foundations, pavements, or engineered fill. Recommendations for clearing and grubbing to remove vegetative matter in soil during site preparation are provided.

7.5 Corrosive/Deleterious Soil

An evaluation of the corrosivity of the on-site material was conducted to assess the impact to concrete and metals. The corrosion impact was evaluated using the results of limited laboratory testing on samples obtained during our subsurface study. Laboratory testing to quantify pH, electrical resistivity, chloride content, and soluble sulfate content was performed on samples of the near surface soil. The results of the corrosivity tests are presented in Appendix C. California Department of Transportation (Caltrans) defines a corrosive environment for structural elements as an area where the soil contains more than 500 parts per million (ppm) of chlorides, sulfates of 0.15 percent (1,500 ppm) or more, or pH of 5.5 or less (Caltrans, 2018). The criteria used to evaluate the deleterious nature of soil on concrete are listed in Table 2. Based on these criteria and the results of our testing, the near-surface soil at the site meets the definition of a corrosive environment for structures, but the sulfate exposure to concrete is negligible, and the exposure classification for sulfate is S0. Recommendations to mitigate the impact of corrosive/deleterious soil on concrete structures are presented in Section 9.8.

Table 2 – Criteria for Deleterious Soil on Concrete

Sulfate Content Percent by Weight	Sulfate Exposure	Exposure Class
0.0 to 0.1	Negligible	S0
0.1 to 0.2	Moderate	S1
0.2 to 2.0	Severe	S2
> 2.0	Very Severe	S3

Reference: American Concrete Institute (ACI) Committee 318 Table 19.3.1.1 (ACI, 2016)

7.6 Expansive Soils

Some clay minerals undergo volume changes upon wetting or drying. Unsaturated soils containing those minerals will shrink/swell with the removal/addition of water. The heaving pressures associated with this expansion can damage structures and flatwork. Laboratory testing was performed on select samples of the near-surface soil to evaluate the expansion index. The tests were performed in general accordance with the American Society of Testing and Materials (ASTM) Standard D 4829 (Expansion Index). The results of our laboratory testing indicate that the expansion index of two samples tested is 20 and 45, which is consistent with a low to very low expansion characteristic.

7.7 Excavation Considerations

We anticipate that the proposed project will involve excavations of up to approximately 9 feet deep for podium level excavation, foundation construction, and utility installation. The geologic materials encountered during our subsurface evaluation over this interval included fill and alluvium consisting of moist to wet, firm to very stiff clay with layers of very loose to loose clayey sand. The findings from our subsurface exploration indicate that the conditions encountered below this interval, if deeper excavations are needed for ground improvement, consisted of stiff to hard clay with layers of loose to very dense sand and clayey sand.

We anticipate that heavy earthmoving or drilling equipment in good working condition should be able to make the proposed excavations. Excavations in the fill may encounter obstructions consisting of debris, rubble, abandoned structures, or over-sized materials that may require special handling or demolition equipment for removal.

Near-vertical cuts in these deposits may not be stable particularly if the excavation encounters seepage or granular soil, extends below or near groundwater, or is exposed to rainfall/runoff.

Groundwater was encountered in the borings during drilling at depths that ranged between approximately 6½ feet (Boring B-2) and 8 feet (Boring B-4) below the ground surface. Based on pore pressure measurements collected during cone penetration testing, the depth to groundwater was estimated to range between approximately 4.7 feet (Sounding CPT-3) and 8.4 feet (Sounding CPT-4) below the ground surface at the time of testing. Variations in groundwater levels within and outside this range should be anticipated. Excavation subgrade that is near or below groundwater may be unstable under construction loading. Excavation subgrade may become unstable if exposed to wet conditions. Recommendations for excavation stabilization are presented. Excavated materials may also be wet and need to be dried out before reuse as fill.

7.8 Infiltration Characteristics

Ninyo & Moore performed percolation testing to evaluate the rate of infiltration on site for design of storm water management systems. The percolation test procedures utilized are presented in Appendix D. The test results, presented in Appendix D and summarized in Table 3, indicate that the infiltration rate of the near surface soil on site is relatively fast and consistent with Hydrologic Soil Group A. Due to the variability of subsurface materials encountered during our exploration, variability in subsurface infiltration should be anticipated.

Table 3 – Percolation Test Results

Test	Test Depth (feet)	Subsurface Conditions	Percolation Rate (minutes/inch)	Infiltration Rate[1] (inch/hour)
P-1	2	Clayey Sand	30	0.84

[1] Infiltration rate is percolation rate adjusted by a reduction factor to exclude percolation through sides of test hole.

8 CONCLUSIONS

Based on the results of our geotechnical evaluation, it is our opinion that the proposed improvements are feasible from a geotechnical standpoint provided the recommendations presented in this report are incorporated into the design and construction of the subject project. The conclusions from our evaluation are as follows:

- The subsurface exploration for this study encountered fill and alluvium. The fill, as encountered, generally consisted of moist, firm to stiff, lean to sandy clay. The alluvium, as encountered, generally consisted of moist to wet, firm to hard, lean to sandy clay and fat clay with layers of very loose to very dense sand and clayey sand.

- The fill encountered in the borings extended to depths that ranged between approximately 1½ feet (Boring B-3) and 6 feet (Boring B-5) below the ground surface. The fill is undocumented. Recommendations for subgrade observation and remedial grading are provided to mitigate the potential for unsuitable materials and poor bearing conditions related to undocumented fill. Alternatively, poor or variable bearing conditions related to undocumented fill can also be mitigated by ground improvement under foundations.

- Groundwater was encountered in the borings during drilling at depths that ranged between approximately 6½ feet (Boring B-2) and 8 feet (Boring B-4) below the ground surface. Based on pore pressure measurements collected during cone penetration testing, the depth to groundwater was estimated to range between approximately 4.7 feet (Sounding CPT-3) and 8.4 feet (Sounding CPT-4) below the ground surface at the time of testing. Variation and fluctuation in groundwater levels should be anticipated as discussed in Section 6.4.

- The site could experience a relatively large degree of ground shaking during a significant earthquake on a nearby fault.

- The results of our liquefaction analysis, presented in Appendix F, indicate that thin layers of sand and silty sand between approximately 25 and 38 feet below the ground surface will liquefy under the considered ground motion along with a few, very thin, scattered layers between 7 and 25 feet. Based on the distribution and relative thickness of the liquefiable layers, we do not regard reduction in foundation bearing capacity due to liquefaction as a design consideration for shallow foundations. Computed values of the Liquefaction Potential Index, presented in Appendix F, indicate that the potential for surface manifestation of liquefaction or sand boils is low.

- The results of our dynamic settlement analysis, presented in Appendix F, indicate that the free-field total dynamic settlement following the considered seismic event will be approximately 2 inches. Differential dynamic settlement is estimated to be about 1 inch over a horizontal distance of approximately 30 feet.

- Ground surface rupture due to faulting is not a design consideration based on the location of the project.

- Landslides and lateral spreading due to liquefaction are not design considerations based on the topographic conditions at the site.

- Static settlement may be a concern for structures supported on shallow footings where the sustained loads are moderate. Recommendations for footings are provided with ground improvement to mitigate static settlement where desirable. Alternative recommendations for mat foundations are also provided.

- Expansion Index testing indicates that the expansion characteristic of the near-surface soil on site has is low to very low.

- Our laboratory corrosion testing indicates that the near-surface site soils are considered corrosive to structures based on California Department of Transportation (Caltrans, 2018) corrosion guidelines. Recommendations for measures to mitigate the impact of corrosive/deleterious soil on concrete structures are presented.

- Percolation testing performed for this study indicate that the infiltration rate at the Test Hole (Figure 2) is relatively fast.

- Excavations that remain unsupported, encounter seepage or granular soil, extend below or near groundwater, or are exposed to water may be unstable and prone to sloughing. Recommendations for excavation stabilization are provided.

- Excavations in the fill may encounter debris, rubble, oversize material, buried objects, or other potential obstructions.

9 RECOMMENDATIONS

The following sections present our geotechnical recommendations for the design and construction of the proposed improvements. The project improvements should be designed and constructed in accordance with these recommendations, applicable codes, and appropriate construction practices.

9.1 Seismic Design Criteria

Ninyo & Moore performed a site-specific ground motion analysis in accordance with the procedure in Chapter 21 of ASCE Standard 7-16. The assumptions and models for this analysis are noted on Figure 4 and are listed in the references. Seismic Site Class C was selected based on the findings from our subsurface exploration presuming that the fundamental period of the proposed structure will not exceed ½ second. The design response spectrum based on the site-specific ground motion analysis is presented on Figure 5 and the corresponding seismic design criteria are summarized in Table 4. The spectral ordinates and seismic coefficients based on the mapped values of the risk-targeted spectral response acceleration, consistent with Section 11.4 of ASCE Standard 7-16, are also presented in the table (SEAOC & OSHPD, 2019). Either the site-specific or the general seismic criteria listed in Table 4 may be used for design as the site-specific ground motion analysis is optional for this site.

Table 4 – California Building Code Seismic Design Criteria

Seismic Design Parameter Evaluated for 37.4747° North Latitude, 122.1328°West Longitude	Site Specific	Section 11.4 ASCE 7-16
Site Class	C	C
Site Coefficient, Fa	---	1.2
Site Coefficient, Fv	---	1.4
Mapped Spectral Response Acceleration at 0.2-second period, S_S	---	1.500g
Mapped Spectral Response Acceleration at 1.0-second period, S_1	---	0.600g
Site-Adjusted Spectral Acceleration at 0.2-second period, S_{MS}	1.620g	1.800g
Site-Adjusted Spectral Acceleration at 1.0-second period, S_{M1}	1.302g	0.840g
Design Spectral Response Acceleration at 0.2-second Period, S_{DS}	1.080g	1.200g
Design Spectral Response Acceleration at 1.0-second Period, S_{D1}	0.868g	0.560g
Seismic Design Category for Risk Category I, II, or III	D	D

9.2 Foundation Recommendations

The proposed job training center may be supported on footings or mat foundations. Recommendations for footings and mat foundations are provided below. Ground improvement may be performed to reduce the degree of static settlement. Recommendations for ground improvement are provided in Section 9.4.

Foundations should be designed in accordance with structural considerations and the following recommendations. In addition, requirements of the appropriate governing jurisdictions and applicable building codes should be considered in design of the structures. The foundation design parameters provided in the following sections are not intended to preclude differential movement of foundations. Minor cracking (considered tolerable) of foundations may occur.

9.2.1 Mat Foundations

The job training center may be supported on a mat foundation designed for a gross allowable bearing capacity of 1,500 pounds per square foot (psf). This allowable bearing capacity includes a factor of safety of more than 3 and may be increased by one-third when considering wind or seismic loading combinations.

Mat foundations should be designed for a total settlement of 1⅓-inch due to sustained loads and a differential settlement of ⅔-inch over a 20-foot span. The deflection of the mat due to applied loads may be evaluated using a modulus of subgrade reaction equivalent to 3 pounds per cubic inch for sustained loads. Mat foundations may undergo an additional 2 inches of total dynamic settlement following the seismic event considered with a differential dynamic settlement of approximately 1 inch over a horizontal distance of about 30 feet. Mat foundation subgrade should be prepared in accordance with the recommendations in Section 9.5.5. The geotechnical engineer should observe mat foundation subgrade to evaluate bearing materials and subgrade condition before the exposed subgrade is covered.

The mat slab should be no less than 10 inches thick and should be reinforced with deformed steel bars that have a nominal diameter of ½ inch or more. The mat slab and slab reinforcement should be designed and detailed by the structural engineer based on the anticipate loading and usage. Masonry briquettes or plastic chairs should be used to aid in the correct placement of slab reinforcement. Recommendations for concrete and concrete cover over reinforcing steel are presented in Section 9.8. Recommendations for a moisture vapor retarding system to reduce the potential for moisture vapor intrusion through the mat foundation are provided in Section 9.9.

A friction coefficient of 0.20 and an allowable lateral bearing pressure of 225 psf per foot of depth up to 2,250 psf may be used to evaluate foundation resistance to lateral loads with a safety factor of 2. The recommended lateral bearing pressure is for level and gently sloping ground conditions where the ground slope adjacent to the foundation is 5 percent or less. The lateral bearing pressure should be neglected to a depth of 12 inches where the ground adjacent to the foundation is not covered by a slab or pavement. The lateral bearing pressure may be increased by one-third when considering loads of short duration such as wind or seismic forces.

9.2.2 Footings

Footings bearing on subgrade prepared per the recommendations in Section 9.5.5 may be designed using the criteria listed in Table 5. The geotechnical engineer should observe the footing excavations to evaluate bearing materials and subgrade condition before the exposed subgrade is covered.

Table 5 – Recommended Bearing Design Parameters for Footings

Footing[1]	Sustained Loads	Footing Widths	Bearing Depth[2]	Allowable Bearing Capacity[3]	Static Settlement
Wall Footing	10 kips/foot or less	12 inches or more	2 feet or more	2,000 psf	2 inches total 1 inch differential over 30 feet
Column Footing	200 kips or less	24 inches or more	2 feet or more	2,000 psf	2½ inches total 1¼ inch differential over 30 feet

Notes:
1 Podium floor within a foot or two of existing grade.
2 Below the lowest adjacent finish grade.
3 Net allowable bearing capacity in pounds per square foot with Safety Factor of 3 or more. Allowable bearing capacity may be increased by one-third for wind or seismic alternative basic load combinations.

Structures supported on footings consistent with these recommendations should be designed for the total and differential settlements listed in Table 5 for sustained loads. Structures may undergo an additional 2 inches of total dynamic settlement following a significant earthquake with a differential dynamic settlement of about 1 inch over a lateral span of 30 feet. Footing settlement due to sustained static loads may be further evaluated using a modulus of subgrade reaction. Recommended values for the modulus of subgrade reaction in pounds per cubic inch (pci) are provided in Table 6. The designer may interpolate between the values in the table for intermediate footing widths.

The spread footings should be reinforced with deformed steel bars as detailed by the project structural engineer. Where footings are located adjacent to utility trenches or other excavations, the footing bearing surfaces should bear below an imaginary plane extending upward from the bottom edge of the adjacent trench/excavation at a 2:1 (horizontal to vertical) angle above the bottom edge of the footing. Footings should be deepened or excavation depths reduced as-needed. Footing bottoms should not be sloped more than 1-unit vertical to 10 units horizontal. Wall footings may be stepped provided that the bearing grade differential between adjacent steps does not exceed 18 inches and the slope of a series of such steps does not exceed 1-unit vertical to 2 units horizontal.

Table 6 – Footing Modulus of Subgrade Reaction

Footing	Footing Width				
	1 foot	2 feet	4 feet	7.5 feet	12.5 feet
Wall Footing	37 pci	17 pci	8 pci	4 pci	--
Column Footing	--	19 pci	10 pci	5.5 pci	3.5 pci

A friction coefficient of 0.35 and an allowable lateral bearing pressure of 225 psf per foot of depth up to 2,250 psf may be used to evaluate footing resistance to lateral loads with a safety factor of 2. The recommended lateral bearing pressure is for level and gently sloping ground conditions where the ground slope adjacent to the foundation is 5 percent or less. The lateral bearing pressure should be neglected to a depth of 12 inches where the ground adjacent to the foundation is not covered by a slab or pavement. The lateral bearing pressure may be increased by one-third when considering loads of short duration such as wind or seismic forces. The weight of the material above a plane rising up and away from the bottom edges of the footings at 20 degrees off plumb may be considered, along with the weight of the footing and the material over the footing, when evaluating footing resistance to uplift. A unit weight of 120 pounds per cubic foot (pcf) for soil or aggregate and 150 pcf for normal weight concrete may be assumed for this evaluation.

9.2.3 Slab-on-Grade Floors

Building floor slabs should be designed by the project structural engineer based on the anticipated loading conditions. Slabs subject to vehicular traffic should be no less than 6 inches thick for traffic consisting predominantly of passenger vehicles with periodic emergency vehicles or garbage trucks. Floor slabs should be reinforced with deformed steel bars with a nominal diameter of ⅜-inch or more. Masonry briquettes or plastic chairs should be used to maintain the position of slab reinforcement, during concrete placement, in the upper half of the slab with appropriate concrete cover over the reinforcing steel. Refer to Section 9.8 for the recommended concrete cover over reinforcing steel. Joints consistent with ACI guidelines (ACI, 2016) may be constructed at periodic intervals to reduce the potential for random cracking of the slab. Recommendations for a moisture vapor retarding system to reduce the potential for moisture vapor intrusion through the mat foundation are provided in Section 9.9. Where a vapor retarding system is not used, slabs should be constructed on 6 inches of compacted aggregate base conforming to Sections 9.5.4 and 9.5.6. Slab subgrade should be prepared in accordance with Section 9.5.5.

9.3 Foundations for Ancillary Improvements

Lightly-loaded ancillary improvements may be supported on foundations designed and constructed in accordance with the recommendations in this section.

9.3.1 Equipment Pads

The transformer and other mechanical equipment may be supported on mat foundations. Mat foundations for equipment pads should be not less than 8 inches thick with reinforcement consisting of one or more layers of deformed steel bars (nominal diameter of ½-inch or more) at a center-to-center spacing of not more than 18 inches in both directions. Mat foundations for equipment pads should be designed and detailed by a structural engineer for the anticipated loading and usage.

Mat foundations for equipment pads should be constructed over 6 inches of aggregate base compacted to 95 percent of the reference density as evaluated by ASTM D1557. Prior to placement of the aggregate base, foundation subgrade should be scarified to a depth of about 8 inches, moisture conditioned to near and above the optimum moisture content, then compacted to 90 percent of the reference density as evaluated by ASTM D1557.

Equipment pads up to 18 feet wide consistent with these recommendations may be designed for a net allowable bearing capacity of 1,000 pounds per square foot (psf). This allowable bearing capacity, which includes a safety factor of three or more, may be increased by one-third when considering wind or seismic loading combinations. The deflection of the mat due to applied loads may be evaluated using a modulus of subgrade reaction equivalent to 5 pounds per cubic inch for sustained loads. Mat foundations may undergo an additional 2 inches of total dynamic settlement following the seismic event considered with a differential dynamic settlement of approximately 1 inch over a horizontal distance of about 30 feet. A friction coefficient of 0.50 may be used to evaluate foundation resistance to lateral loads where the slab is underlain by aggregate base with no moisture vapor retarding system.

9.3.2 Minor Footings

Play area equipment, parking stackers, site walls, and other lightly-loaded ancillary improvements may be supported on footings. Footings 12- to 36-inches wide on level ground embedded 12 inches below the adjacent grade and bearing on firm or compact subgrade may be designed for a net allowable bearing capacity of 1,500 pounds per square foot. The allowable bearing capacity may be increased by one-third when considering wind or seismic load combinations.

Excavations for minor footings should be inspected. Debris, vegetation, or other deleterious matter should be removed and replaced with compacted fill per the recommendations in this report. Excavation subgrade that is loose, soft, or dry of optimum should be scarified and moisture conditioned, as needed, to achieve a moisture content near and above the optimum, before compaction, by mechanical means, to 90 percent of the reference density as evaluated by ASTM D1557.

Structures supported on footings consistent with these recommendations should be designed for a total and differential settlement due to sustained loads of approximately ½-inch and ¼ inch, respectively, over a horizontal distance of 30 feet. Minor footings may undergo an additional 2 inches of total dynamic settlement following the seismic event considered with a differential dynamic settlement of approximately 1 inch over a horizontal distance of about 30 feet.

The footings should be reinforced with deformed steel bars as detailed by the project structural engineer. A friction coefficient of 0.35 and an allowable lateral bearing pressure of 225 psf per foot of depth up to 2,250 psf may be used to evaluate footing resistance to lateral loads with a safety factor of 2. The lateral bearing pressure should be neglected to a depth of 12 inches where the ground adjacent to the foundation is not covered by a slab or pavement. The lateral bearing pressure may be increased by one-third when considering loads of short duration such as wind or seismic forces.

9.3.3 Drilled Piers

Play area equipment, parking stackers, light poles, and other lightly-loaded ancillary improvements may be supported on drilled piers as an alternative to footings. Drilled piers for ancillary improvements embedded up to 20 feet below grade may be designed for an allowable side friction of up to 500 pounds per square foot (psf) at 50 psf per foot of embedment depth to evaluate resistance to downward axial loads and up to 350 psf at 35 psf per foot depth for upward axial loads. The recommended values for allowable skin friction include a safety factor of 2 for downward loading and 3 for upward loading. The allowable side friction may be increased by one-third for alternative basic load combinations with loads of short duration such as wind or seismic loads. The spacing between adjacent piers should be equivalent to three pier diameters or more to mitigate reduction in axial resistance due to group effects. Structures supported on shallow pier foundations should be designed for a total settlement due to sustained loads of approximately ½ inch with a differential of approximately ¼ inch over a horizontal distance of 30 feet.

A lateral bearing pressure of 100 pounds per square foot (psf) per foot depth up to 1,500 psf may be used to evaluate resistance to lateral loads and overturning moments in accordance with Section 1807 of the California Building Code with a one-third increase for wind or seismic loading conditions. The allowable lateral bearing pressure may be increased by a factor of two for structures that can accommodate ½ inch of lateral deflection of the top of the pier foundation.

The spacing between adjacent piers should be equivalent to three pier diameters or more to avoid a reduction in lateral load resistance due to group effects for piers in a row perpendicular to the direction of lateral loading. For piers in a row parallel to the direction of lateral loading, the contribution of trailing piers to the lateral load resistance of the group should be neglected where the center to center spacing is less than eight pier diameters.

Drilled pier excavations should be cleaned of loose material prior to pouring concrete. Drilled pier excavations that encounter groundwater or cohesionless soil may be unstable and may need to be stabilized by temporary casing or use of drilling mud. Standing water should be removed from the pier excavation or the concrete should be delivered to the bottom of the excavation, below the water surface, by tremie pipe. Casing should be removed from the excavation as the concrete is placed. Concrete should be placed in the piers in a manner that reduces the potential for segregation of the components.

9.4 Ground Improvement

Ground improvement may be performed to reduce the estimated potential settlement due to sustained static loads on foundations, mitigate concerns related to undocumented fill, and permit an increase in the allowable bearing capacity. The ground improvement program should be designed and constructed by a specialty contractor with experience utilizing the selected ground improvement technique on several previous projects with similar ground conditions. The ground improvement program should be designed to reduce the future building settlement under sustained loads to 1 inch (total) with a differential static settlement of ½ inch over a lateral distance of 20 feet. We anticipate that ground improvement by stone columns, aggregate piers, rigid inclusions, or drilled displacement grouting can achieve this objective. General recommendations and descriptions of these methods are provided in the following subsections.

9.4.1 Stone Columns and Aggregate Piers

Stone columns (or aggregate piers), consisting of crushed rock installed in a hole created by an auger, vibratory probe, or driven/pushed mandrel and compacted in lifts by a vibratory probe or rammer/tamper, may be used to reinforce the subgrade below footings and improve the average stiffness of the composite ground thereby reducing settlement and increasing the allowable bearing capacity for the footings. We anticipate that these methods can be designed to achieve an improved allowable bearing capacity of 4,000 pounds per square foot (psf). A pre-production test section should be constructed to demonstrate that the selected ground improvement technique and installation parameters can achieve the design criteria. Static load testing should be performed to evaluate the modulus of the constructed test columns/piers under loading conditions consistent with production work.

The ground improvement contractor should submit qualifications with resumes of key personal and descriptions of representative projects completed; a ground improvement design with shop drawings that describe the spacing, location, depth, and nominal diameter of the columns/piers; calculations to document the basis for the design; a work procedures plan outlining proposed means and methods for ground improvement; and a quality control plan that describes the measures and procedures to be implemented by the contractor to document that the ground improvement elements have been constructed in conformance with the work plan and shop drawings, and that the objective of the program has been achieved.

The quality control program should include a gradation analysis of the aggregate backfill material; monitoring, recording, and daily reporting of key parameters; and modulus testing of the constructed columns/piers. The key parameters for monitoring and reporting should include, as appropriate, start and finish time for column/pier installation; treatment depth; vibrator amperage draw or tamping duration per lift; and total quantity of backfill added per column or pier. The ground improvement and testing operations should be observed by the geotechnical engineer.

9.4.2 Rigid Inclusions and Drilled Displacement Grouting

Rigid inclusions (or drilled displacement grouting), where columns of grout or concrete are constructed by drilled-displacement or drilled-replacement methods, may also be used to reinforce the subgrade below footings and improve the average stiffness of the composite ground. The concrete or grout is typically placed through the hollow stem of the drilling tool as the tool is withdrawn from the ground. The grout/concrete columns formed by these techniques do not typically include steel reinforcement and are not structurally connected to the footings with an aggregate cushion or load transfer platform between the columns and the footing. We anticipate that rigid inclusions or drilled displacement grouting can be designed to achieve an improved allowable bearing capacity of 5,000 pounds per square foot (psf). A pre-production test section should be constructed to demonstrate that the selected ground improvement technique and installation parameters can achieve the design criteria. Static or dynamic load testing should be performed to evaluate resistance to axial loads.

The ground improvement contractor should submit qualifications with resumes of key personal and descriptions of representative projects completed; a ground improvement design with shop drawings that describe the spacing, location, depth, and nominal diameter of the columns; calculations to document the basis for the design; a work procedures plan outlining proposed means and methods for ground improvement; and a quality control plan that describes the measures and procedures to be implemented by the contractor to document that the ground improvement elements have been constructed in conformance with the work plan and shop drawings, and that the objective of the program has been achieved.

The quality control program should include sampling and compression testing of the grout/concrete; and monitoring, recording, and daily reporting of key parameters. The contractor should furnish equipment to automatically measure auger rotation, auger depth, penetration rate, torque delivered to the auger, crowd force, lifting rate, volume of grout placed, and pressure of the grout near the auger tip. These parameters should be automatically recorded as a function of auger depth at vertical intervals of 2 feet or less and submitted to the geotechnical engineer for review. To reduce the potential for soil mining due to over-rotation where continuous flight augers are used, the auger penetration rate should generally exceed the auger pitch in 1½ to 2 rotations for cohesionless soil and in 2 to 3 rotations for clay. The potential for soil mining and an appropriate penetration rate for the site conditions can be evaluated by pre-production test section. The target penetration rate should be selected by the ground improvement contractor based on the proposed equipment and experience on sites with similar ground conditions or based on the pre-production test section. To reduce the potential for defects in the column, the applied grouting pressure and the withdrawal rate should be maintained so that the grout pressure at the discharge point exceeds the overburden pressure. The volume of grout placed should exceed the theoretical volume of the column, typically by about 15 to 20 percent. The contractor should select a target grout volume factor based on the proposed equipment and experience on sites with similar ground conditions or based on a pre-production test section. The observed grout volume factor should be within 7½ percent of the target. The ground improvement and testing operations should be observed by the geotechnical engineer.

9.5 Earthwork

The earthwork should be conducted in accordance with the relevant grading ordinances having jurisdiction and the following recommendations. The geotechnical engineer should observe earthwork operations. Evaluations performed by the geotechnical engineer during the course of field operations may result in new recommendations, which could supersede the recommendations in this section.

9.5.1 Pre-Construction Conference

We recommend that a pre-construction conference be held to discuss the grading recommendations presented in the report. The owner and/or their representative, the architect, the engineer, Ninyo & Moore, and the contractor should be in attendance to discuss project schedule and earthwork requirements.

9.5.2 Site Preparation

Site preparation should begin with the removal of vegetation, utility lines, surface obstructions (e.g., pavements, aggregate base, curb/gutter, foundations), rubble and debris, and other deleterious materials from areas to be graded. Vegetation should be removed to such a depth that organic material is generally not present. Clearing and grubbing should extend to the outside of the proposed excavation and fill areas. Rubble and excavated materials that do not meet criteria for use as fill should be disposed of in an appropriate landfill. Soils containing roots or other organic matter may be stockpiled for later use as landscaping fill, as authorized by the owner’s representative. Active utilities within the project limits, if any, should be re-routed or protected from damage by construction activities. Existing utilities to be abandoned should be removed, crushed in place, or backfilled with grout. Excavations resulting from removal of buried utilities, tree stumps, or obstructions should be backfilled with compacted fill in accordance with the recommendations in the following sections.

9.5.3 Subgrade Observation and Remedial Grading

Prior to placement of fill, erection of forms or placement of reinforcement for foundations, the client should request an evaluation of the exposed subgrade by Ninyo & Moore. Materials that are considered unsuitable shall be excavated under the observation of the geotechnical engineer in accordance with the recommendations in this section or the field recommendations of the geotechnical engineer.

Unsuitable materials include, but may not be limited to dry, loose, soft, wet, expansive, organic, or compressible natural soil; and undocumented or otherwise deleterious fill materials. Unless otherwise noted, unsuitable materials should be removed from trench bottoms and below bearing surfaces to a depth at which suitable foundation subgrade, as evaluated in the field by the geotechnical engineer, is exposed. Recommendations for clearing and grubbing to remove vegetation and other unsuitable materials are presented in Section 9.5.2.

Undocumented fill was encountered in the borings. The fill encountered in the borings extended to depths that ranged between approximately 1½ feet (Boring B-3) and 6 feet (Boring B-5) below the ground surface. To mitigate the potential for variable support characteristics of undocumented fill under mat foundations, ground improvement as described in Section 9.4 may be performed or the building pad should be overexcavated to a depth of 5 feet below the existing grade but not less than 2 feet below the future bearing elevation for the mat foundation. Where not obstructed by property limits or adjacent structures, removals should extend a lateral distance equivalent to 5 feet beyond the foundation. The exposed subgrade after remedial excavation should be scarified and moisture conditioned as needed to achieve a moisture content near and above the optimum before compaction to 90 percent of the reference density as evaluated by ASTM D1557. Remedial excavations should be backfilled with fill that conforms with the recommendations in Section 9.5.4 and is placed and compacted in accordance with the recommendations in Section 9.5.6. Undocumented fill that conforms with the criteria for general fill in Section 9.5.4, or can be processed to conform with the criteria for general fill, may be reused as fill.

The impact of undocumented fill under footings can be mitigated by the ground improvement described in Section 9.4. Where ground improvement is not performed, the impact of undocumented fill under footings should be mitigated by overexcavating the footing locations to remove the undocumented fill. Ninyo & Moore should be retained to observe the remedial excavations to evaluate depth of removal to suitable materials. The exposed subgrade after remedial excavation should be scarified and moisture conditioned as needed to achieve a moisture content near and above the optimum before compaction to 90 percent of the reference density as evaluated by ASTM D1557. Remedial excavations should be backfilled with fill that conforms with the recommendations in Section 9.5.4 and is placed and compacted in accordance with the recommendations in Section 9.5.6. Undocumented fill that conforms with the criteria for general fill in Section 9.5.4, or can be processed to conform with the criteria for general fill, may be reused as fill. Alternatively, remedial excavations under footings may be backfilled with lean concrete or controlled low strength material (CLSM). Remedial excavations that are backfilled with general fill should extend a lateral distance beyond the footing edges equivalent to the depth of removal below the footing bearing elevation. Remedial excavations under footings that are backfilled with CLSM or lean concrete need not extend beyond the footing edges.

9.5.4 Material Recommendations

Materials used during earthwork operations should comply with the requirements listed in Table 7.

Table 7 – Recommended Material Requirements		
Material and Use	**Source**	**Requirements[1,2]**
General Fill: - for uses not otherwise specified	Import	Close-graded with 35 percent or more passing No. 4 sieve and either: Expansion Index of 50 or less, Plasticity Index of 12 or less, or less than 10 percent, by dry weight, passing No. 200 sieve
	On-site borrow	No additional requirements[1]
Controlled Low Strength Material (CLSM)	Import	CSS[4] Section 19-3.02G
Permeable Aggregate	Import	Open-graded, clean, compactable crushed rock or angular gravel; nominal size ¾ inch or less
Aggregate Base	Import	Class II; CSS[4] Section 26-1.02
Asphalt Concrete	Import	Type A; CSS[4] Section 39-2
Bedding and Pipe Zone Material -material below pipe invert to 12 inches above pipe	Import	90 to 100 percent (by mass) should pass No. 4 sieve, and 5 percent or less should pass No. 200 sieve
Trench Backfill - above bedding material	Import or on-site borrow	As per general fill and excluding rock/lumps retained on 4-inch sieve or 2-inch sieve in top 12 inches

Notes:

1 In general, fill should not consist of pea-gravel and should be free of rocks or lumps in excess of 6-inches diameter, trash, debris, roots, vegetation or other deleterious material.

2 In general, import fill should be tested or documented to be non-corrosive[3] and free from hazardous materials in concentrations above levels of concern.

3 Non-corrosive as defined by the Corrosion Guidelines (Caltrans, 2018).

4 CSS is California Standard Specifications (Caltrans, 2015).

Materials should be evaluated by the geotechnical engineer for suitability prior to use. The contractor should notify the geotechnical consultant 72 hours prior to import of materials or use of on-site materials to permit time for sampling, testing, and evaluation of the proposed materials. On-site materials may need to be dried out before re-use as fill. The contractor should be responsible for the consistency of import material brought to the site.

9.5.5 Subgrade Preparation

Subgrade should be prepared as per the recommendations in Table 8. Prepared subgrade should be maintained in a moist (but not saturated) condition by the periodic sprinkling of water prior to placement of additional overlying fill or construction of footings and slabs.

Subgrade that has been permitted to dry out and loosen or develop desiccation cracking, should be scarified, moisture-conditioned, and recompacted as per the requirements above.

A thin layer (approximately 3 inches) of lean concrete or controlled low strength material (CLSM) may be placed over prepared subgrade for footings or mat foundations to maintain the appropriate moisture condition during erections of forms and placement of reinforcing steel.

Table 8 – Subgrade Preparation Recommendations	
Subgrade Location	**Preparation Recommendations**
Below Footings	• Perform remedial grading or ground improvement as per Section 9.5.3 or Section 9.4, respectively. • Maintain compacted fill in moist condition by sprinkling water.
Below Mat Slabs	• Perform remedial grading or ground improvement as per Section 9.5.3 or Section 9.4, respectively. • Maintain compacted fill in moist condition by sprinkling water.
Below Fill and Flatwork	• Clear and grub per Section 9.5.2. • Check for unsuitable materials as per Section 9.5.3. • Scarify 8 inches then moisture condition and compact as per Section 9.5.6. • Keep in moist condition by sprinkling water.
Below Pavement	• Clear and grub per Section 9.5.2. • Check for unsuitable materials as per Section 9.5.3. • Scarify 8 inches then moisture condition and compact as per Section 9.5.6. • Proof roll compacted subgrade with loaded water truck under the observation of the geotechnical engineer. Mitigate yielding areas in accordance with the recommendations of the engineer. • Keep in moist condition by sprinkling water.
Utility Trenches	• Check for unsuitable materials per Section 9.5.2. • Remove or compact loose/soft material.

Remedial measures may be needed where the specified compaction cannot be achieved for footing and mat foundation subgrade due to shallow groundwater conditions. Where aeration, mixing, and recompaction cannot achieve the specified relative compaction, overexcavation and replacement with ¾-inch open-graded crushed rock that is compacted into the subgrade, may be needed to achieve a firm subgrade condition. The depth of overexcavation and replacement will be influenced by the conditions encountered and will be evaluated by the geotechnical engineer during construction.

9.5.6 Fill Placement and Compaction

Fill and backfill should be compacted in horizontal lifts in conformance with the recommendations presented in Table 9. The allowable uncompacted thickness of each lift of fill depends on the type of compaction equipment utilized, but generally should not exceed 8 inches in loose thickness.

Compacted fill should be maintained in a moist (but not saturated) condition by the periodic sprinkling of water prior to placement of additional overlying fill or construction of footings and slabs. Fill that has been permitted to dry out and loosen or develop desiccation cracking, should be scarified, moisture conditioned, and recompacted as per the requirements above.

Table 9 – Compaction Recommendations

Fill Type	Location	Compacted Density[1]	Moisture Content[2]
Aggregate Base	Pavement section or below hardscape	95 percent	Near Optimum
Subgrade	Below pavement with vehicular traffic	95 percent	+ 2 percent
	In locations not already specified	90 percent	+ 2 percent
Asphalt Concrete	Pavement section	91 percent	Not Applicable
Trench Backfill	Below pavement (within 2 feet of finished grade)	95 percent	+ 2 percent
	In locations not already specified	90 percent	+ 2 percent
Bedding and Pipe Zone Fill	Material below invert to 12 inches above pipe	90 percent	Near Optimum
General Fill	Below pavement (within 2 feet of finished grade)	95 percent	+ 2 percent
	In locations not already specified	90 percent	+ 2 percent

Notes:
1 Expressed as percent relative compaction or ratio of field density to reference density (typically on a dry density basis for soil and aggregate and on a wet density basis for asphalt concrete). The reference density of soil and aggregate should be evaluated by ASTM D 1557. The reference density of asphalt concrete should be evaluated by ASTM D 2041.
2 Target moisture content at compaction relative to the optimum as evaluated by ASTM D 1557.

9.5.7 Temporary Slopes and Excavation Stabilization

Trench excavations shall be stabilized in accordance with the Excavation Rules and Regulations (29 Code of Federal Regulations [CFR], Part 1926) stipulated by the Occupational Safety and Health Administration (OSHA). Stabilization shall consist of shoring sidewalls or laying slopes back.

Dewatering pits or sumps should be used to depress the groundwater level (if encountered) below the bottom of the excavation. Table 10 lists the OSHA material type classifications and corresponding allowable temporary slope layback inclinations for soil deposits that may be encountered on site. Alternatively, an internally-braced shoring system or trench shield conforming to the OSHA Excavation Rules and Regulations (29 CFR, Part 1926) may be used to stabilize excavation sidewalls during construction. The lateral earth pressures listed in Table 10 may be used to design or select the internally-braced shoring system or trench shield. The recommendations listed in this table are based upon the limited subsurface data provided by our subsurface exploration and reflect the influence of the environmental conditions that existed at the time of our exploration. Excavation stability, material classifications, allowable slopes, and shoring pressures should be re-evaluated and revised, as-needed, during construction. Excavations, shoring systems and the surrounding areas should be evaluated daily by a competent person for indications of possible instability or collapse.

Table 10 – OSHA Material Classifications and Allowable Slopes

Formation	OSHA Classification	Allowable Temporary Slope[1,2,3]	Lateral Earth Pressure on Shoring[4] (psf)
Fill & Alluvium (above groundwater)	Type C	1½h:1v (34°)	80×D + 72

Notes:

1 Allowable slope for excavations less than 20 feet deep. Excavation sidewalls in cohesive soil may be benched to meet the allowable slope criteria (measured from the bottom edge of the excavation). The allowable bench height is 4 feet. The bench at the bottom of the excavation may protrude above the allowable slope criteria.
2 In layered soil, layers shall not be sloped steeper than the layer below.
3 Temporary excavations less than 4 feet deep may be made with vertical side slopes and remain unshored if judged to be stable by a competent person (29 CFR, Part 1926.650).
4 'D' is depth of excavation for excavations up to 20 feet deep. Includes a surface surcharge equivalent to two feet of soil.

The shoring system should be designed or selected by a suitably qualified individual or specialty subcontractor. The shoring parameters presented in this report are preliminary design criteria, and the designer should evaluate the adequacy of these parameters and make appropriate modifications for their design. We recommend that the contractor take appropriate measures to protect workers. OSHA requirements pertaining to worker safety should be observed.

Excavations made in close proximity to existing structures may undermine the foundation of those structures and/or cause soil movement related distress to the existing structures. Stabilization techniques for excavations in close proximity to existing structures will need to account for the additional loads imposed on the shoring system and appropriate setback distances for temporary slopes. The geotechnical engineer should be consulted for additional recommendations if the proposed excavations cross below a plane extending down and away from the foundation bearing surfaces of the adjacent structure at an angle of 2:1 (horizontal to vertical).

Excavation subgrade may become unstable and subject to pumping under heavy equipment loads if exposed to water or where excavations extend near or below the groundwater level. The contractor should be prepared to stabilize the bottom of excavations. In general, unstable bottom conditions may be mitigated by scarifying the subgrade and aerating the soil to achieve a moisture content near the optimum, dewatering to depress groundwater levels below the bottom of the excavation, overexcavating to a suitable depth and replacing the wet material with suitable fill, compacting a layer of crushed rock fill into the subgrade, or using geogrid to stabilize additional fill. Specific recommendations for excavation stabilization will be influenced by the nature of the excavation and the conditions encountered during construction.

9.5.8 Constructed Slopes

Fill slopes derived from on-site materials or cut slopes intended for long term stability may be constructed at an inclination of 2:1 (horizontal to vertical) or flatter. Constructed slopes taller than 15 feet should be re-evaluated by the geotechnical engineer.

Fill slopes, if utilized, should be constructed in accordance with the recommendations for subgrade preparation, fill placement, and other recommendations in this report. In addition, fill slopes should be over-built laterally by about 2 feet and cut back to expose compacted fill. Track-walking or wheel-rolling in lieu of overbuilding/trimming should not be permitted to mitigate the loose, uncontrolled outer surface of the fill slope. The geotechnical engineer should be consulted to provide additional recommendations for keyways, benches, and subdrains where fill slopes are constructed on grades steeper than 5:1 (horizontal to vertical).

Slopes that are not paved or otherwise armored, should be vegetated with drought-tolerant, deep-rooted plants to reduce the potential for erosion. Irrigation pipes should be anchored to the slope face rather than placed in trenches. Slope irrigation should be maintained at a level just sufficient to support plant growth. Leaking pipes should be promptly repaired.

9.5.9 Construction Dewatering

Water intrusion into the excavations may occur as a result of groundwater seepage or surface runoff. The contractor should be prepared to take appropriate dewatering measures in the event that water intrudes into the excavations. Sump pits, trenches, or similar measures should be used to depress the water level below the bottom of the excavation. Considerations for construction dewatering should include anticipated drawdown, volume of pumping, potential for settlement, and groundwater discharge. Disposal of groundwater should be performed in accordance with the guidelines of the Regional Water Quality Control Board.

9.5.10 Utility Trenches

Trenches constructed for the installation of underground utilities should be stabilized in accordance with the recommendations in Section 9.5.7. Utility trenches should be backfilled with materials that conform to the recommendations in Section 9.5.4. Trench backfill, bedding, and pipe zone fill should be compacted in accordance with Section 9.5.6 of this report. Bedding and pipe zone fill should be shoveled under pipe haunches and compacted by manual or mechanical, hand-held tampers. Trench backfill should be compacted by mechanical means. Densification of trench backfill by flooding or jetting should not be permitted.

To reduce potential for moisture intrusion into the building envelope, we recommend plugging utility trenches at locations where the trench excavations cross under the building perimeter. The trench plug should be constructed of a compacted, fine-grained, cohesive soil that fills the cross-sectional area of the trench for a distance equivalent to the depth of the excavation. Alternatively, the plug may be constructed of concrete or CLSM.

9.5.11 Rainy Weather Considerations

We recommend scheduling earthwork and foundation construction for the period between approximately April 15 and October 15 to avoid the rainy season. In the event that grading is performed during the rainy season, the plans for the project should be supplemented to include a stormwater management plan prepared in accordance with the requirements of the relevant agency having jurisdiction. The plan should include details of measures to protect the subject property and adjoining off-site properties from damage by erosion, flooding or the deposition of mud, debris, or construction-related pollutants, which may originate from the site or result from the grading operation. The protective measures should be installed by the commencement of grading, or prior to the start of the rainy season. The protective measures should be maintained in good working order unless the project drainage system is installed by that date and approval has been granted by the building official to remove the temporary devices.

In addition, construction activities performed during rainy weather may impact the stability of excavation subgrade and exposed ground. Temporary swales should be constructed to divert surface runoff away from excavations and slopes. Steep temporary slopes should be covered with plastic sheeting during significant rains. The geotechnical consultant should be consulted for recommendations to stabilize the site as-needed. A thin layer (approximately 3 inches) of lean concrete or CLSM may be poured over prepared subgrade for footings or slabs to maintain the appropriate moisture condition during erections of forms and placement of reinforcing steel.

9.6 Retaining Walls and Vaults

Walls backfilled with imported fill or on-site soil meeting the criteria for general fill in Section 9.5.4 and retaining up to 10 feet of soil above the wall footing may be designed for active or at-rest equivalent fluid earth pressures of 86 or 96 psf per foot depth for undrained conditions with level backfill. Walls with drained backfill conditions may be designed for active or at-rest equivalent fluid earth pressures of 47 or 67 psf per foot depth with level backfill. Walls that yield or deflect may be designed for active earth pressures. Wall deflection equivalent to about 1 percent of wall height may be needed to reduce at-rest earth pressures to active earth pressures. Vaults or other below grade walls that are restrained by framing, floor diaphragms, or abutting walls should be designed to resist at-rest earth pressures. For rising backfill conditions, the active or at-rest equivalent fluid earth pressures may be increased by 1 psf per foot depth per degree of inclination. Walls retaining broken back slopes may be evaluated by considering the slope height to be included as part of the wall height, or by considering the slope angle to be the slope of a plane extending from the toe of the slope at the back of the wall to the ground surface at a lateral distance behind the wall equivalent to twice the wall height. An additional equivalent fluid pressure of 32 psf per foot depth may be used to evaluate seismic earth pressure on retaining walls, as appropriate, for consideration with active earth pressures.

Walls retaining level ground should be designed to resist construction or live load surcharges on the backfill. The lateral earth pressure due to a backfill surcharge of 240 psf should be a uniform horizontal surcharge of 94 psf for yielding conditions and 135 psf for at-rest conditions. An additional backfill surcharge and lateral earth pressure for adjacent footings should be considered, as applicable, where the adjacent footings bear above an imaginary plane that rises up and away from the bottom edge of the wall at a 2:1 (horizontal to vertical) gradient.

Hydrostatic pressures may be neglected, provided that suitable drainage of the retained soil is provided. The retained soil should be drained by weep holes or a subdrain at the base of the wall stem consisting of ¾-inch crushed rock wrapped in filter fabric (Mirafi 140N, or equivalent). The subdrain should be capped by a pavement or 12 inches of native soil and drained by a perforated pipe (Schedule 40 polyvinyl chloride pipe, or similar). The pipe should be sloped at 1 percent or more to discharge at an appropriate outlet away from the wall. Alternatively, geocomposite drain panels (Miradrain 6000XL, or similar) placed against the back of the wall may be used to supplement a smaller subdrain located near the base of the wall. Measures to reduce the rate of moisture or vapor intrusion through the wall may be advisable for walls where the discoloration resulting from moisture intrusion would be undesirable. Such measures might include use of concrete with a low water-to-cementitious-materials ratio, and/or the placement of an asphalt emulsion or 10-mil thick plastic membrane to the back surface of the wall.

Lateral forces may be resisted by friction at the base of the wall footing for gravity and semi-gravity walls, and passive earth pressure acting on the embedded wall, wall footing, or wall key, if present, for semi-gravity and cantilever walls. Semi-gravity and cantilever walls on near level ground may be designed for a passive equivalent fluid lateral earth pressure of 225 psf per foot depth presuming a lateral deflection equivalent to 1 percent of the wall embedment depth to mobilize the passive condition. The passive earth pressure may be proportionally reduced for lower levels of lateral deflection as desired. The passive earth pressure for walls on ground sloping more than 5 percent should be reduced by 5 psf per foot depth per degree of inclination. Passive earth pressure should be neglected to a depth of 1 foot below the ground surface when evaluating lateral load resistance where the ground surface is not covered by pavement or flatwork. Gravity and semi-gravity walls may be designed for a coefficient of friction of 0.35 to resist lateral loads and a net allowable bearing capacity of 1,300 psf for a 12-inch footing width and 12 inches of embedment below the adjacent grade plus 200 psf per additional foot of width and 500 psf per additional foot of embedment up to 4,000 psf. The allowable bearing capacity may be increased by one-third for seismic load combinations. The coefficient of friction may be increased to 0.50 where the footing is constructed over 6 inches of aggregate base compacted to 95 percent of the reference density as evaluated by ASTM D1557.

Footing bottoms should not be sloped more than 1-unit vertical to 10 units horizontal. Wall footings may be stepped provided that the bearing grade differential between adjacent steps does not exceed 18 inches and the slope of a series of such steps does not exceed 1-unit vertical to 2 units horizontal. Walls should be designed to withstand a total static settlement of 1 inch with a differential of ½ inch over a 20-foot span.

9.7 Pavement and Flatwork

Recommendations for pavement and exterior flatwork are presented in the following sections. Recommendations for preparation of subgrade are presented in Section 9.5.5. Pavement sections were evaluated for a range of traffic indexes or loading conditions. The designer may interpolate between the values provided once a traffic index or loading condition has been selected.

9.7.1 Asphalt Pavement

Ninyo & Moore conducted an analysis to evaluate appropriate asphalt pavement structural sections following the methodology presented in the Highway Design Manual (Caltrans, 2016). Alternative sections were evaluated. The pavement sections were designed for a 20-year service life presuming that periodic maintenance, including crack sealing and resurfacing will be performed during the service life of the pavement. Premature deterioration may occur without periodic maintenance. Our recommendations for the pavement sections are presented in Table 11.

Table 11 – Asphalt Concrete Pavement Structural Sections

Design R-Value	Traffic Index	Alternative 1	Alternative 2
5	5	3 inches AC 10 inches AB	6 inches AC 5 inches AB
5	6	3½ inches AC 13 inches AB	7 inches AC 5 inches AB
5	7	4 inches AC 16 inches AB	8 inches AC 7 inches AB

Notes:
1 AC is Type A, Dense-Graded Hot Mix Asphalt complying with Caltrans Standard Specification 39-2 (2015).
2 AB is Class II Aggregate Base complying with Caltrans Standard Specification 26-1.02 (2015).

Aggregate base for pavement should be placed in lifts of no more than 8 inches in loose thickness and compacted per Section 9.5.6. Asphalt concrete should be placed and compacted per Section 9.5.6. Pavements should be sloped so that runoff is diverted to an appropriate collector (concrete gutter, swale, or area drain) to reduce the potential for ponding of water on the pavement. Concentration of runoff over asphalt pavement should be discouraged. Cracks that form in the asphalt concrete surface should be periodically sealed to reduce moisture intrusion into the aggregate base section. Deep curbs that extend 6 inches below the aggregate base section may be used to reduce the potential moisture intrusion into the aggregate base section adjacent to landscaped areas or the bottom of slopes. Subdrains may be considered as a supplement or alternative means of the mitigating moisture in the aggregate base section. Root barriers adjacent to trees may be considered to reduce the potential for pavement heave from root growth.

9.7.2 Exterior Flatwork

Concrete walkways and other exterior flatwork not subject to vehicular loading should be 4 inches thick (or more) over 4 inches of aggregate base. Concrete thickness should be increased to 6 inches over 6 inches of aggregate base at driveways for vehicular traffic up to periodic garbage trucks and emergency vehicles. The aggregate base should conform to and be compacted in accordance with our recommendations in Sections 9.5.4 and 9.5.6, respectively. Flatwork and driveway subgrade should be prepared in accordance with the recommendations in Section 9.5.5.

Appropriate jointing of concrete flatwork can encourage cracks to form at joints, reducing the potential for crack development between joints. Joints should be laid out in a square pattern at consistent intervals. Contraction and construction should be detailed and constructed in accordance with the guidelines of ACI Committee 302 (ACI, 2016). The lateral spacing between contraction joints should be 8 feet or less for a 4-inch thick slab and 12 feet or less for a 6-inch thick slab. Contraction joints formed by premolded inserts, grooving plastic concrete, or saw-cutting at initial hardening, should extend to a depth equivalent to 25 percent of the slab thickness and 1 inch or more for thin slabs.

Flatwork may be reinforced with distributed steel to reduce the potential for differential slab movement where cracking occurs. The distributed reinforcing steel should be terminated about 6 inches from contraction joints and should consist of No. 3 deformed bars at 18 inches on center, both ways. Slabs reinforced with distributed steel should be 6 inches thick (or more). To reduce the potential for differential slab movement across joints, the distributed steel may be extended through the joints. This improvement will be balanced by a reduction in the functionality of the contraction joint to encourage crack formation at joints. Masonry briquettes or plastic chairs should be used to maintain the position of the reinforcement in the upper half of the slab with 1½ inches of cover over the steel. Root barriers adjacent to trees may be considered to reduce the potential for pavement heave from root growth.

9.8 Concrete

Laboratory testing indicated that the site soil may be considered a corrosive environment to structures per the Caltrans Corrosion Guidelines (2018) based on the concentration of chloride. Although the concentration of sulfate and corresponding potential for sulfate attack on concrete is negligible for the soil tested, due to the variability in the on-site soil, we recommend that Type II/V or Type V cement be used for concrete structures in contact with soil. In addition, the concrete should have a water-to-cement ratio of not more than 0.40 and a 3-inch thick or thicker concrete cover should be maintained over reinforcing steel where concrete is cast-in-place against soil. Concrete cover over reinforcing steel for other exposure conditions should conform to ACI guidelines (ACI, 2016). A corrosion engineer should be consulted to further assess the potential for corrosion, review these mitigation measures, and provide recommendations for supplementary measures as-needed.

In order to reduce the potential for shrinkage cracks in the concrete during curing, we recommend that the concrete for slabs and flatwork should not contain large quantities of water or accelerating admixtures containing calcium chloride. Higher compressive strengths may be achieved by using larger aggregates in lieu of increasing the cement content and corresponding water demand. Additional workability, if desired, may be obtained by including water-reducing or air-entraining admixtures. Concrete should be placed in accordance with ACI Manual of Concrete Practice (MCP) and project specifications. Particular attention should be given to curing techniques and curing duration. Slabs that do not receive adequate curing have a more pronounced tendency to develop random shrinkage cracks and other defects.

9.9 Moisture Vapor Retarding System

The migration of moisture through slabs underlying enclosed spaces or overlain by moisture sensitive floor coverings should be discouraged by providing a moisture vapor retarding system between the subgrade soil and the bottom of slabs. We recommend that the moisture vapor retarding system consist of a 4-inch-thick capillary break, overlain by a 15-mil-thick plastic membrane. The capillary break should be constructed of clean, compacted, open-graded crushed rock or angular gravel of ¾-inch nominal size. To reduce the potential for slab curling and cracking, an appropriate concrete mix with low shrinkage characteristics and a low water-to-cementitious-materials ratio should be specified. In addition, the concrete should be delivered and placed in accordance with ASTM C94 with attention to concrete temperature and elapsed time from batching to placement, and the slab should be cured in accordance with the ACI Manual of Concrete Practice (ACI, 2016), as appropriate. The plastic membrane should conform to the requirements in the latest version of ASTM Standard E 1745 for a Class A membrane. The bottom of the moisture barrier system should be higher in elevation than the exterior grade, if possible. Positive drainage should be established and maintained adjacent to foundations and flatwork.

Where the exterior grade is at a higher elevation than the moisture vapor retarding system (including the capillary break layer), consideration should be given to constructing a subdrain around the foundation perimeter. The subdrain should consist of ¾-inch crushed rock wrapped in filter fabric (Mirafi 140N, or equivalent). The subdrain should be capped by a pavement or 12 inches of native soil and drained by a perforated pipe (Schedule 40 polyvinyl chloride pipe, or similar). The pipe should be sloped at 1 percent or more to discharge at an appropriate outlet away from the foundation. The pipe should be located below the bottom elevation of the moisture vapor retarding system but above a plane extending down and away from the bottom edge of the foundation at a 2:1 (horizontal to vertical) gradient.

9.10 Surface Drainage and Site Maintenance

Surface drainage on the site should generally be provided so that water is diverted away from structures and is not permitted to pond. Positive drainage should be established adjacent to structures to divert surface water to an appropriate collector (graded swale, v-ditch, or area drain) with a suitable outlet. Drainage gradients should be 2 percent or more a distance of 5 feet or more from the structure for impervious surfaces and 5 percent or more a distance of 10 feet or more from the structure for pervious surfaces. Slope, pad, and roof drainage should be collected and diverted to suitable discharge areas away from structures or other slopes by non-erodible devices (e.g., gutters, downspouts, concrete swales, etc.). Graded swales, v-ditches, or curb and gutter should be provided at the site perimeter to restrict flow of surface water onto and off of the site. Slopes should be vegetated or otherwise armored to reduce potential for erosion of soil. Drainage structures should be periodically cleaned out and repaired, as-needed, to maintain appropriate site drainage patterns.

Landscaping adjacent to foundations should include vegetation with low-water demands and irrigation should be limited to that which is needed to sustain the plants. Trees should be restricted from the areas adjacent to foundations a distance equivalent to the canopy radius of the mature tree.

Care should be taken by the contractor during grading to preserve any berms, drainage terraces, interceptor swales or other drainage devices on or adjacent to the project area. Drainage patterns established at the time of grading should be maintained for the life of the project. Future alteration of the established drainage patterns may impact the constructed improvements.

9.11 Review of Construction Plans

The recommendations provided in this report are based on preliminary design information for the proposed construction. We recommend that a copy of the plans be provided to Ninyo & Moore for review before bidding to check the interpretation of our recommendations and that the designed improvements are consistent with our assumptions. It should be noted that, upon review of these documents, some recommendations presented in this report might be revised or modified to meet the project requirements.

9.12 Construction Observation and Testing

The recommendations provided in this report are based on subsurface conditions encountered in discrete borings and soundings. During construction, the geotechnical engineer should be retained to check and evaluate the exposed subsurface conditions for consistency with the findings in this report. During construction, the geotechnical engineer should be retained to:

- Observe preparation and compaction of subgrade.
- Check and test imported materials prior to use as fill.
- Observe placement and compaction of fill, aggregate base, and asphalt concrete.
- Perform field density tests to evaluate fill and subgrade compaction.
- Observe foundation excavations for bearing materials and cleaning prior to placement of reinforcing steel and concrete.
- Observe drilling and construction of soldier-pile-and-lagging walls if installed.
- Observe ground improvement operations if performed.

The recommendations provided in this report assume that Ninyo & Moore will be retained as the geotechnical consultant during the construction phase of the project. If another geotechnical consultant is selected, we request that the selected consultant provide a letter to the architect and the owner (with a copy to Ninyo & Moore) indicating that they fully understand Ninyo & Moore's recommendations, and that they are in full agreement with the recommendations contained in this report.

10 LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that this evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

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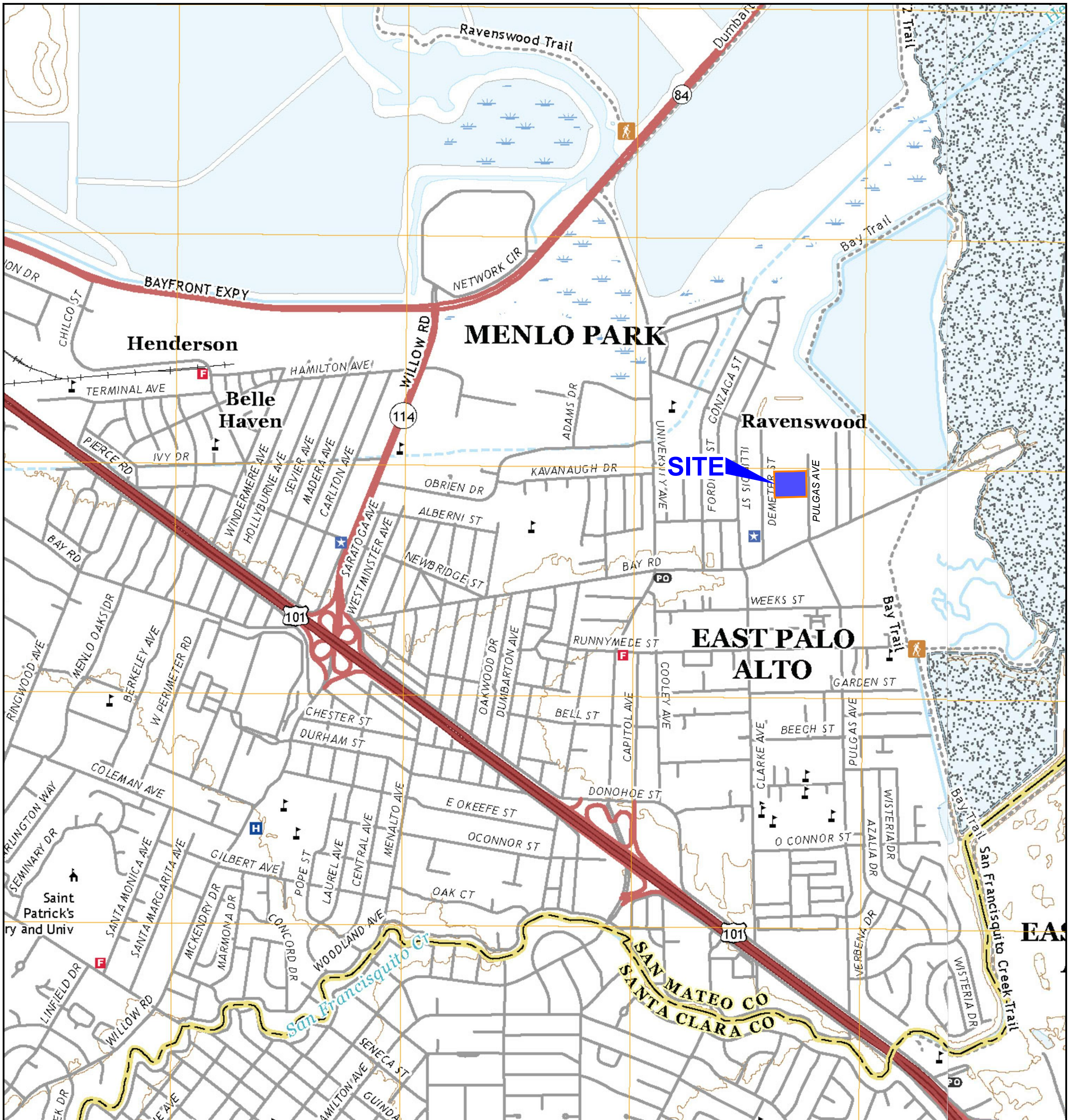
FIGURES



NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE I REFERENCE: USGS, 2018

N

SCALE (FEET)

0 2,000 4,000

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FIGURE 1

SITE LOCATION

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA
403645001 I 05/20

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LEGEND

SITE BOUNDARY

CPT-1 (65') CPT LOCATION TOTAL DEPTH, IN FEET

MAM SURVEY LINE

B-1 (50') SOIL BORING TOTAL DEPTH IN FEET

P-1 (2') PERCOLATION TEST LOCATION TOTAL DEPTH, IN FEET

N

SCALE (FEET) 0 100 200

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE I REFERENCE: GOOGLE EARTH, 2020

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FIGURE 2

EXPLORATION LOCATIONS

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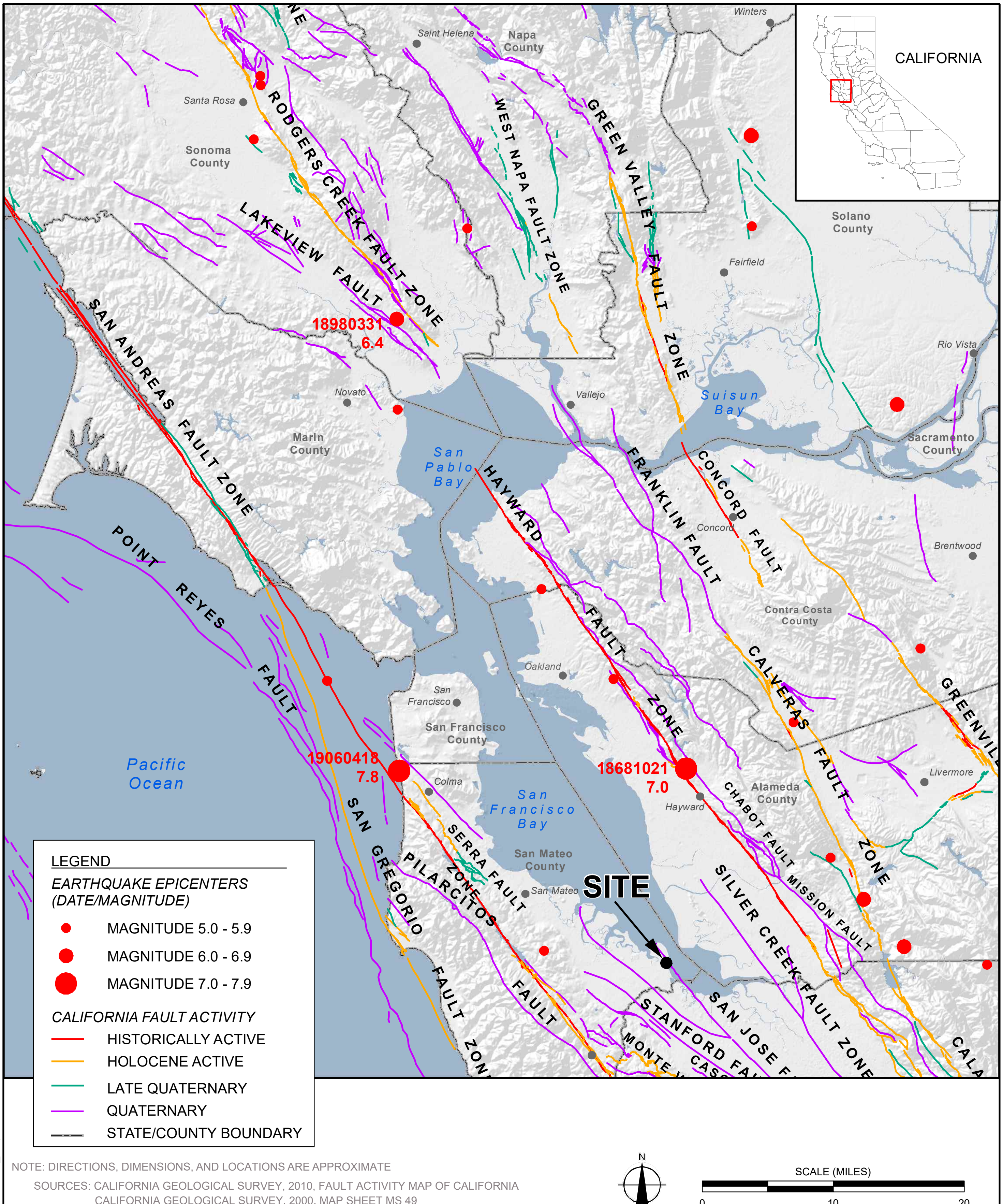
2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA
403645001 I 05/20



NOTE: DIRECTIONS, DIMENSIONS, AND LOCATIONS ARE APPROXIMATE

SOURCES: CALIFORNIA GEOLOGICAL SURVEY, 2010, FAULT ACTIVITY MAP OF CALIFORNIA
CALIFORNIA GEOLOGICAL SURVEY, 2000, MAP SHEET MS 49

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FIGURE 3

FAULT LOCATIONS AND EARTHQUAKE EPICENTERS

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2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA
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LEGEND

Qa	ALLUVIAL GRAVEL, SAND, SILT, & CLAY (HOLOCENE)
Qbm	ESTUARINE ORGANIC CLAY & SILTY CLAY (HOLOCENE)
Qa.1	ALLUVIAL FAN DEPOSITS (HOLOCENE)

THRUST FAULT

FAULT

GEOLOGIC CONTACT

STRIKE AND DIP OF BEDDING

N

SCALE (FEET)

0 2,000 4,000

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE | REFERENCE: DIBBLEE, 2007

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FIGURE 4

REGIONAL GEOLOGY

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EAST PALO ALTO, CALIFORNIA
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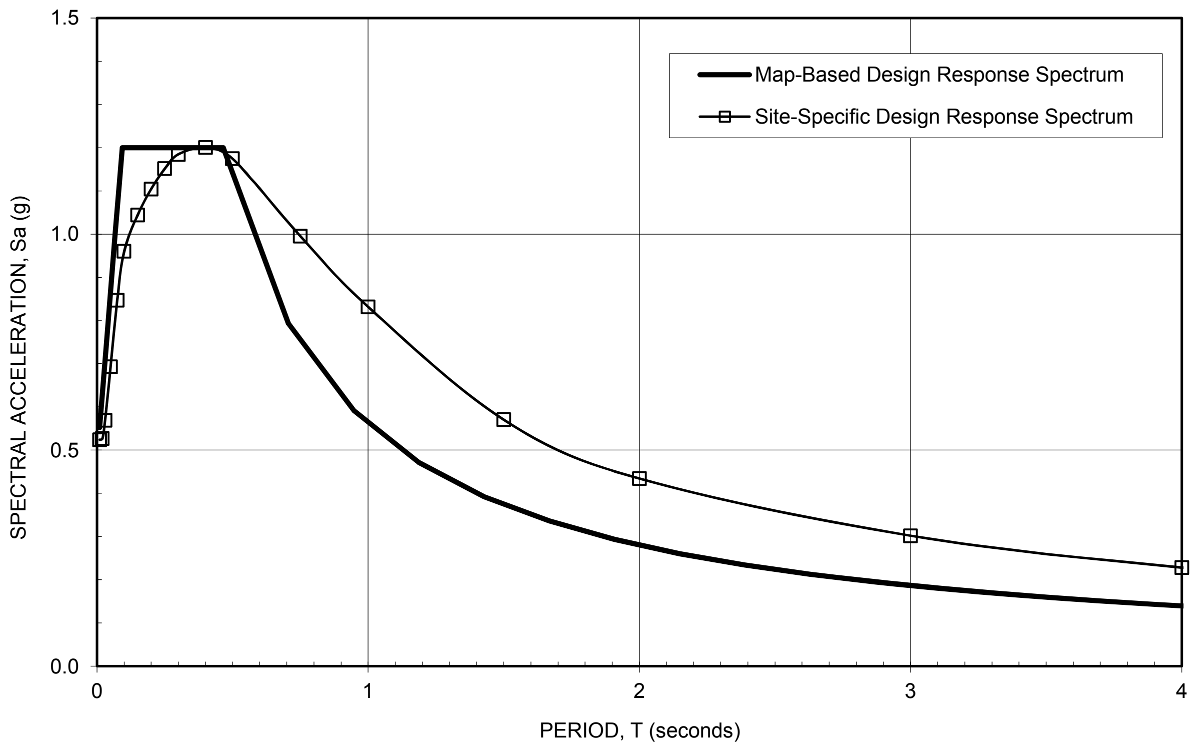
PERIOD (seconds)	MAP-BASED DESIGN RESPONSE SPECTRUM Sa, (g)	SITE-SPECIFIC DESIGN RESPONSE SPECTRUM Sa, (g)
0.010	0.557	0.524
0.050	0.866	0.693
0.100	1.200	0.960
0.150	1.200	1.044
0.200	1.200	1.104
0.250	1.200	1.151
0.300	1.200	1.184
0.400	1.200	1.200
0.500	1.120	1.174
0.750	0.747	0.995
1.000	0.560	0.831

S_{DS} = 1.080	S_{D1} = 0.868	S_{MS} = 1.620	S_{M1} = 1.302	PGA_M = 0.616



NOTES:

1 Site specific design response spectrum is two-thirds of the acceleration response spectrum that is associated with the maximum considered earthquake and is expected to achieve a 1% probability of collapse in a 50-year period (MCE_R). The MCE_R spectrum is computed as the lesser of probablistic and deterministic spectral response accelerations at each period per ASCE 7-16 Section 21.2.3. The site specific design response spectrum conforms with the lower bound limit in ASCE 7-16 Section 21.3.

2 Probabilistic response spectrum is the 5% damped acceleration in the direction of maximum horizontal response associated with a ground motion having a 2% probability of exceedance in 50 years and adjusted for risk of collapse per Method 1 of ASCE 7-16 Section 21.2.1. Spectrum computed using UCERF3 single branch earthquake forecast and the CY14, CB14, and BSSA14 attenuation relationships.

3 Deterministic response spectrum is the 84th percentile, 5% damped spectral reponse acceleration in the maximum horizontal direction computed using CY14, CB14, and BSSA14 attenuation relationships and considering a Mw 8.0 event on the San Andreas fault about 13km from the site. Scaled to 1.5*Fa where appropriate.

4 Map-based design response spectrum is computed from mapped spectral ordinates, modified for Site Class C (Very dense and soft rock) conditions, in accordance with ASCE 7-16 Section 11.4. It is presented for comparison.

FIGURE 5

ACCELERATION RESPONSE SPECTRA

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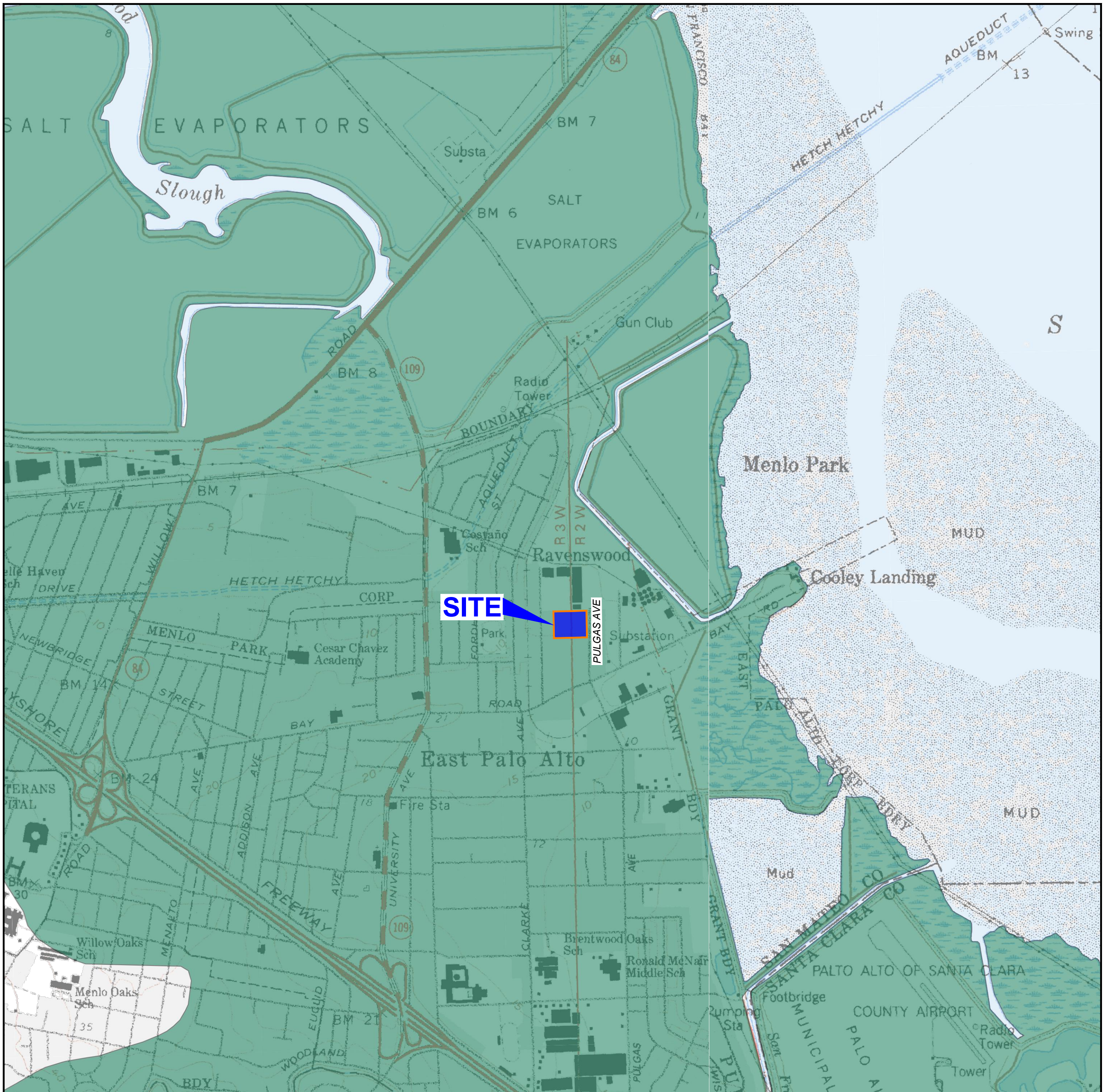
2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA



LEGEND

LIQUEFACTION ZONES:
Areas where historic occurrence of liquefaction, or local geological, geotechnical, and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

NOTE: DIMENSIONS, DIRECTIONS, AND LOCATIONS ARE APPROXIMATE | REFERENCE: CGS, 2006

N

SCALE (FEET)
0 2,000 4,000

403645001.dwg 05/27/2020 AEK

FIGURE 6

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SEISMIC HAZARD ZONES

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA
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APPENDIX A

Boring Logs

APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples

A disturbed soil sample was obtained in the field using the following method.

Bulk Sample

Bulk samples of representative earth materials were obtained from the borings. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test (SPT) Sampler

Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The sampler was driven into the ground 18 inches with a 140-pound hammer falling freely from a height of 30 inches in general accordance with ASTM D 1586. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the sampler, bagged, sealed and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following method.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3.0 inches, was lined with 6-inch long, thin brass liners with an inside diameter of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a hammer in general accordance with ASTM D 3550. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer, and the number of blows per foot of driving are presented on the boring log as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass liners, sealed, and transported to the laboratory for testing.

The Shelby Tube Sampler

The Shelby tube sampler is a seamless, thin-walled, steel tube having an external diameter of 3.0 inches and a length of 30 inches. The tube was connected to the drill rod or hand tool and pushed into an undisturbed soil mass to obtain a relatively undisturbed sample of cohesive soil in general accordance with ASTM D 1587. When the tube was almost full (to avoid overpenetration), it was withdrawn from the boring, removed from the drill rod or hand tool, sealed at both ends, and transported to the laboratory for testing.

Field Testing

The following tests were performed in the field to evaluate soil properties.

Static Cone Penetrometer

A penetrometer with a conical tip having an apex angle of 60 degrees and a cone base area of 1.5 square centimeters was manually pushed 6 inches into the soil. The penetrometer was instrumented to measure the Cone Penetration Index (Qc) computed as the peak force on the cone divided by the cone base area. The Cone Penetration Index is reported in kilograms per square centimeter (ksc) on the boring logs at the depth of the test as a measure of the relative density or consistency of the soil encountered.

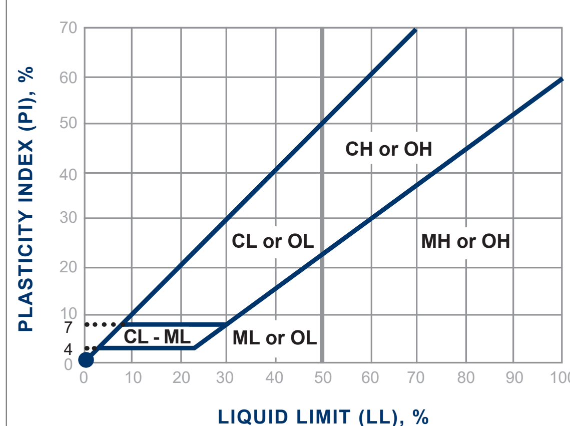
Soil Classification Chart Per ASTM D 2488

Primary Divisions			Secondary Divisions: Group Symbol	Secondary Divisions: Group Name
COARSE-GRAINED SOILS more than 50% retained on No. 200 sieve	GRAVEL more than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVEL less than 5% fines	GW	well-graded GRAVEL
			GP	poorly graded GRAVEL
		GRAVEL with DUAL CLASSIFICATIONS 5% to 12% fines	GW-GM	well-graded GRAVEL with silt
			GP-GM	poorly graded GRAVEL with silt
			GW-GC	well-graded GRAVEL with clay
			GP-GC	poorly graded GRAVEL with
		GRAVEL with FINES more than 12% fines	GM	silty GRAVEL
			GC	clayey GRAVEL
			GC-GM	silty, clayey GRAVEL
	SAND 50% or more of coarse fraction passes No. 4 sieve	CLEAN SAND less than 5% fines	SW	well-graded SAND
			SP	poorly graded SAND
		SAND with DUAL CLASSIFICATIONS 5% to 12% fines	SW-SM	well-graded SAND with silt
			SP-SM	poorly graded SAND with silt
			SW-SC	well-graded SAND with clay
			SP-SC	poorly graded SAND with clay
		SAND with FINES more than 12% fines	SM	silty SAND
			SC	clayey SAND
			SC-SM	silty, clayey SAND
FINE-GRAINED SOILS 50% or more passes No. 200 sieve	SILT and CLAY liquid limit less than 50%	INORGANIC	CL	lean CLAY
			ML	SILT
			CL-ML	silty CLAY
		ORGANIC	OL (PI > 4)	organic CLAY
			OL (PI < 4)	organic SILT
	SILT and CLAY liquid limit 50% or more	INORGANIC	CH	fat CLAY
			MH	elastic SILT
		ORGANIC	OH (plots on or above "A"-line)	organic CLAY
			OH (plots below "A"-line)	organic SILT
	Highly Organic Soils		PT	Peat

Grain Size

Description		Sieve Size	Grain Size	Approximate Size
Boulders		> 12"	> 12"	Larger than basketball-sized
Cobbles		3 - 12"	3 - 12"	Fist-sized to basketball-sized
Gravel	Coarse	3/4 - 3"	3/4 - 3"	Thumb-sized to fist-sized
	Fine	#4 - 3/4"	0.19 - 0.75"	Pea-sized to thumb-sized
Sand	Coarse	#10 - #4	0.079 - 0.19"	Rock-salt-sized to pea-sized
	Medium	#40 - #10	0.017 - 0.079"	Sugar-sized to rock-salt-sized
	Fine	#200 - #40	0.0029 - 0.017"	Flour-sized to sugar-sized
Fines		Passing #200	< 0.0029"	Flour-sized and smaller

Plasticity Chart



Apparent Density - Coarse-Grained Soil

Apparent Density	Spooling Cable or Cathead: SPT (blows/foot)	Spooling Cable or Cathead: Modified Split Barrel (blows/foot)	Automatic Trip Hammer: SPT (blows/foot)	Automatic Trip Hammer: Modified Split Barrel (blows/foot)
Very Loose	≤ 4	≤ 8	≤ 3	≤ 5
Loose	5 - 10	9 - 21	4 - 7	6 - 14
Medium Dense	11 - 30	22 - 63	8 - 20	15 - 42
Dense	31 - 50	64 - 105	21 - 33	43 - 70
Very Dense	> 50	> 105	> 33	> 70

Consistency - Fine-Grained Soil

Consistency	Spooling Cable or Cathead: SPT (blows/foot)	Spooling Cable or Cathead: Modified Split Barrel (blows/foot)	Automatic Trip Hammer: SPT (blows/foot)	Automatic Trip Hammer: Modified Split Barrel (blows/foot)
Very Soft	< 2	< 3	< 1	< 2
Soft	2 - 4	3 - 5	1 - 3	2 - 3
Firm	5 - 8	6 - 10	4 - 5	4 - 6
Stiff	9 - 15	11 - 20	6 - 10	7 - 13
Very Stiff	16 - 30	21 - 39	11 - 20	14 - 26
Hard	> 30	> 39	> 20	> 26

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USCS METHOD OF SOIL CLASSIFICATION

BORING LOG EXPLANATION SHEET

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	
0								Bulk sample.
								Modified split-barrel drive sampler.
								No recovery with modified split-barrel drive sampler.
								Sample retained by others.
								Standard Penetration Test (SPT).
5								No recovery with a SPT.
			XX/XX					Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.
								No recovery with Shelby tube sampler.
								Continuous Push Sample.
								Seepage.
10								Groundwater encountered during drilling.
								Groundwater measured after drilling.
							SM	MAJOR MATERIAL TYPE (SOIL): Solid line denotes unit change.
							CL	Dashed line denotes material change.
15								Attitudes: Strike/Dip b: Bedding c: Contact j: Joint f: Fracture F: Fault cs: Clay Seam s: Shear bss: Basal Slide Surface sf: Shear Fracture sz: Shear Zone sbs: Shear Bedding Surface
20								The total depth line is a solid line that is drawn at the bottom of the boring.

DATE DRILLED	11/12/2019	BORING NO.	B-1
GROUND ELEVATION	12' ± (MSL)	SHEET	1 OF 2
METHOD OF DRILLING	6" Hollow Stem Auger, Mobile B-61, Hand Auger Top 5'		
DRIVE WEIGHT	140 lbs (wireline)	DROP	30 inches
SAMPLED BY	GL	LOGGED BY	GL
REVIEWED BY	PCC		

DEPTH (feet)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0	Qc=17 Qc=20			CL	FILL: Brown to dark brown, moist, stiff, lean CLAY.
	22"/30"	17.2	94.2	CL	ALLUVIUM: Brown, moist, stiff, sandy lean CLAY.
	16	20.8	107.3		
10	11	20.5	106.2		Yellowish brown, wet, stiff.
	9			SP-SC	Brown, wet, loose, poorly graded SAND with clay.
					Medium Dense.
20	52			CL	Brown, wet, hard, lean CLAY.
	30	22.7	99.7		Very stiff.
30	30	21.0	104.2		
	38	22.1	102.6		
	21	23.7		SC	Yellowish brown, wet, dense, clayey SAND.
40	24			CL	Yellowish brown, wet, very stiff, lean CLAY.

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EAST PALO ALTO, CALIFORNIA
403645001 | 5/20

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
40								ALLUVIUM:(continued) Yellowish brown, wet, very stiff, lean CLAY.
		■	42	25.4	90.6			Hard.
							SC	Yellowish brown, wet, medium dense, clayey SAND.
		■	60	19.6	102.2		CL	Yellowish brown, wet, hard, lean CLAY.
50								Total Depth = 50.0 feet. Backfilled with cement grout on 11/12/2019. Groundwater was encountered at a depth of approximately 7 feet below the round surface during drilling. Notes: The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents. Groundwater may rise to a level higher than that measured in borehole due to relatively slow rate of seepage in clay and several other factors as discussed in the report.
60								
70								
80								

DATE DRILLED 11/12/2019 BORING NO. B-1

GROUND ELEVATION 12' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING 6" Hollow Stem Auger, Mobile B-61, Hand Auger Top 5'

DRIVE WEIGHT 140 lbs (wireline) DROP 30 inches

SAMPLED BY GL LOGGED BY GL REVIEWED BY PCC

DATE DRILLED	11/12/2019	BORING NO.	B-2
GROUND ELEVATION	12' ± (MSL)	SHEET 1 OF 1	
METHOD OF DRILLING	6" Hollow Stem Auger, Mobile B-61, Hand Auger Top 5'		
DRIVE WEIGHT	140 lbs (wireline)	DROP	30 inches
SAMPLED BY GL	LOGGED BY GL	REVIEWED BY	PCC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							CL	FILL: Brown, dry to moist, firm, sandy lean CLAY.
			Qc=15 Qc=10				SC	ALLUVIUM: Yellowish brown, moist, very loose, clayey SAND.
			Qc=18				CL	Brown, moist, firm, sandy lean CLAY.
			12				SC	Brown, moist, loose, clayey SAND. Yellowish brown.
			12				CL	Brown, wet, firm, sandy lean CLAY.
10								
			11					
			10	19.2			SC	Brown, wet, loose, clayey SAND.
			28	25.2	99.2		CL	Brown, wet, very stiff, lean CLAY.
20								
			23					Light brown.
			22					Yellowish brown.
30								
			31	20.4	104.3		SP-SC	Brown, wet, medium dense, poorly graded SAND with clay.
			51					Very dense.
								Total Depth = 36.5 feet. Backfilled with cement grout on 11/12/2019. Groundwater was encountered at a depth of approximately 6.5 feet below the ground surface during drilling. Groundwater was measured at a depth of approximately 8 feet in borehole about 15 minutes after drilling. See notes on Boring B-1.
40								

DATE DRILLED 11/12/2019 BORING NO. B-3

GROUND ELEVATION 13' ± (MSL) SHEET 1 OF 1

METHOD OF DRILLING 6" Hollow Stem Auger, Mobile B-61, Hand Auger Top 5'

DRIVE WEIGHT 140 lbs (wireline) DROP 30 inches

SAMPLED BY GL LOGGED BY GL REVIEWED BY PCC

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0			Qc=15				CL	FILL: Dark brown, dry to moist, firm, lean CLAY.
			Qc=11				SC	ALLUVIUM: Yellowish brown, moist, very loose, clayey SAND.
			Qc=16					
			Qc=18					
			Qc=19					
			17					Loose.
				▽ ▼				
			11	20.1	103.3		CL	Brown, wet, firm, sandy lean CLAY. Trace gravel.
10								
			13	21.9	91.2		SC	Yellowish brown, wet, loose, clayey SAND.
			26	26.5	93.7		CL	Brown, wet, very stiff, lean CLAY.
20								
			14	23.5	100.5			Light brown, wet, stiff, sandy lean CLAY. Yellowish brown.
			32	17.1	111.6			Very stiff.
30								
			20	22.2	99.9			Reddish yellow, stiff.
								Total Depth = 35 feet. Backfilled with cement grout on 11/12/2019.
								Groundwater was encountered at a depth of approximately 7 feet below the ground surface during drilling. Groundwater was measured at a depth of approximately 7.5 feet in borehole about 15 minutes after drilling.
								See additional notes on Boring B-1.
40								

DATE DRILLED	11/11/2019	BORING NO.	B-4
GROUND ELEVATION	12' ± (MSL)	SHEET 1 OF 1	
METHOD OF DRILLING	6" Hollow Stem Auger, Mobile B-61, Hand Auger Top 5'		
DRIVE WEIGHT	140 lbs(wireline)	DROP	30 inches
SAMPLED BY	GL	LOGGED BY GL	REVIEWED BY PCC

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE:Approximately 4.5 inches thick.
						GP-GM	AGGREGATE BASE:Approximately 2 inches thick. Gray to brown, dry to moist, medium dense, poorly graded GRAVEL with sand.
	Bulk	Qc=11 Qc=14 Qc=14 Qc=17				CL	FILL: Olive gray to black, moist, firm, sandy lean CLAY.
							Stiff.
	Driven	21	20.5	103.3		CL	ALLUVIUM: Brown, moist, very stiff, lean CLAY.
			▽				
10	Driven	10	23.2	104.8			Wet; firm; sandy.
		11					Stiff, decrease in sand content.
			▼				
	Driven	8					Firm.
						SC	Yellowish brown, wet, very loose, clayey SAND.
						CL	Yellowish brown, wet, firm, sandy lean CLAY.
20	Driven	22					Brown, very stiff.
	Driven	50					Hard; trace sand.
	Driven	10					Light brown, firm; trace gravel.
30	Driven	54	15.2	113.3		SW-SC	Brown, wet, medium dense, well-graded SAND with clay.
		21					
							Total Depth = 31.5 feet. Backfilled with cement grout on 11/11/2019. Groundwater was encountered at a depth of approximately 8 feet below the ground surface during drilling. Groundwater was measured at a depth of approximately 12 feet in borehole about 15 minutes after drilling. See additional notes on Boring B-1.
40							

DATE DRILLED	11/11/2019	BORING NO.	B-5
GROUND ELEVATION	10' ± (MSL)	SHEET	1 OF 2
METHOD OF DRILLING	6" Hollow Stem Auger, Mobile B-61, Hand Auger Top 5'		
DRIVE WEIGHT	140 lbs(wireline)	DROP	30 inches
SAMPLED BY	GL	LOGGED BY	GL
REVIEWED BY	PCC		

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0						GP-GM	ASPHALT CONCRETE: Approximately 4 inches thick.
	X		Qc=12			CL	AGGREGATE BASE: Approximately 8 inches thick. Gray to brown, dry to moist, medium dense, poorly graded GRAVEL with sand.
	X		Qc=11				FILL: Olive gray to black, moist, firm, lean CLAY.
			24"/28"	22.1	104.2		
		X	20	23.0	101.9		
						CL	ALLUVIUM: Yellowish brown, moist, stiff, lean CLAY.
		X	11	30.1	62.7		Wet.
10							
		X	20	30.5	90.3		Stiff.
		X	40	25.7	97.3	CH	Brown, wet, hard, fat CLAY.
20							
		X	32	14.0	107.9		Light brown; very stiff.
						SW-SC	Brown, wet, medium dense, well-graded SAND with clay.
		X	45	18.4	107.4		
30							
		X	63				Very dense.
		X	23				Medium dense.
		X	24	18.6		SP	Brown, wet, medium dense, poorly graded SAND.Approximately 2 inches thick.
40							

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DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED 11/11/2019 BORING NO. B-5 GROUND ELEVATION 10' ± (MSL) SHEET 2 OF 2 METHOD OF DRILLING 6" Hollow Stem Auger, Mobile B-61, Hand Auger Top 5' DRIVE WEIGHT 140 lbs(wireline) DROP 30 inches SAMPLED BY GL LOGGED BY GL REVIEWED BY PCC **DESCRIPTION/INTERPRETATION**
40							CL	ALLUVIUM:(continued) Yellowish brown, wet, hard, sandy lean CLAY.
		■	50	30.7	98.6			
		■	52	23.4	98.2			
50								Total Depth = 50 feet.Backfilled with cement grout on 11/11/2019. Groundwater was encountered at a depth of approximately 7 feet below the ground surface during drilling. Groundwater was measured at a depth of approximately 10 feet in borehole about 15 minutes after drilling. See additional notes on Boring B-1.
60								
70								
80								

APPENDIX B

Cone Penetration Testing

APPENDIX B

CONE PENETRATION TESTING

Field Procedure for Cone Penetration Testing

A penetrometer with a conical tip having an apex angle of 60 degrees and a cone base area of 15 square centimeters was hydraulically pushed through the soil using the reaction mass of a 30 ton rig at a constant rate of about 20 millimeter per second in accordance with ASTM D 5778. The penetrometer was instrumented to measure, by electronic methods, the force on the conical point required to penetrate the soil, the force on a friction sleeve behind the cone tip as the penetrometer was advanced, and the pore pressure on a transducer behind the cone tip. Penetration data was collected and recorded electronically at intervals of about 2-inches. Cone resistance corrected for pore pressure was calculated by dividing the measured force of penetration by the cone base area and adding a fraction of the recorded pore pressure. Friction sleeve resistance was calculated by dividing the measured force on the friction sleeve by the surface area of the sleeve. The friction ratio was calculated as the ratio of the tip resistance to the sleeve friction. A graph of the computed values of cone resistance (tip) and friction ratio are presented on the logs in the following pages. The tip resistance and friction ratio were used to classify the soil behavior type encountered using the method by Robertson (2009). A graph of the encountered soil types are also presented on the logs in the following pages.

Job No: 19-56172
Client: Ninyo & Moore
Project: Project Thunder
Start Date: 11-Nov-2019
End Date: 26-Nov-2019

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Assumed Phreatic Surface[1] (ft)	Final Depth (ft)	Northing[2] (m)	Easting[2] (m)	Elevation[3] (ft)	Refer to Notation Number
CPT-01	19-56172_CP01	26-Nov-2019	383:T1500F15U500	8.2	64.96	4147814	576660	13	
CPT-02	19-56172_CP02	26-Nov-2019	383:T1500F15U500	7.4	100.97	4147844	576734	12	
CPT-03	19-56172_CP03	11-Nov-2019	443:T1500F15U500	4.7	75.54	4147938	576730	9	
CPT-04	19-56172_CP04	26-Nov-2019	383:T1500F15U500	8.4	75.46	4147851	576631	13	
CPT-05	19-56172_CP05	11-Nov-2019	443:T1500F15U500	7.0	65.12	4147961	576641	12	
CPT-06	19-56172_CP06	11-Nov-2019	443:T1500F15U500	7.3	65.12	4147903	576661	12	

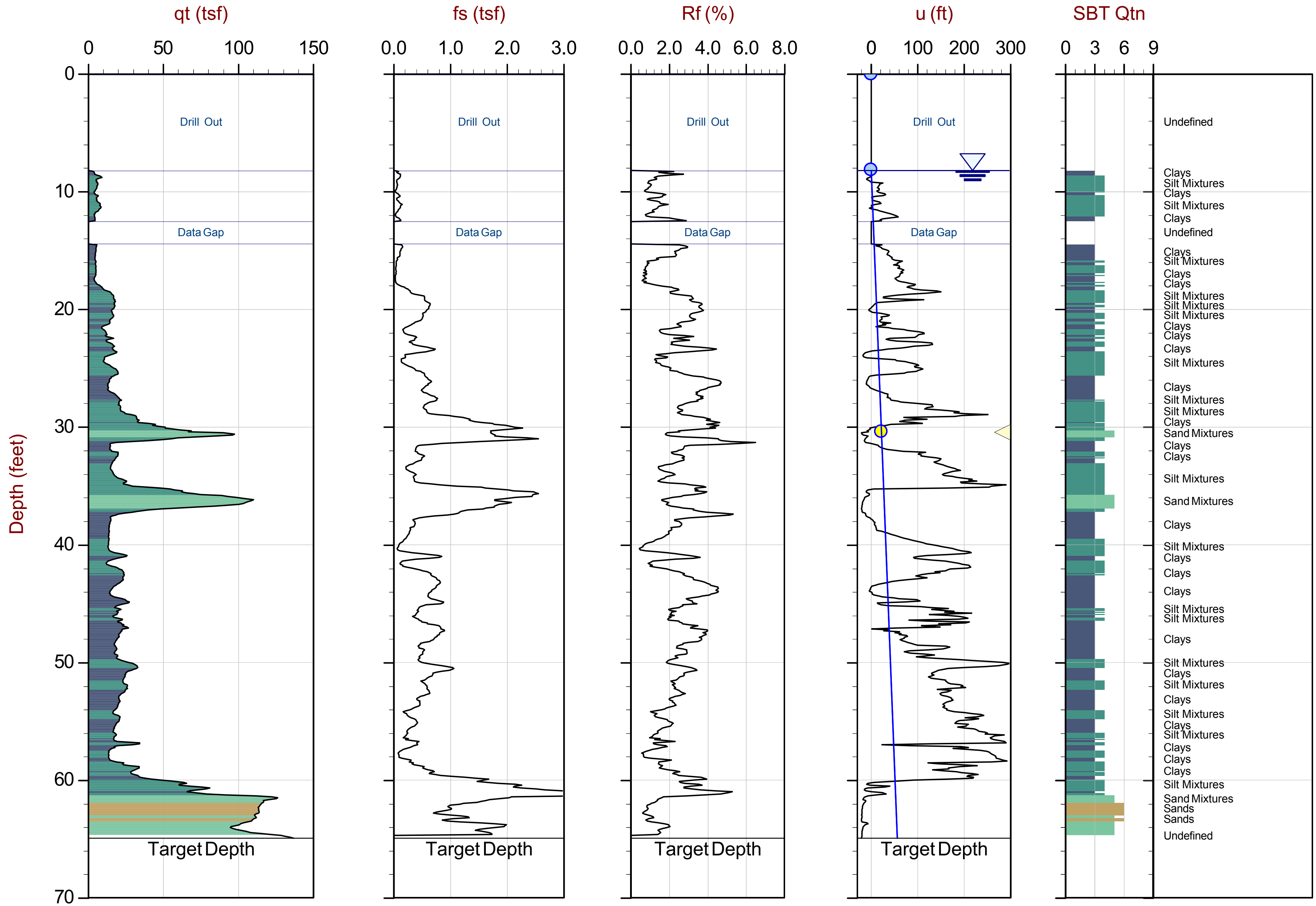
1. The assumed phreatic surface was based on the results of the shallowest pore pressure dissipation test performed within the sounding. Hydrostatic conditions were assumed for the calculated parameters.
2. The coordinates were acquired using consumer grade GPS equipment, datum: WGS 1984 / UTM Zone 10 North.
3. Elevations are refrenced to the ground surface and are derived from Google Earth Elevation for the recorded coordinates.

CONETEC

Ninyo & Moore

Job No: 19-56172
Date: 2019-11-26 09:40
Site: Project Thunder

Sounding: CPT-01
Cone: 383:T1500F15U500



Max Depth: 19.800 m / 64.96 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-56172_CP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 4147814m E: 576660m

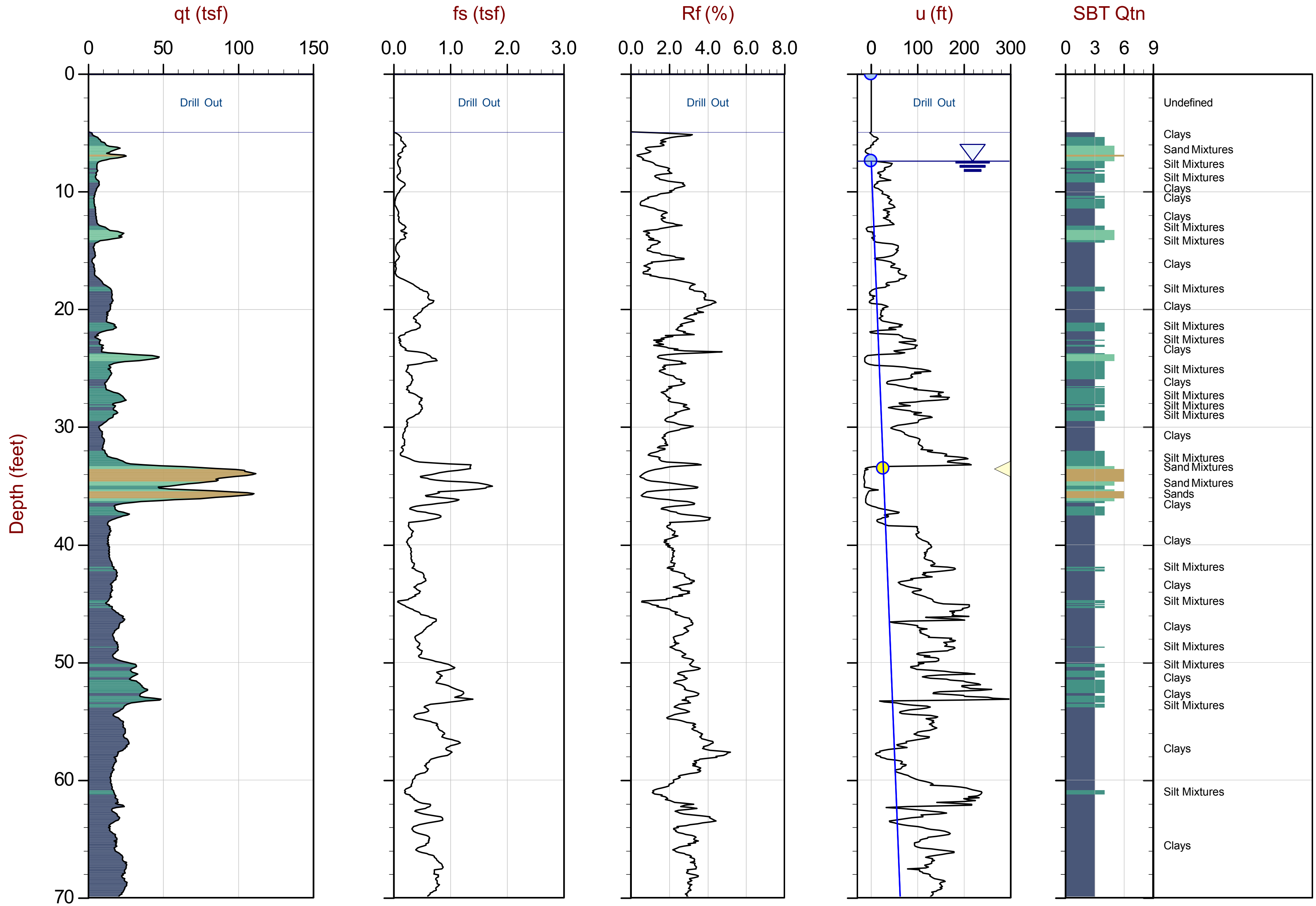
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Ninyo & Moore

Job No: 19-56172
Date: 2019-11-26 08:06
Site: Project Thunder

Sounding: CPT-02
Cone: 383:T1500F15U500



Max Depth: 30.775 m / 100.97 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-56172_CP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 4147844m E: 576734m

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

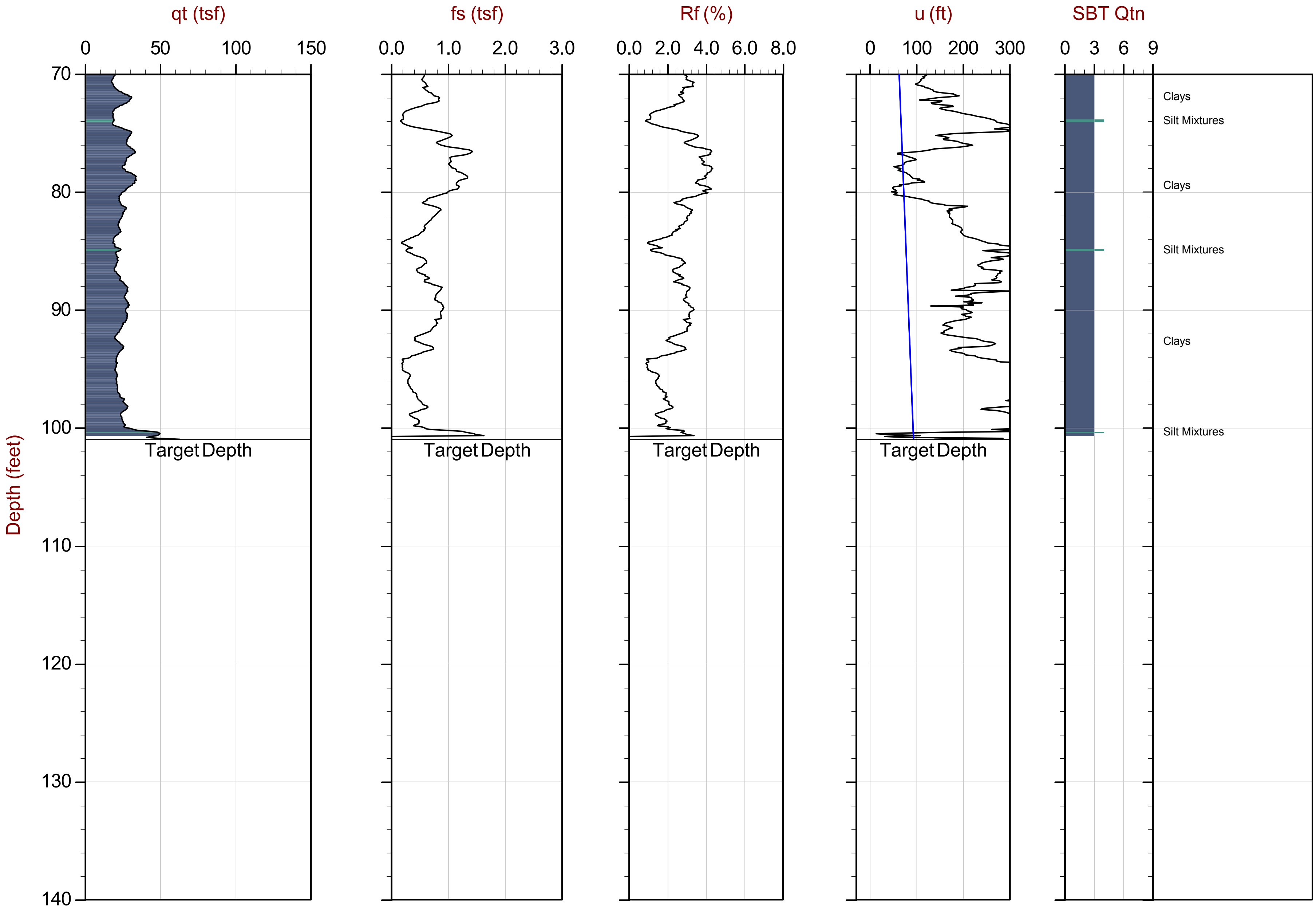
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Ninyo & Moore

Job No: 19-56172
Date: 2019-11-26 08:06
Site: Project Thunder

Sounding: CPT-02
Cone: 383:T1500F15U500



Max Depth: 30.775 m / 100.97 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-56172_CP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 4147844m E: 576734m

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

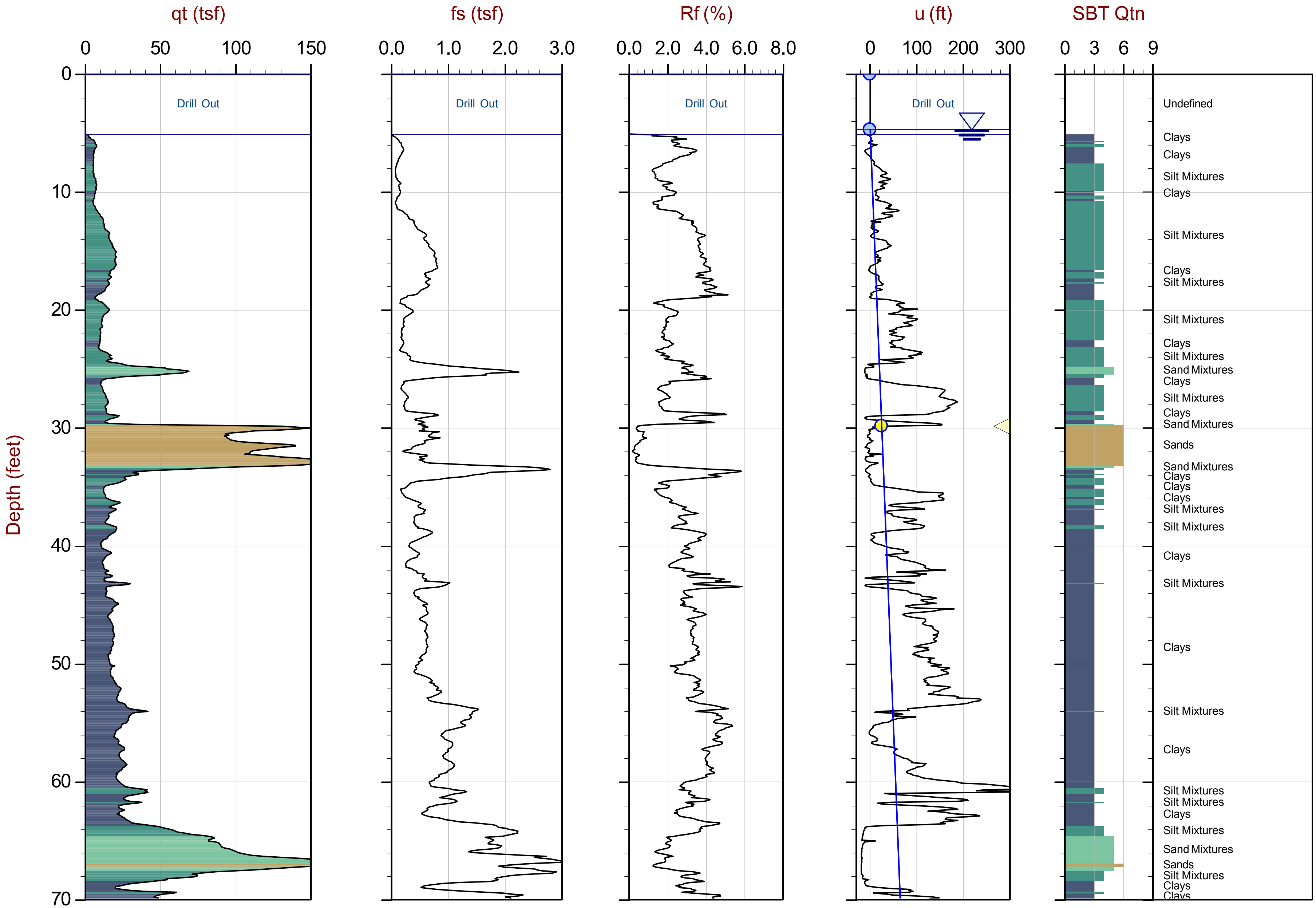
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Ninyo & Moore

Job No: 19-56172
Date: 2019-11-11 07:51
Site: Project Thunder

Sounding: CPT-03
Cone: 443:T1500F15U500



Max Depth: 23.025 m / 75.54 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-56172_CP03.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 4147938m E: 576730m

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

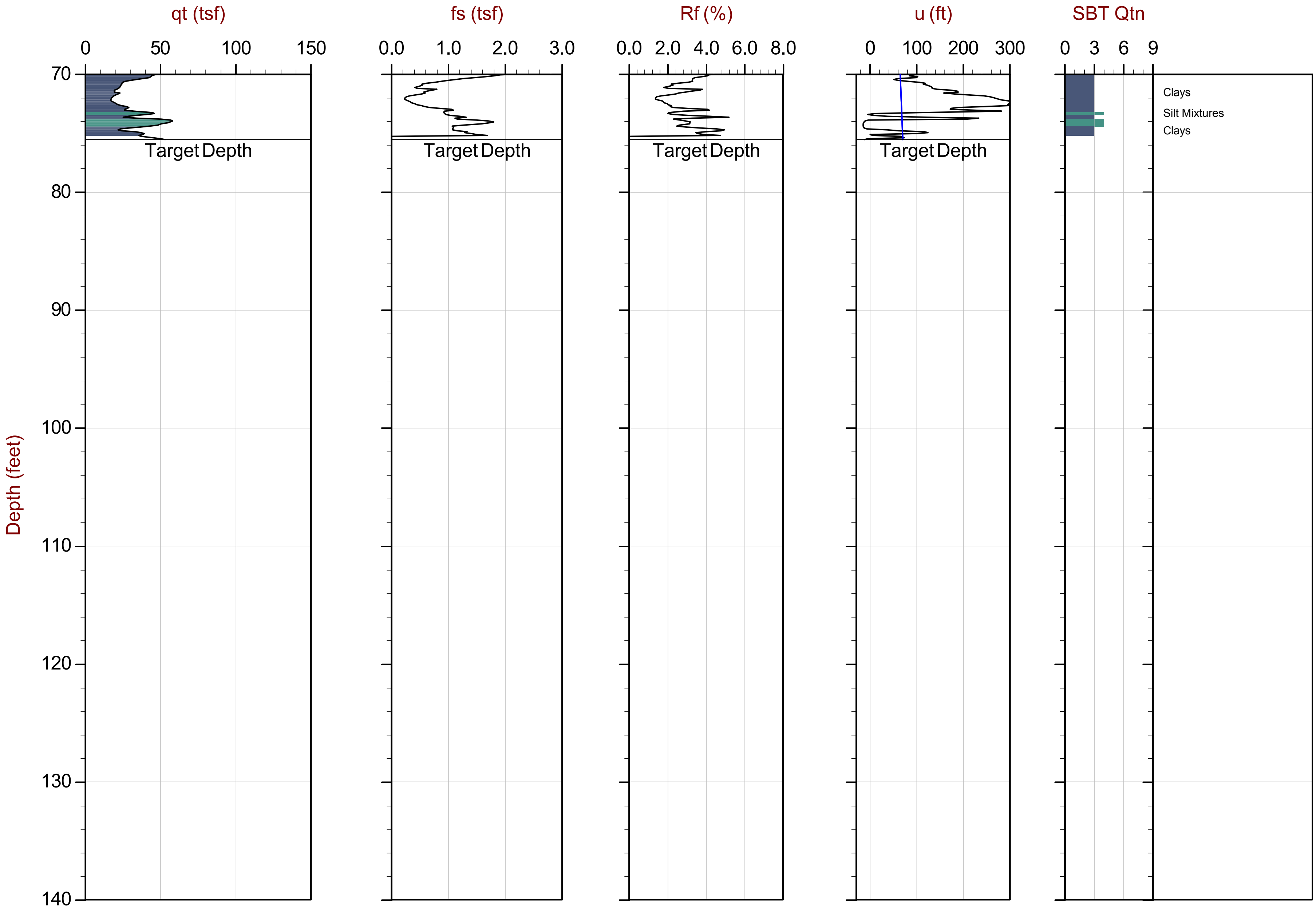
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

Ninyo & Moore

Job No: 19-56172
Date: 2019-11-11 07:51
Site: Project Thunder

Sounding: CPT-03
Cone: 443:T1500F15U500



Max Depth: 23.025 m / 75.54 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-56172_CP03.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 4147938m E: 576730m

Equilibrium Pore Pressure (Ueq) — Assumed Ueq — Dissipation, Ueq achieved — Dissipation, Ueq not achieved — Hydrostatic Line

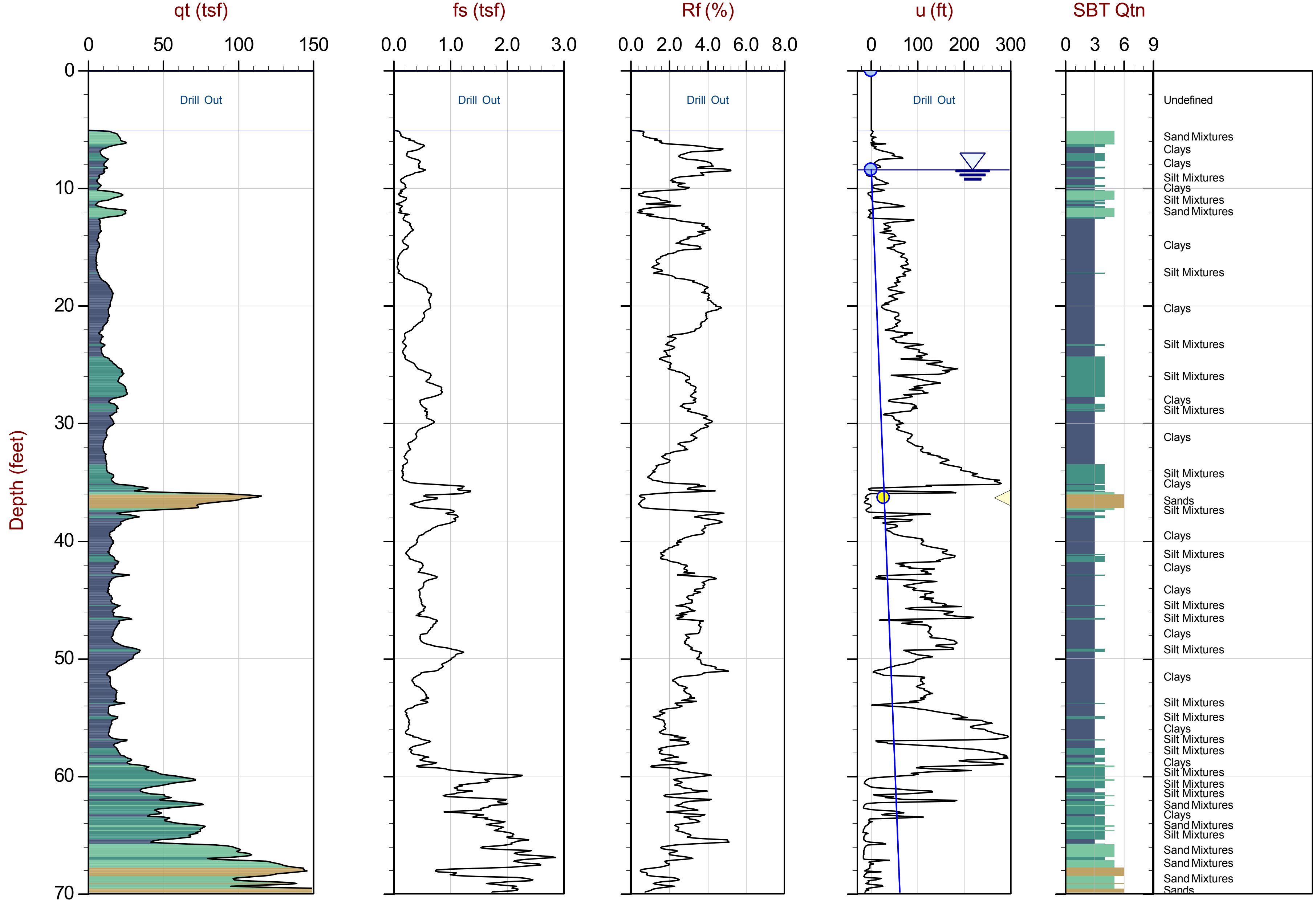
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Ninyo & Moore

Job No: 19-56172
Date: 2019-11-26 10:31
Site: Project Thunder

Sounding: CPT-04
Cone: 383:T1500F15U500



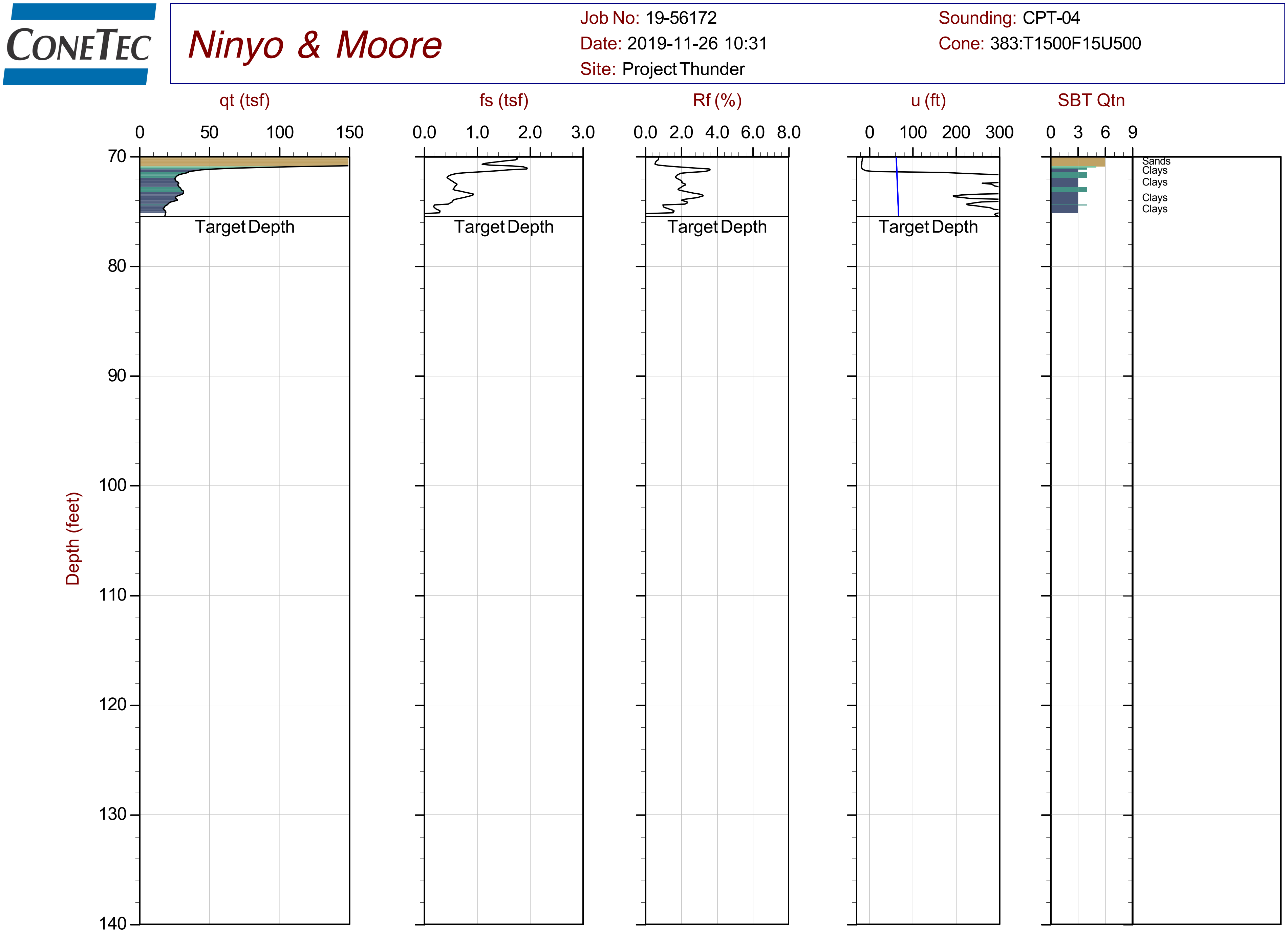
Max Depth: 23.000 m / 75.46 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-56172_CP04.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 4147851m E: 576631m

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



Max Depth: 23.000 m / 75.46 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-56172_CP04.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 4147851m E: 576631m

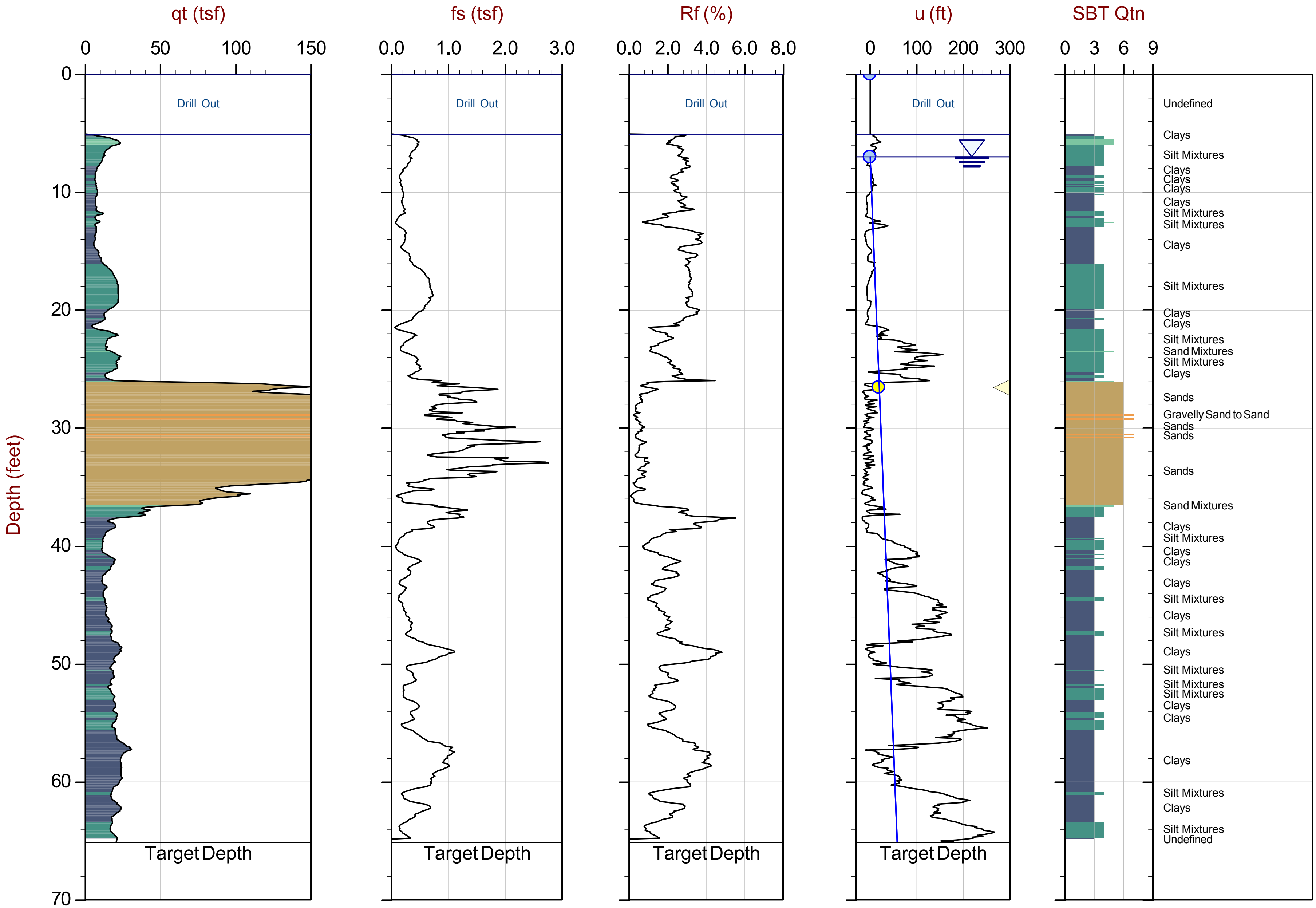
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Ninyo & Moore

Job No: 19-56172
Date: 2019-11-11 09:17
Site: Project Thunder

Sounding: CPT-05
Cone: 443:T1500F15U500



Max Depth: 19.850 m / 65.12 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-56172_CP05.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 4147961m E: 576641m

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Dissipation, Ueq not achieved Hydrostatic Line

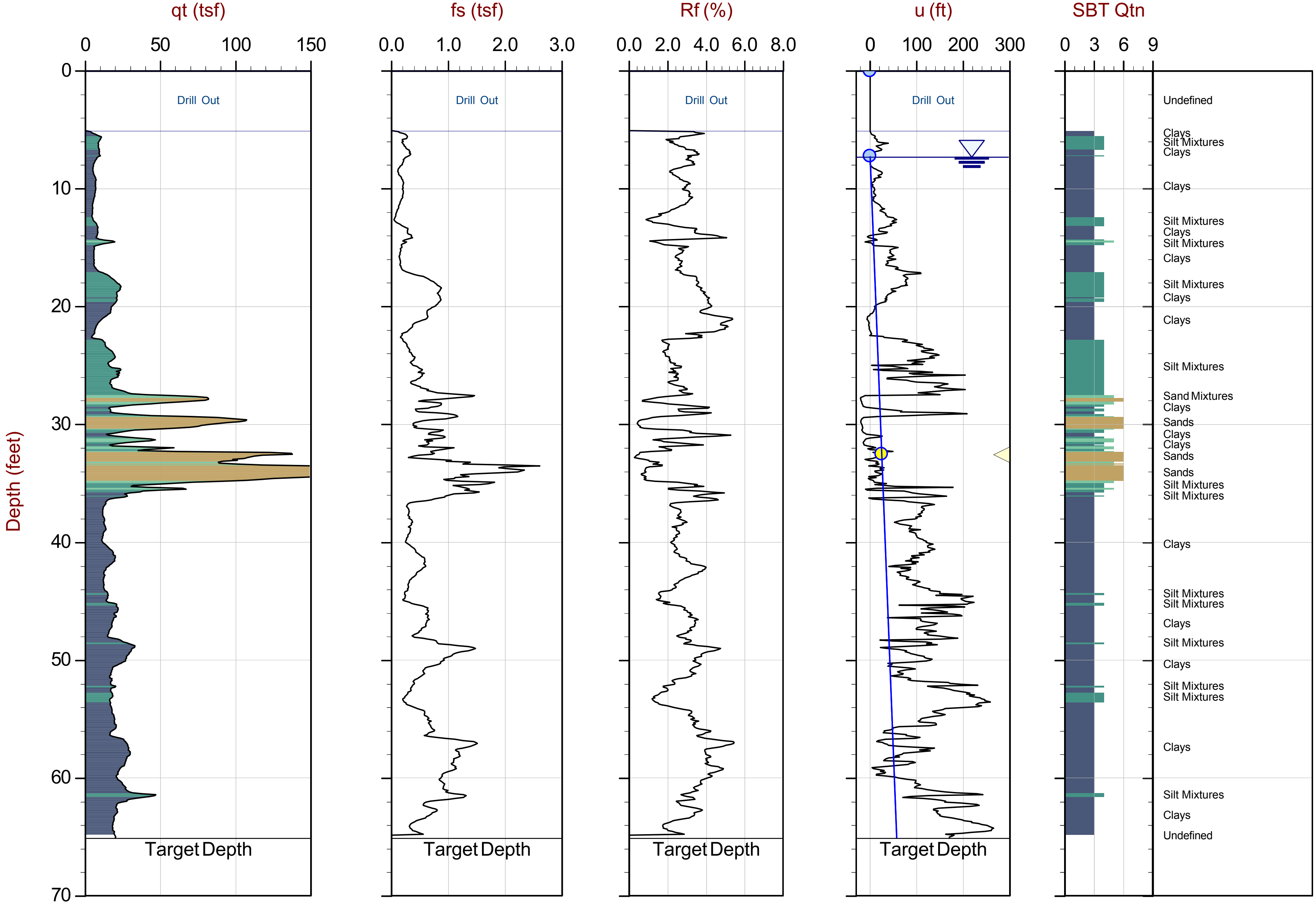
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

Ninyo & Moore

Job No: 19-56172
Date: 2019-11-11 10:24
Site: Project Thunder

Sounding: CPT-06
Cone: 443:T1500F15U500



Max Depth: 19.850 m / 65.12 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 19-56172_CP06.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10N N: 4147903m E: 576661m

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Dissipation, Ueq not achieved | Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Job No: 19-56172
Client: Ninyo & Moore
Project: Project Thunder
Start Date: 11-Nov-2019
End Date: 26-Nov-2019

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)
CPT-01	19-56172_CP01	15	300	30.43	22.3	8.2
CPT-02	19-56172_CP02	15	200	33.55	26.1	7.4
CPT-03	19-56172_CP03	15	305	29.86	25.1	4.7
CPT-04	19-56172_CP04	15	180	36.33	27.9	8.4
CPT-05	19-56172_CP05	15	335	26.57	19.5	7.0
CPT-06	19-56172_CP06	15	405	32.56	25.3	7.3

APPENDIX C

Laboratory Testing

APPENDIX C

LABORATORY TESTING

Classification
Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488-00. Soil classifications are indicated on the boring logs in Appendix A.

Moisture Content
The moisture content of samples obtained from the exploratory borings was evaluated in accordance with ASTM D 2216. The test results are presented on the boring logs in Appendix A.

In-Place Density Tests
The dry density of relatively undisturbed samples obtained from the exploratory borings was evaluated in general accordance with ASTM D 2937. The test results are presented on the logs of the exploratory borings in Appendix A.

200 Wash Analysis
An evaluation of the percentage of particles finer than the No. 200 sieve in selected soil samples was performed in general accordance with ASTM D 1140. The test results are presented on Figure C-1.

Gradation Analysis
Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D 422. The grain-size distribution curves are shown on Figures C-2 through C-12. The test results were utilized in evaluating the soil classification in accordance with the Unified Soil Classification System (USCS).

Atterberg Limits
Tests were performed on selected representative soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System (USCS). The test results and classifications are shown on Figure C-13.

Consolidation Test
Consolidation tests were performed on selected relatively undisturbed soil samples in general accordance with ASTM D 2435. The samples were inundated during testing to represent adverse field conditions. The percent of consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The results of the tests are summarized on Figures C-14 through C-17.

Direct Shear Tests
Direct shear tests were performed on relatively undisturbed samples in general accordance with ASTM D 3080 to evaluate the shear strength characteristics of the selected materials. The samples were inundated during shearing to represent adverse field conditions. The results are shown on Figure C-18 and C-19.

Expansion Index Test
The expansion index of selected materials were evaluated in general accordance with ASTM D 4829. The specimens were molded under a specified compactive energy at approximately 50 percent saturation (plus or minus 1 percent). The prepared 1-inch thick by 4-inch diameter specimens were loaded with a surcharge of 144 pounds per square foot and inundated with tap

water. Readings of volumetric swell were made for a period of 24 hours. The test results are presented on Figure C-20.

Soil Corrosivity Tests

Soil pH, and resistivity tests were performed on a representative samples in general accordance with California Test (CT) 643. The soluble sulfate and chloride contents of the selected samples were evaluated in general accordance with CT 417 and CT 422, respectively. The test results are presented on Figure C-21.

Unconsolidated Undrained Triaxial Compression Tests

A triaxial compression test was performed on selected relatively undisturbed samples in general accordance with ASTM D 2850. The specimens were sheared under compression without drainage at a constant rate of strain shortly after application of a confining stress in a triaxial cell. The test results are presented on Figure C-22.

Unconfined Compression Tests

Unconfined compression tests were performed on relatively undisturbed samples in general accordance with ASTM D 2216. The test results are presented on Figure C-23.

SAMPLE LOCATION	SAMPLE DEPTH (ft)	DESCRIPTION	PERCENT PASSING NO. 4	PERCENT PASSING NO. 200	USCS (TOTAL SAMPLE)
B-3	14.5-15.0	Yellowish brown clayey SAND.	90	48	SC
B-4	24.5-25.0	Light brown sandy CLAY.	93	68	CL
B-5	9.5-10.0	Yellowish brown lean CLAY.	100	78	CL
B-5	19.5-20.0	Yellowish brown lean CLAY.	100	75	CL

PERFORMED IN ACCORDANCE WITH ASTM D 1140

FIGURE C-1

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NO. 200 SIEVE ANALYSIS TEST RESULTS

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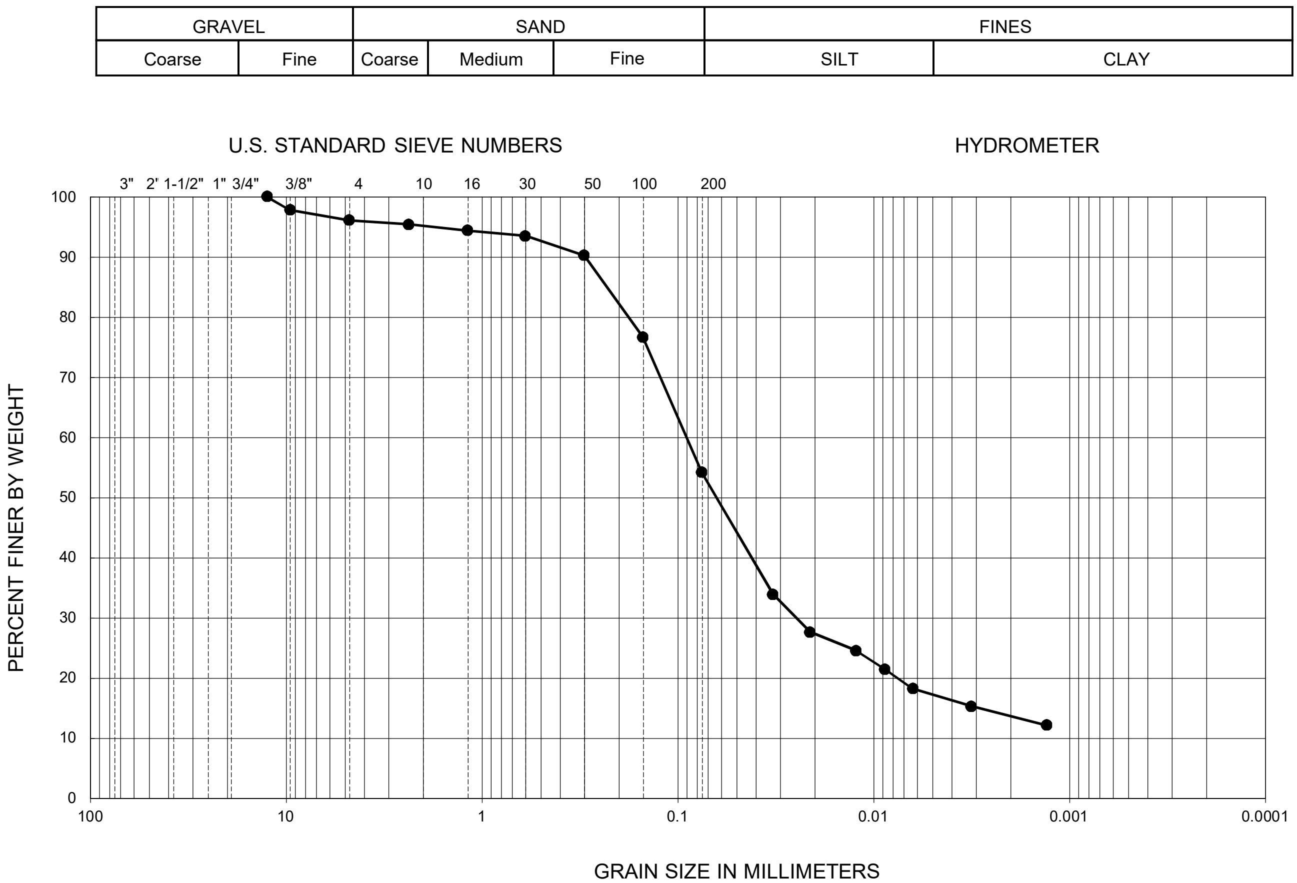

Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-1	6.0-6.5	28	16	12	--	0.025	0.095	--	--	54	CL

PERFORMED IN ACCORDANCE WITH ASTM D 422

FIGURE C-2

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GRADATION TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

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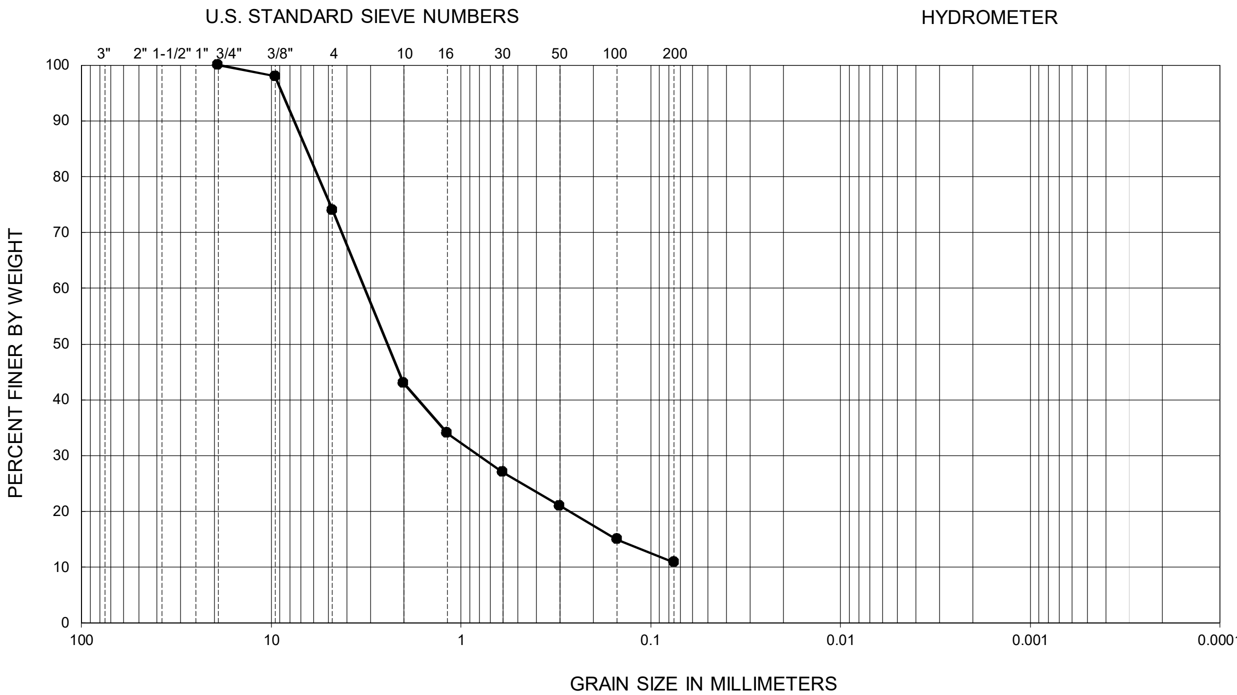
GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-1	14.5-15.0	--	--	--	--	0.85	3.51	--	--	11	SP-SC

PERFORMED IN ACCORDANCE WITH ASTM D 422 / D6913

FIGURE C-3

GRADATION TEST RESULTS

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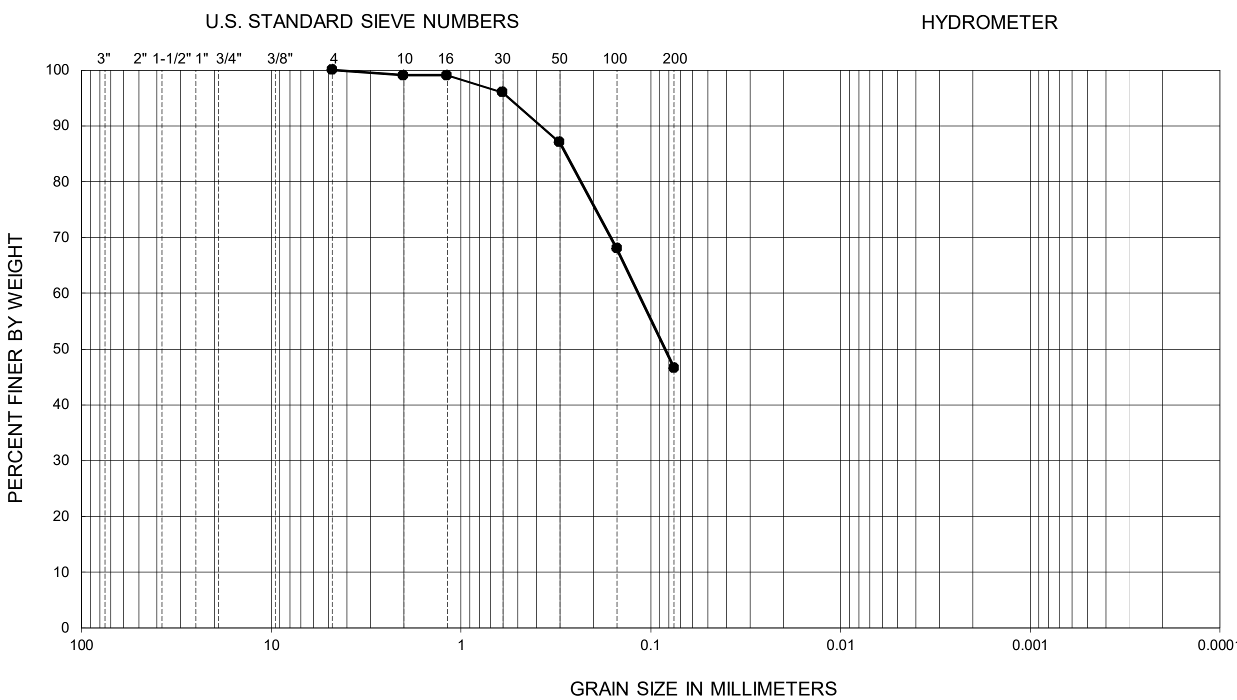
2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-1	35.0-36.5	--	--	--	--	--	0.12	--	--	47	SC

PERFORMED IN ACCORDANCE WITH ASTM D 422 / D6913

FIGURE C-4

GRADATION TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

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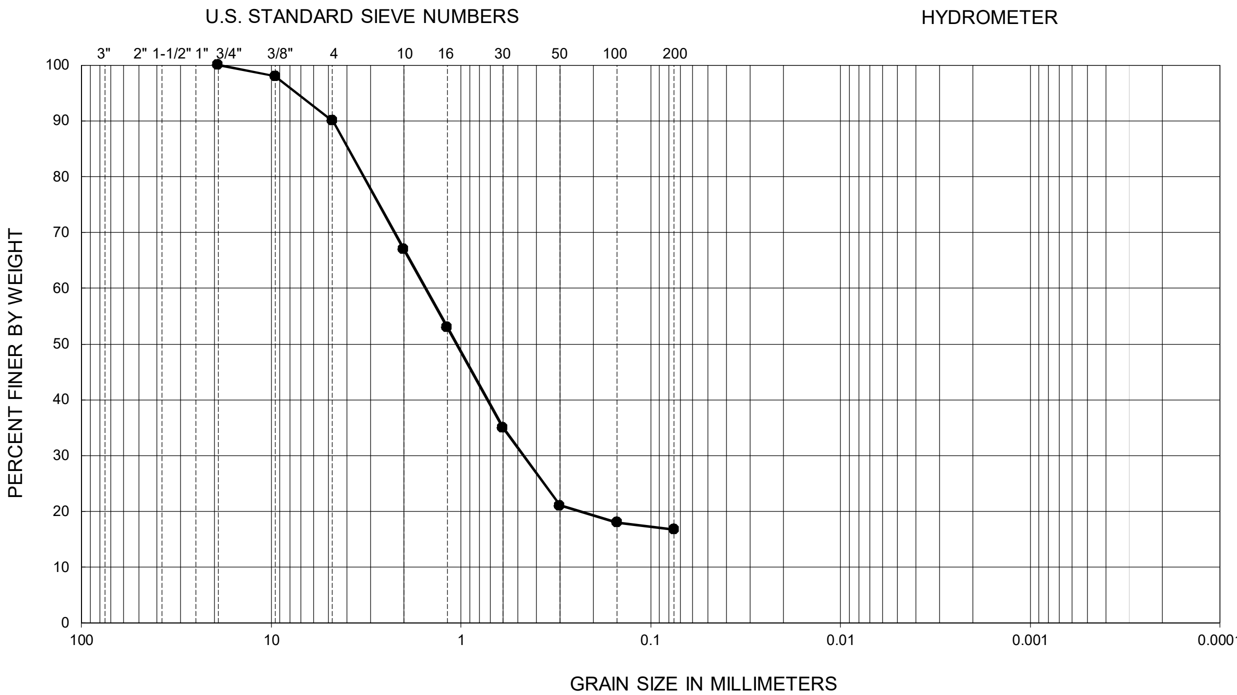
GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-2	15.0-16.5	--	--	--	--	0.49	1.59	--	--	17	SC

PERFORMED IN ACCORDANCE WITH ASTM D 422 / D6913

FIGURE C-5

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GRADATION TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

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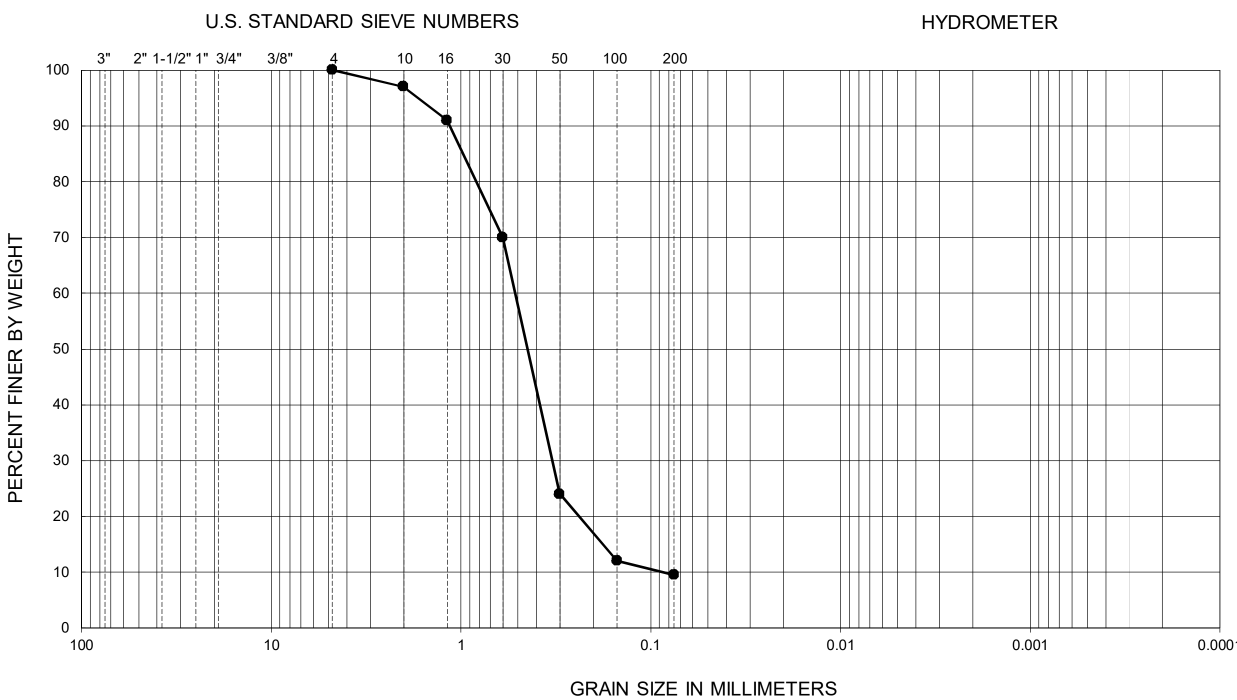
GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-2	34.5-35.0	--	--	--	0.09	0.34	0.53	5.9	2.4	10	SP-SC

PERFORMED IN ACCORDANCE WITH ASTM D 422 / D6913

FIGURE C-6

GRADATION TEST RESULTS

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2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

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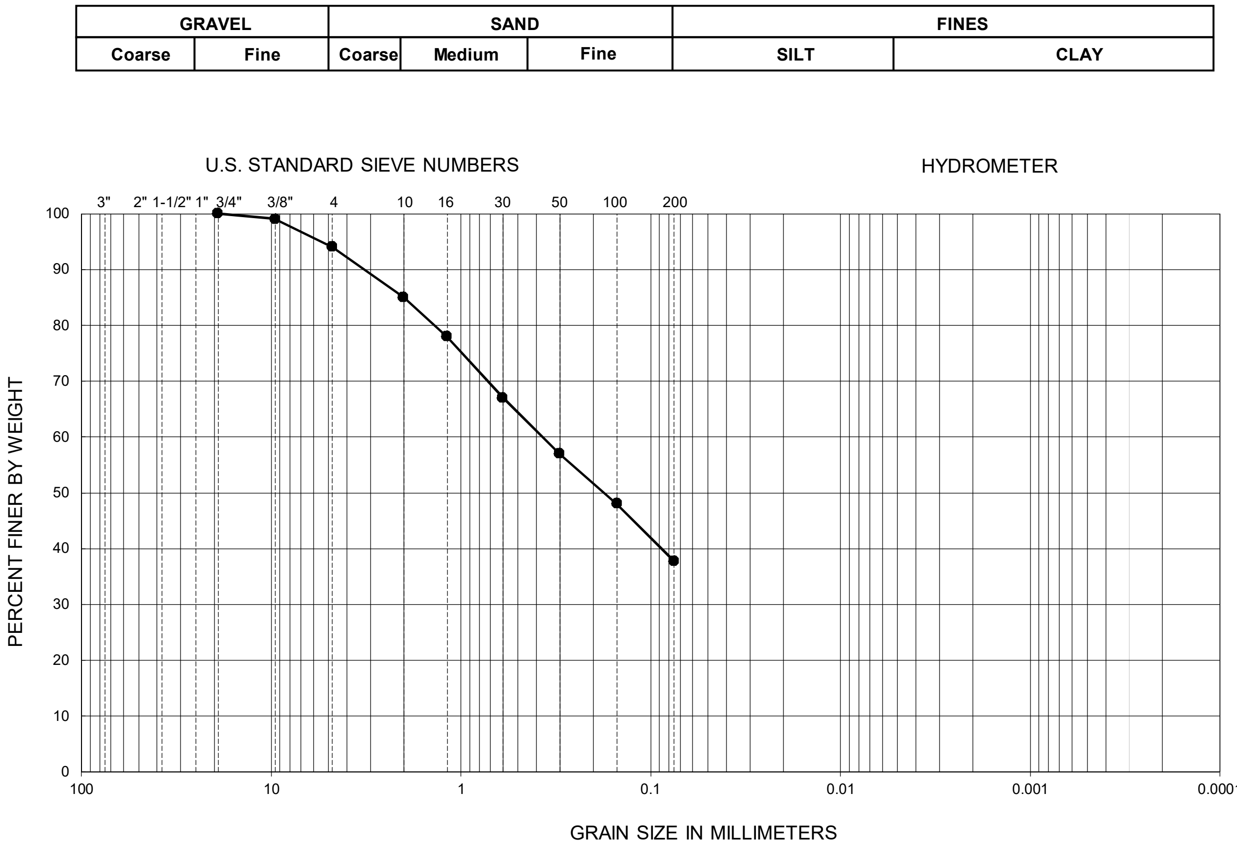

Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-3	6.0-6.5	--	--	--	--	--	0.39	--	--	38	SC

PERFORMED IN ACCORDANCE WITH ASTM D 422 / D6913

FIGURE C-7

GRADATION TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

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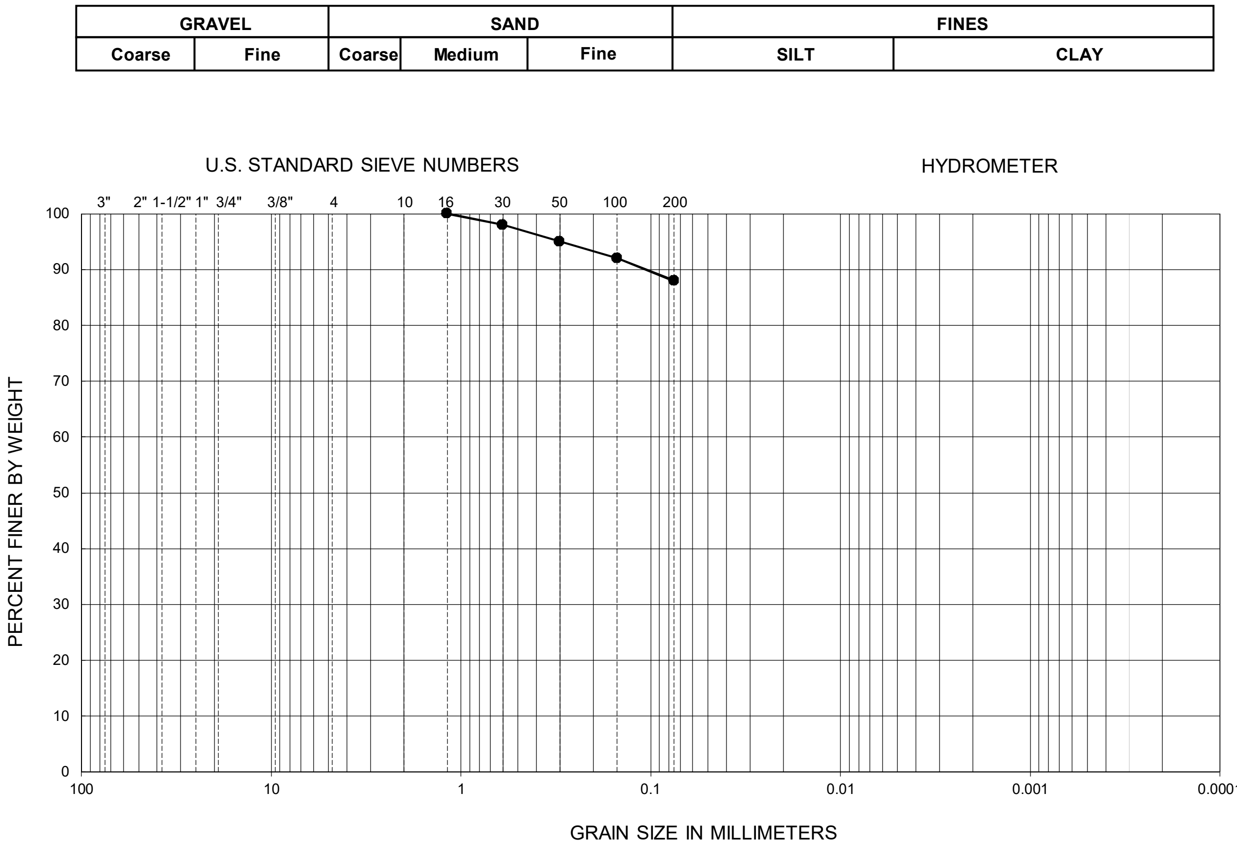

Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-3	19.5-20.0	--	--	--	--	--	--	--	--	88	CL

PERFORMED IN ACCORDANCE WITH ASTM D 422 / D6913

FIGURE C-8

GRADATION TEST RESULTS

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2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

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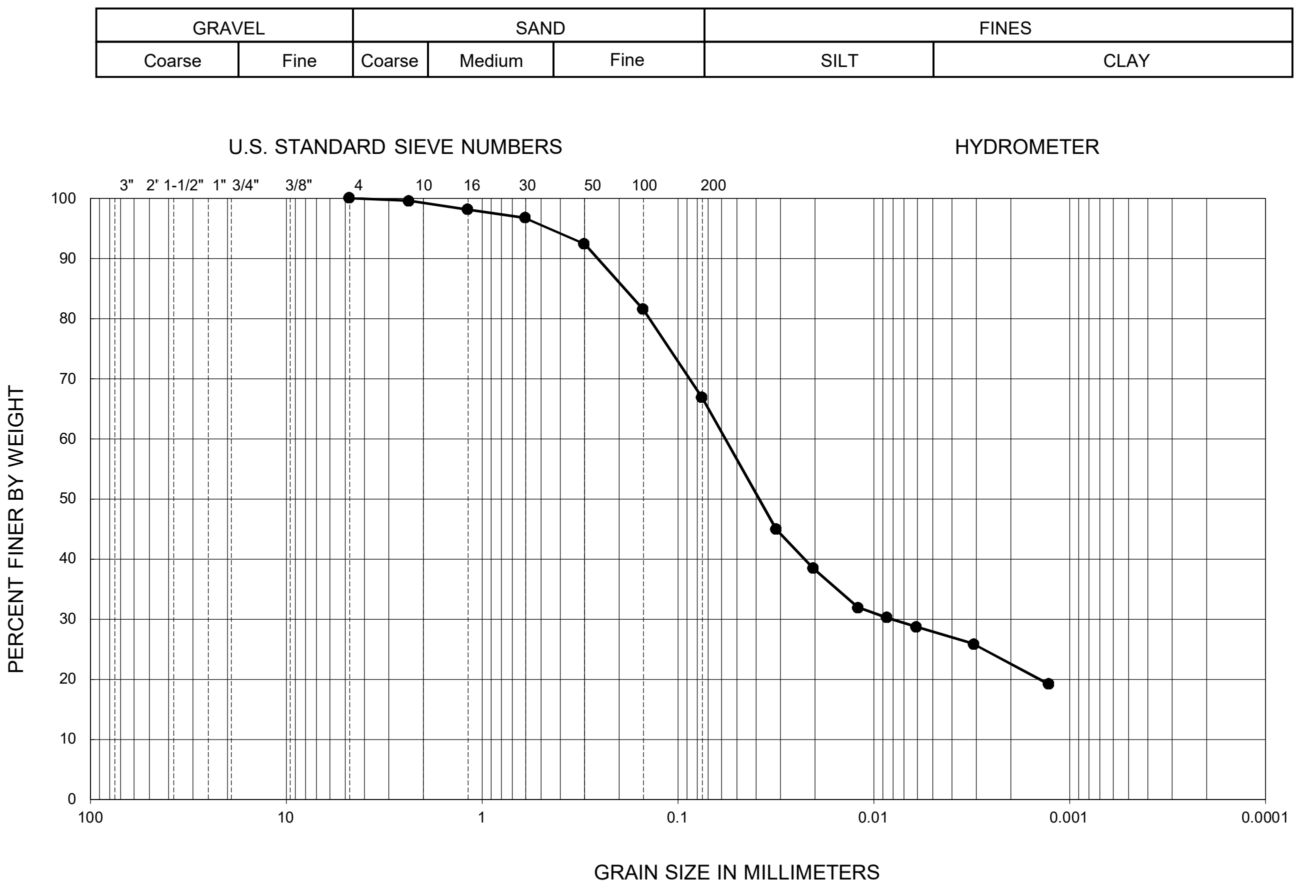

Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (%)	USCS
●	B-4	6.0-6.5	33	15	18	--	0.01	0.06	--	--	67	CL

PERFORMED IN ACCORDANCE WITH ASTM D 422

FIGURE C-9

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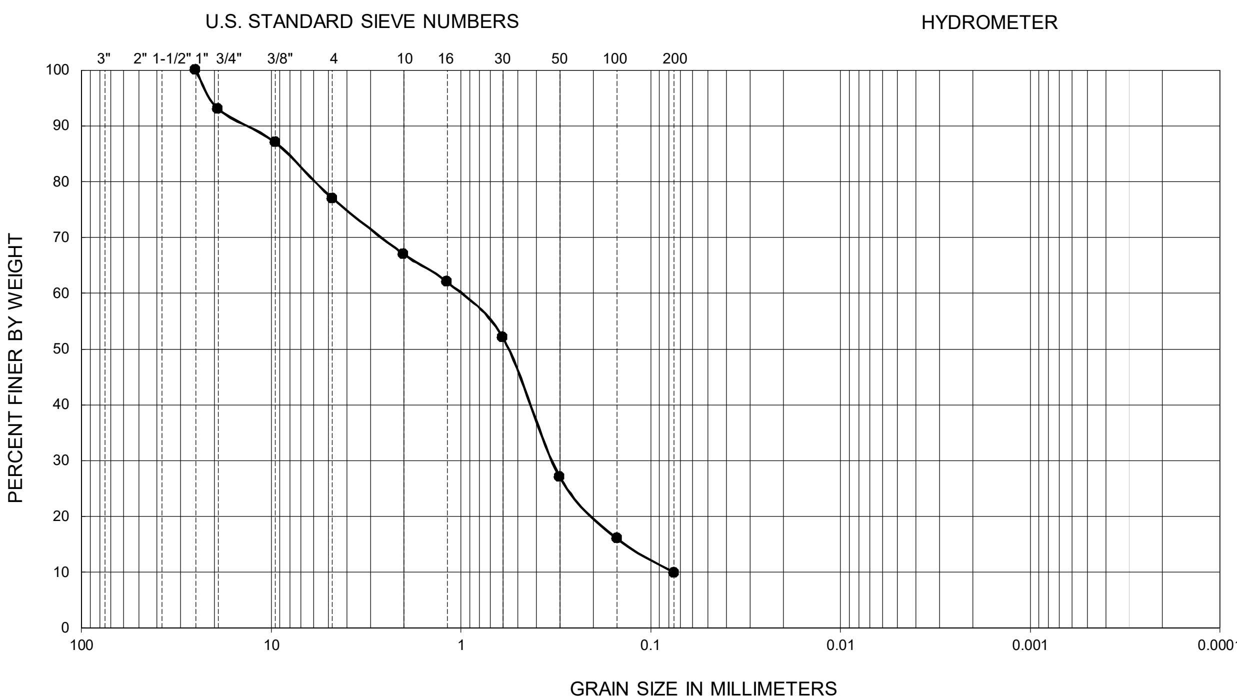
GRADATION TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-4	29.5-30.0	--	--	--	0.08	0.34	1.06	13.8	1.4	10	SW-SC

PERFORMED IN ACCORDANCE WITH ASTM D 422 / D6913

FIGURE C-10

GRADATION TEST RESULTS

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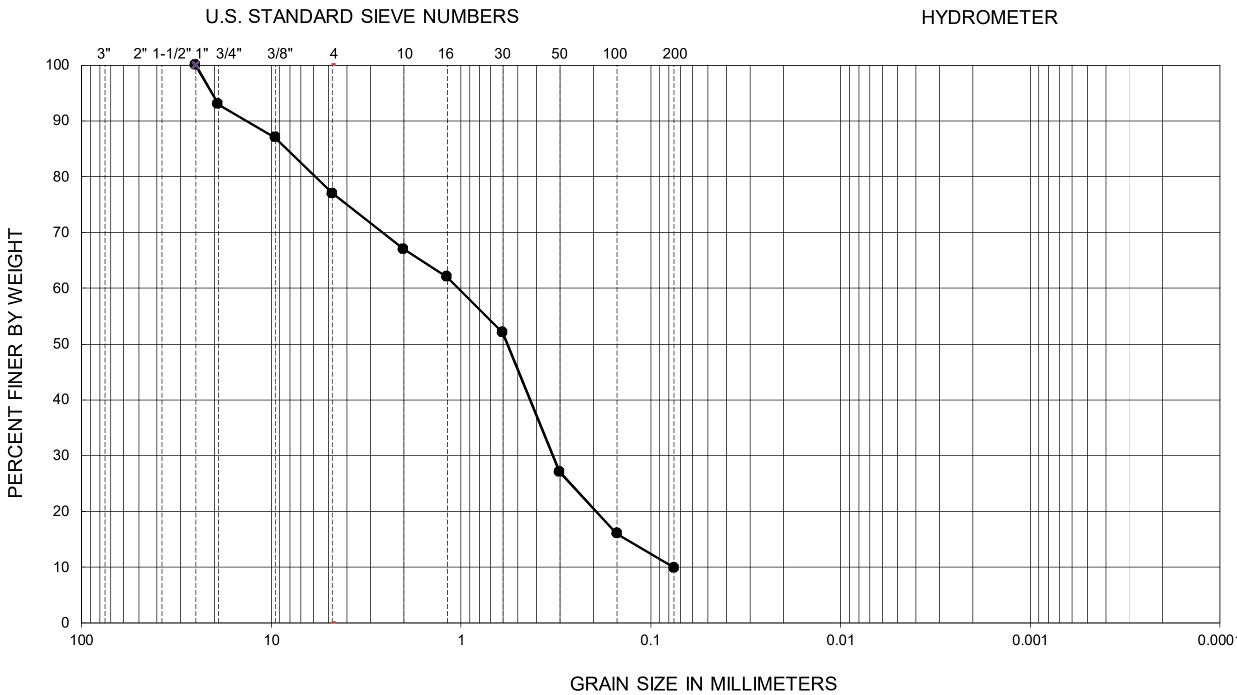
2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-5	29.5-30.0	--	--	--	0.08	0.34	1.06	13.8	1.4	10	SW-SC

PERFORMED IN ACCORDANCE WITH ASTM D 422 / D6913

FIGURE C-11

GRADATION TEST RESULTS

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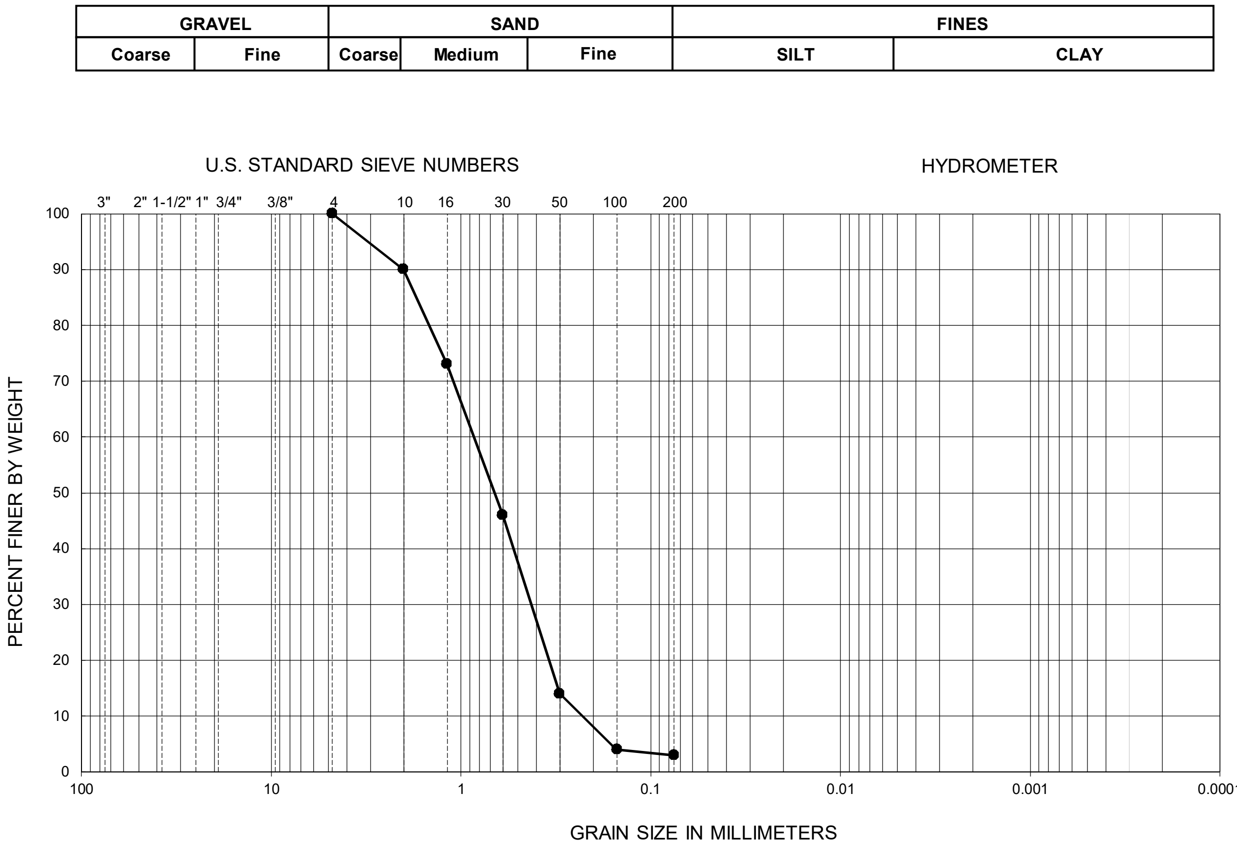
2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-5	38.5-39.5	--	--	--	0.24	0.45	0.90	3.8	0.9	3	SP

PERFORMED IN ACCORDANCE WITH ASTM D 422 / D6913

FIGURE C-12

GRADATION TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

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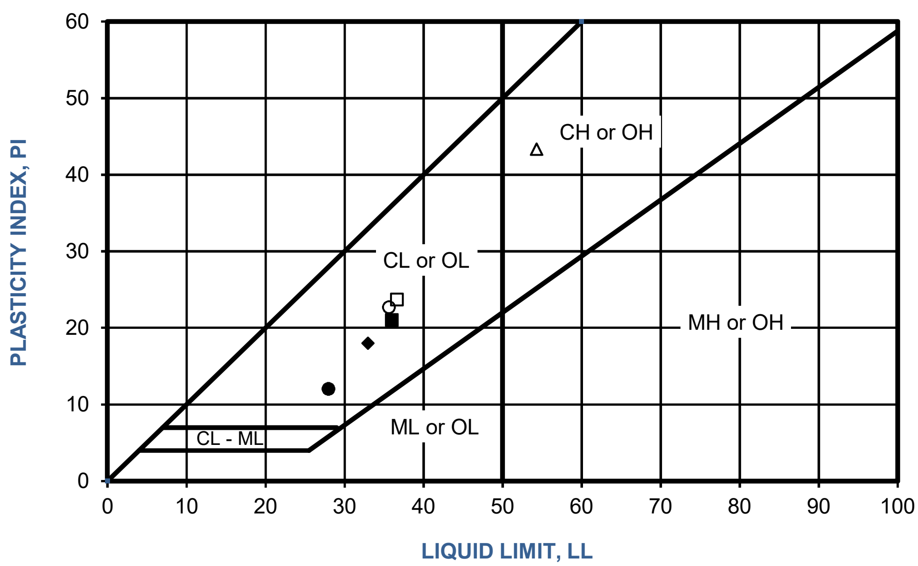
SYMBOL	LOCATION	DEPTH (ft)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS
●	B-1	6.0-6.5	28	16	12	CL	CL
■	B-3	14.5-15.0	36	15	21	CL	CL
◆	B-4	6.0-6.5	33	15	18	CL	CL
○	B-4	24.5-25.0	36	13	23	CL	CL
□	B-5	9.5-10.0	37	13	24	CL	CL
∆	B-5	19.5-20.0	54	11	43	CH	CH



PERFORMED IN ACCORDANCE WITH ASTM D 4318

FIGURE C-13

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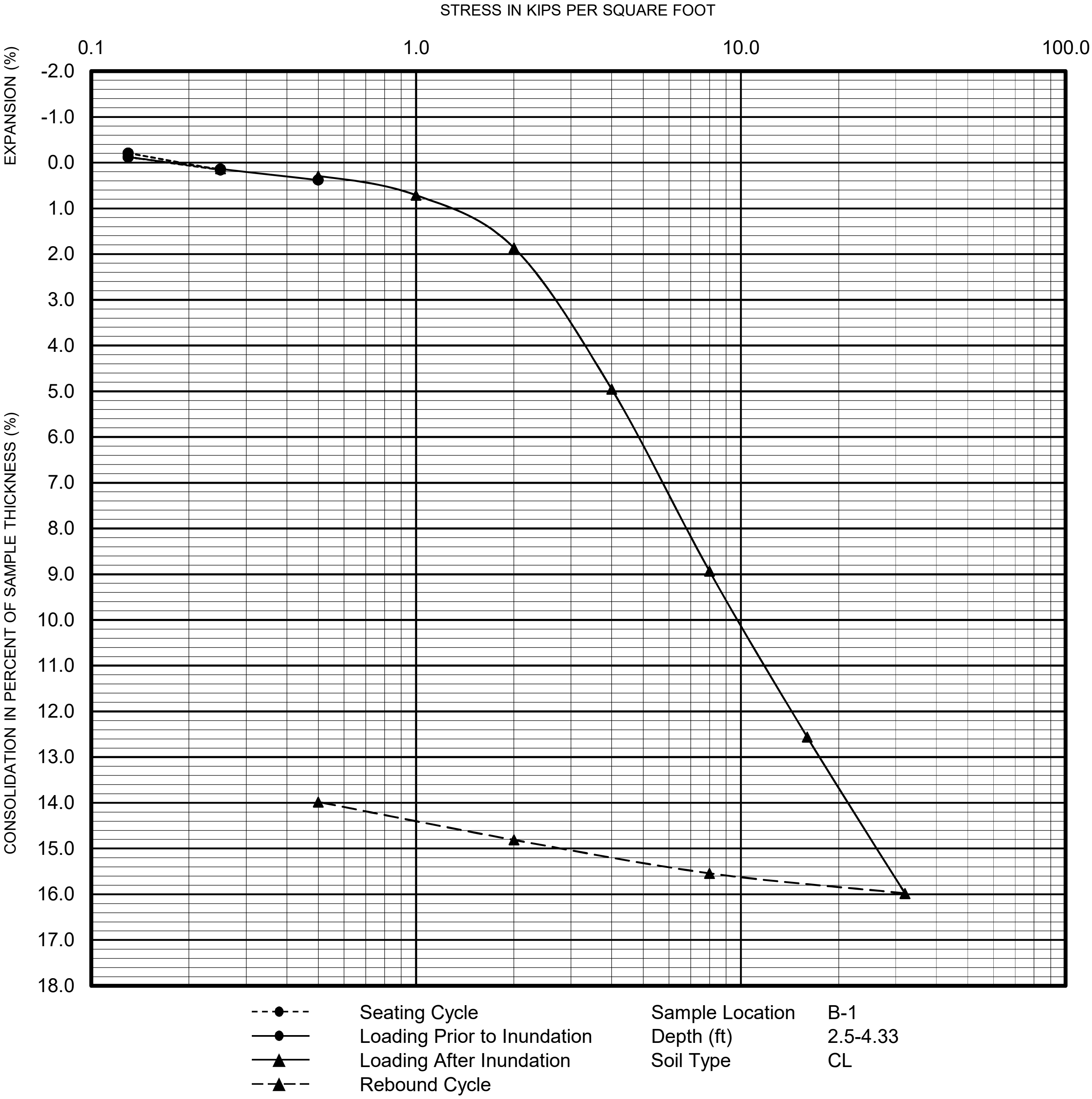
ATTERBERG LIMITS TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20



Sample Location	B-1
Depth (ft)	2.5-4.33
Soil Type	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

FIGURE C-14

CONSOLIDATION TEST RESULTS

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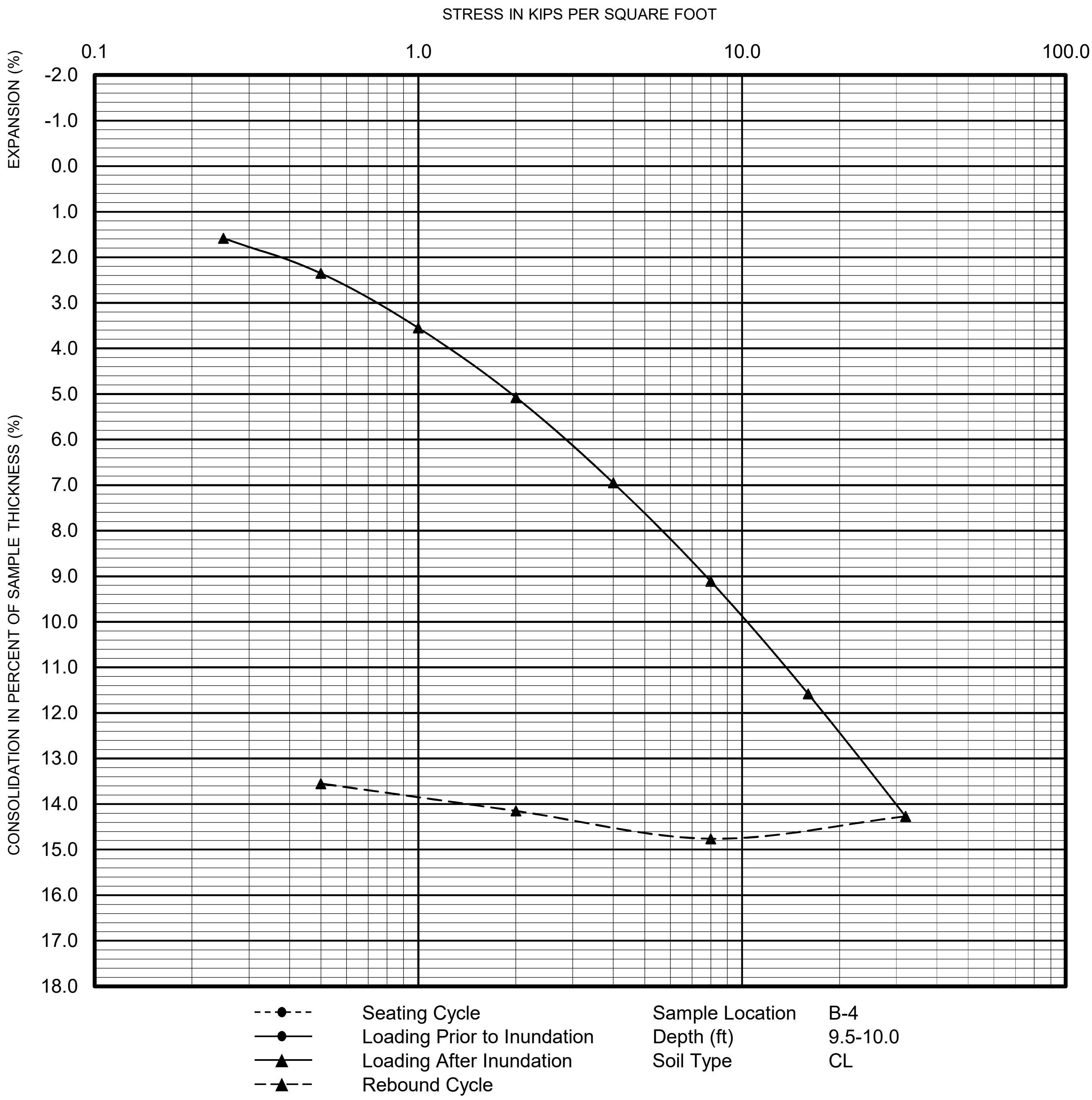
2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20



Sample Location	B-4
Depth (ft)	9.5-10.0
Soil Type	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

FIGURE C-15

CONSOLIDATION TEST RESULTS

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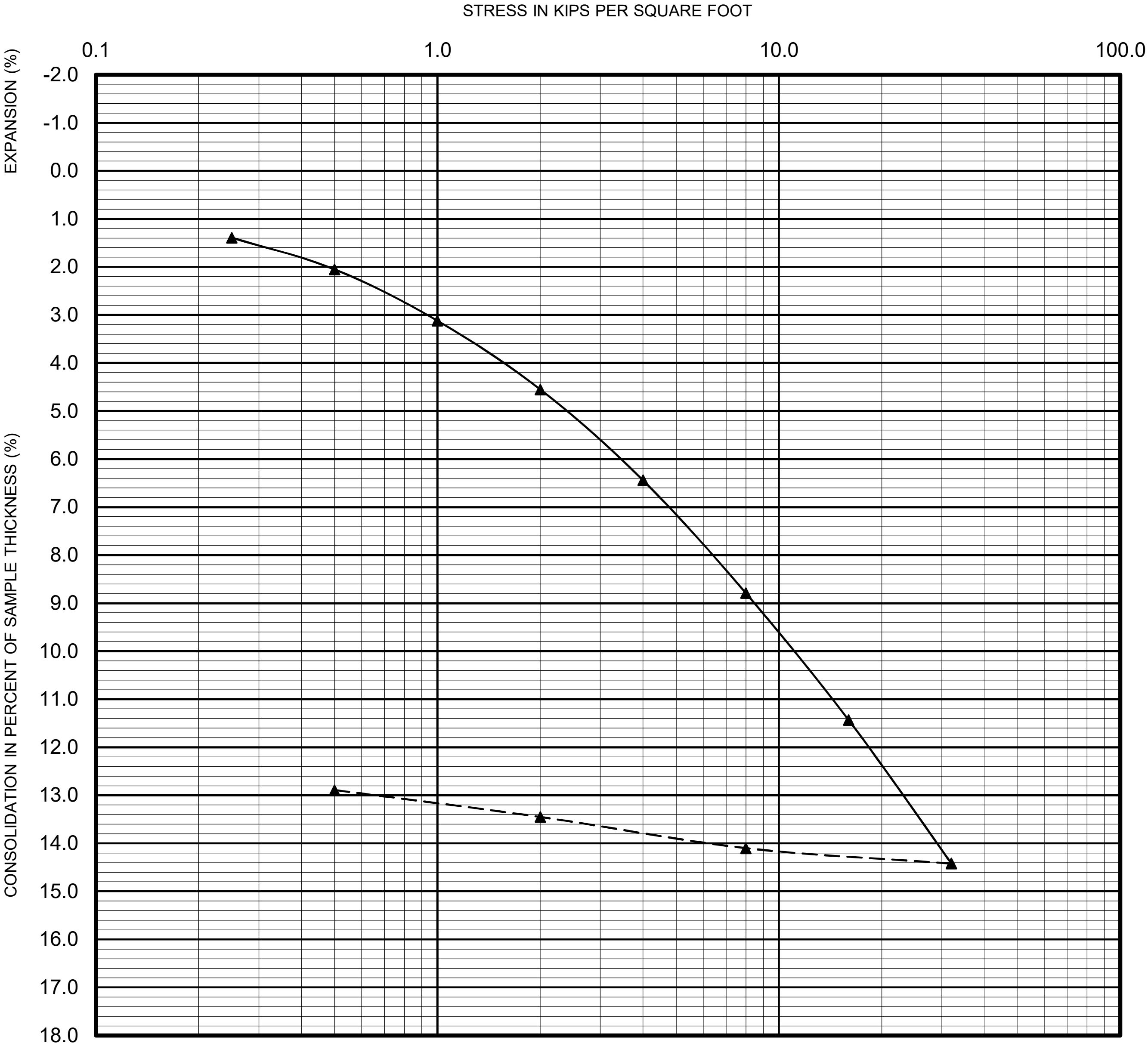
Geotechnical & Environmental Sciences Consultants

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20



Seating Cycle		Sample Location	B-4
Loading Prior to Inundation		Depth (ft)	24.5-25.0
Loading After Inundation		Soil Type	CL
Rebound Cycle			

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

FIGURE C-16

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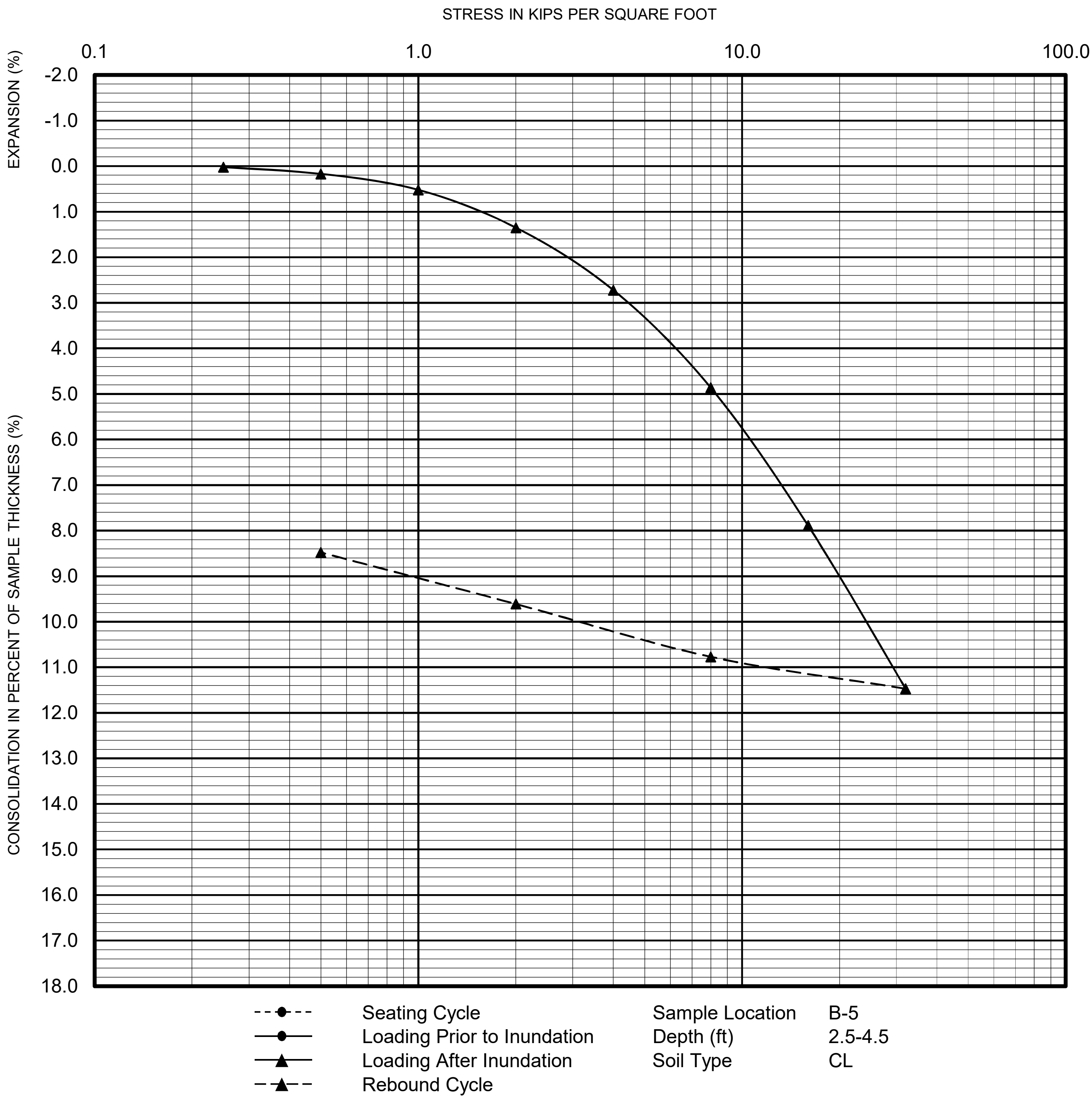
CONSOLIDATION TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20



Sample Location	B-5
Depth (ft)	2.5-4.5
Soil Type	CL

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

FIGURE C-17

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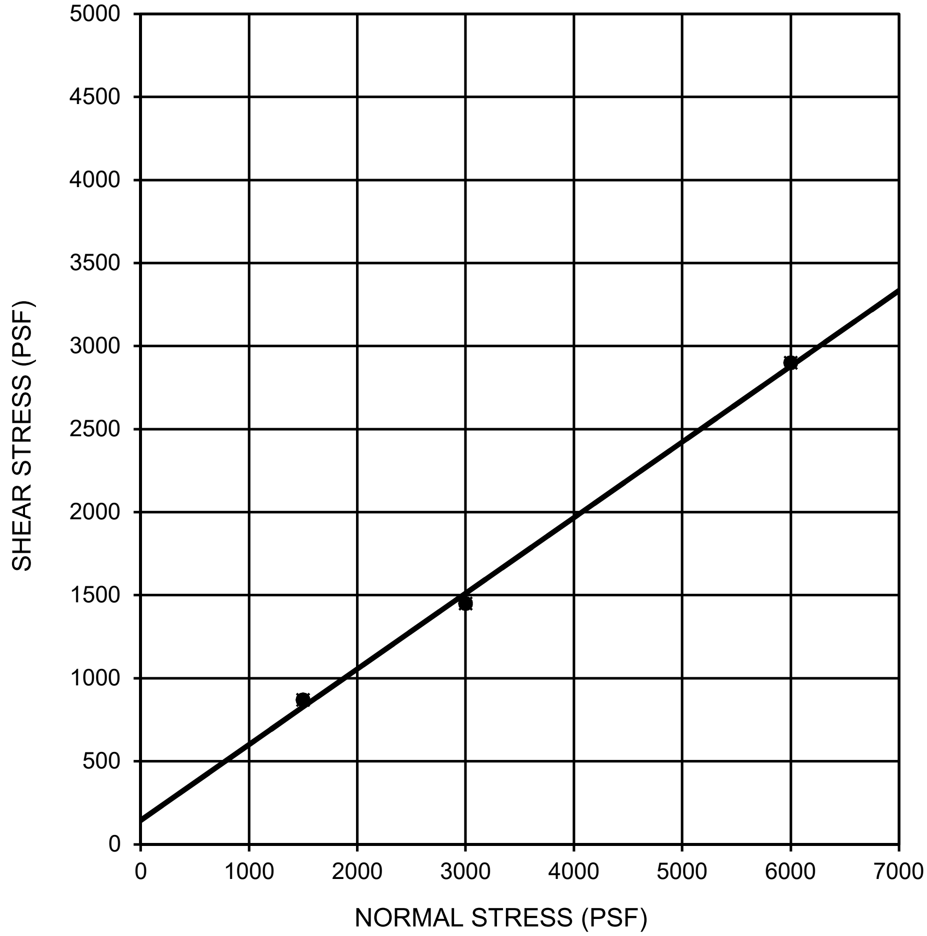
CONSOLIDATION TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20



Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (degrees)	Soil Type
Clayey SAND with clay	—●—	B-1	14.5-15.0	Peak	145	24	SP-SC
Clayey SAND with clay	- - X - -	B-1	14.5-15.0	Ultimate	145	24	SP-SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080

FIGURE C-18

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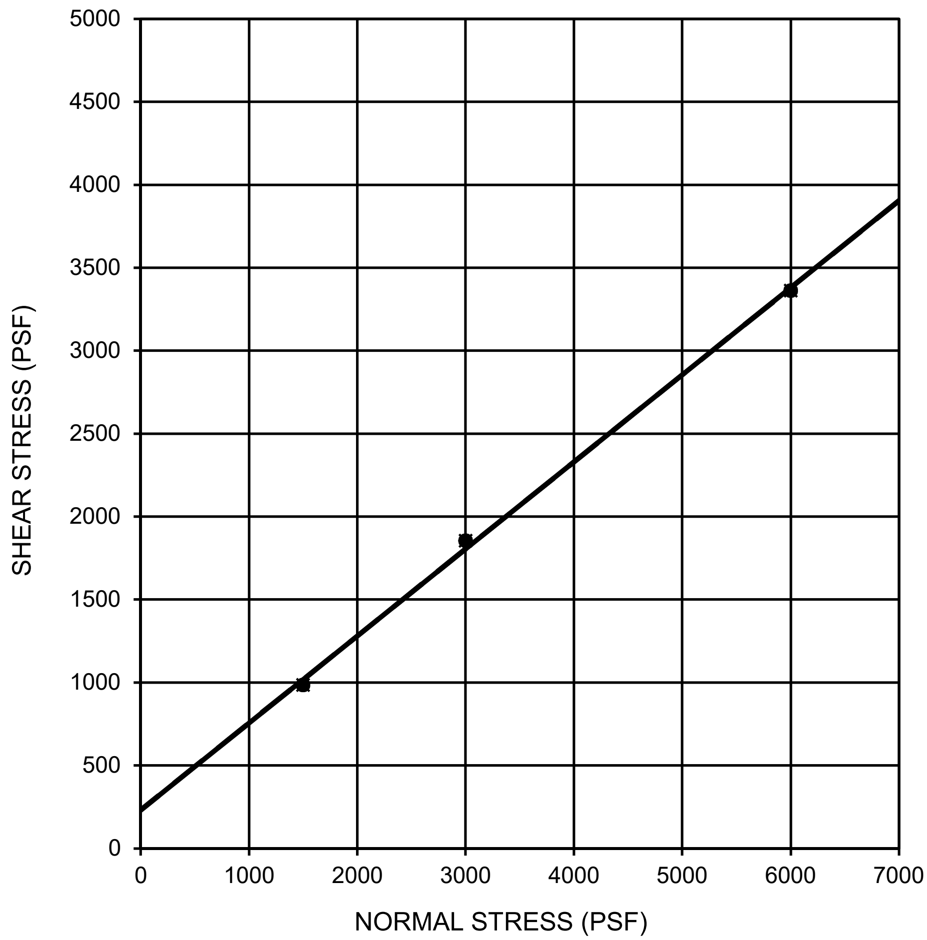
DIRECT SHEAR TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20



Description	Symbol	Sample Location	Depth (ft)	Shear Strength	Cohesion (psf)	Friction Angle (degrees)	Soil Type
Clayey SAND	—●—	B-3	6.0-6.5	Peak	232	28	SC
Clayey SAND	- - X - -	B-3	6.0-6.5	Ultimate	232	28	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 3080

FIGURE C-19

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DIRECT SHEAR TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20

SAMPLE LOCATION	SAMPLE DEPTH (ft)	INITIAL MOISTURE (percent)	COMPACTED DRY DENSITY (pcf)	FINAL MOISTURE (percent)	VOLUMETRIC SWELL (in)	EXPANSION INDEX	POTENTIAL EXPANSION
B-1	1.0-2.5	12.1	100.7	23.4	0.045	45	Low
B-4	1.0-5.0	9.7	110.6	17.8	0.020	20	Very Low

PERFORMED IN ACCORDANCE WITH ASTM D 4829

FIGURE C-20

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EXPANSION INDEX TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20

SAMPLE LOCATION	SAMPLE DEPTH (ft)	pH [1]	RESISTIVITY [1] (ohm-cm)	SULFATE CONTENT [2]		CHLORIDE CONTENT [3] (ppm)
				(ppm)	(%)	
B-1	5.0-6.0	7.2	1,200	240	0.024	780
B-4	1.0-5.0	7.0	950	600	0.060	3300

[1] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 643
[2] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 417
[3] PERFORMED IN GENERAL ACCORDANCE WITH CALIFORNIA TEST METHOD 422

FIGURE C-21

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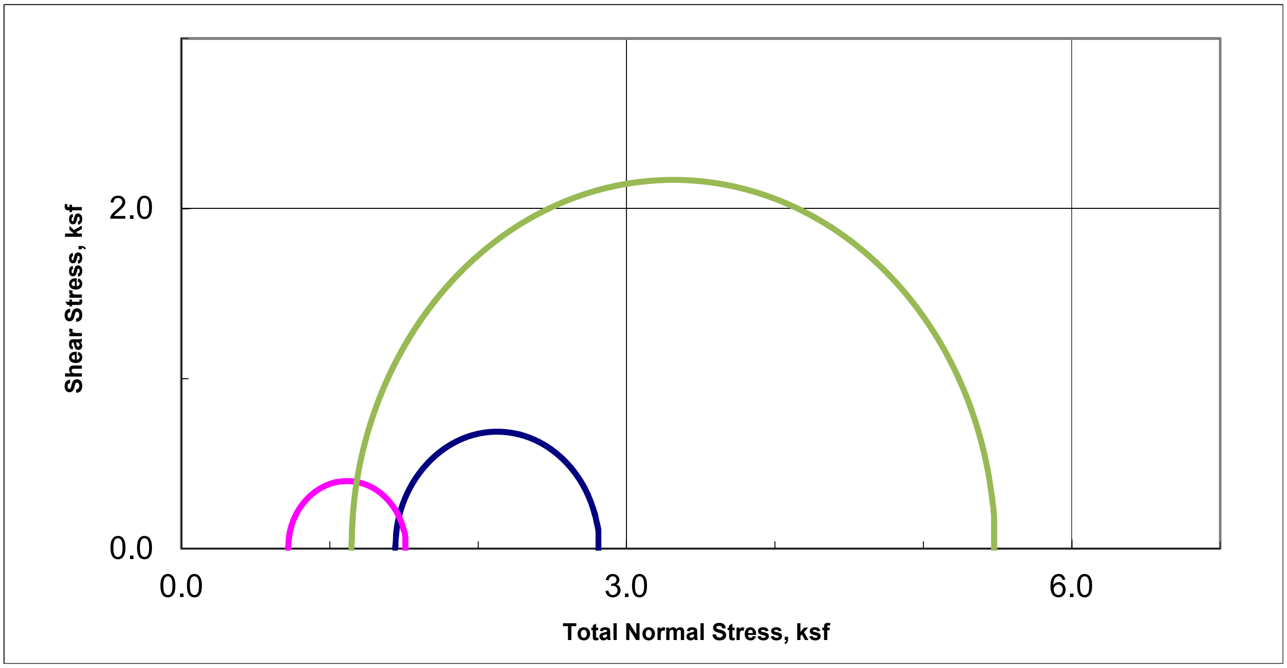
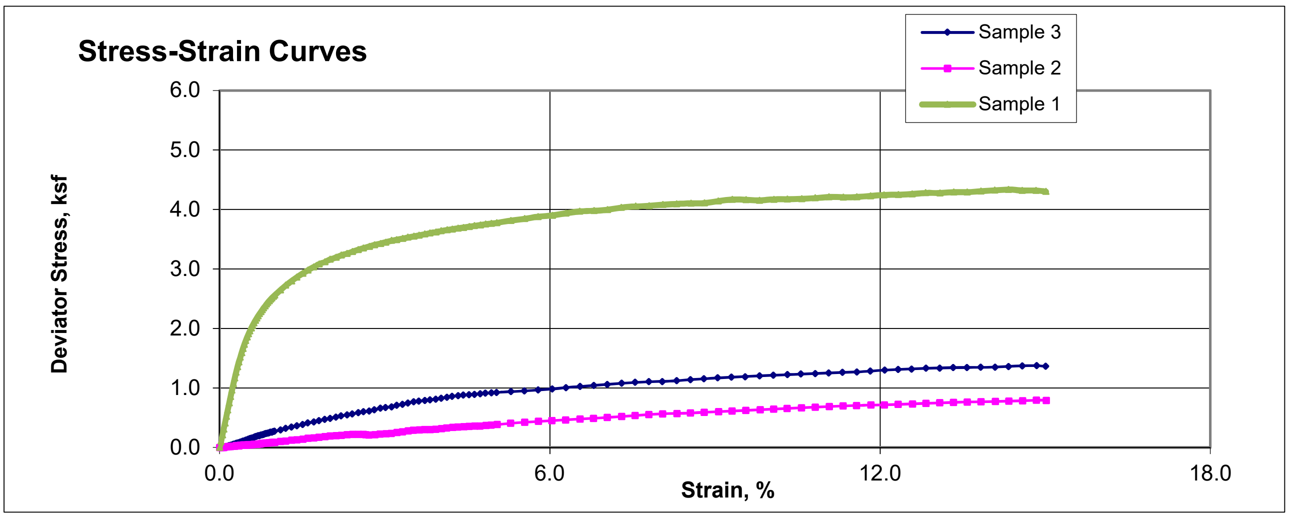
CORROSIVITY TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20





SYMBOL	DESCRIPTION	SOIL TYPE	SAMPLE LOCATION	SAMPLE DEPTH (ft.)	MOISTURE CONTENT w, (%)	DRY DENSITY γ_d, (pcf)	CELL PRESSURE (ksf)	UNDRAINED SHEAR STRENGTH (ksf)
◆	Brown lean CLAY	CL	B-2	19.5-20.0	25.2	99.2	1.15	2.17
■	Brown sandy lean CLAY	CL	B-4	9.5-10.0	23.2	104.8	0.72	0.40
◆	Yellowish brown sandy lean CLAY	CL	B-4	24.5-25.0	--	--	1.44	0.69

PERFORMED IN ACCORDANCE WITH ASTM D 2850
STRAIN RATE: 1.0%/MIN

FIGURE C-22

UNCONSOLIDATED-UNDRAINED TRIAXIAL TEST

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

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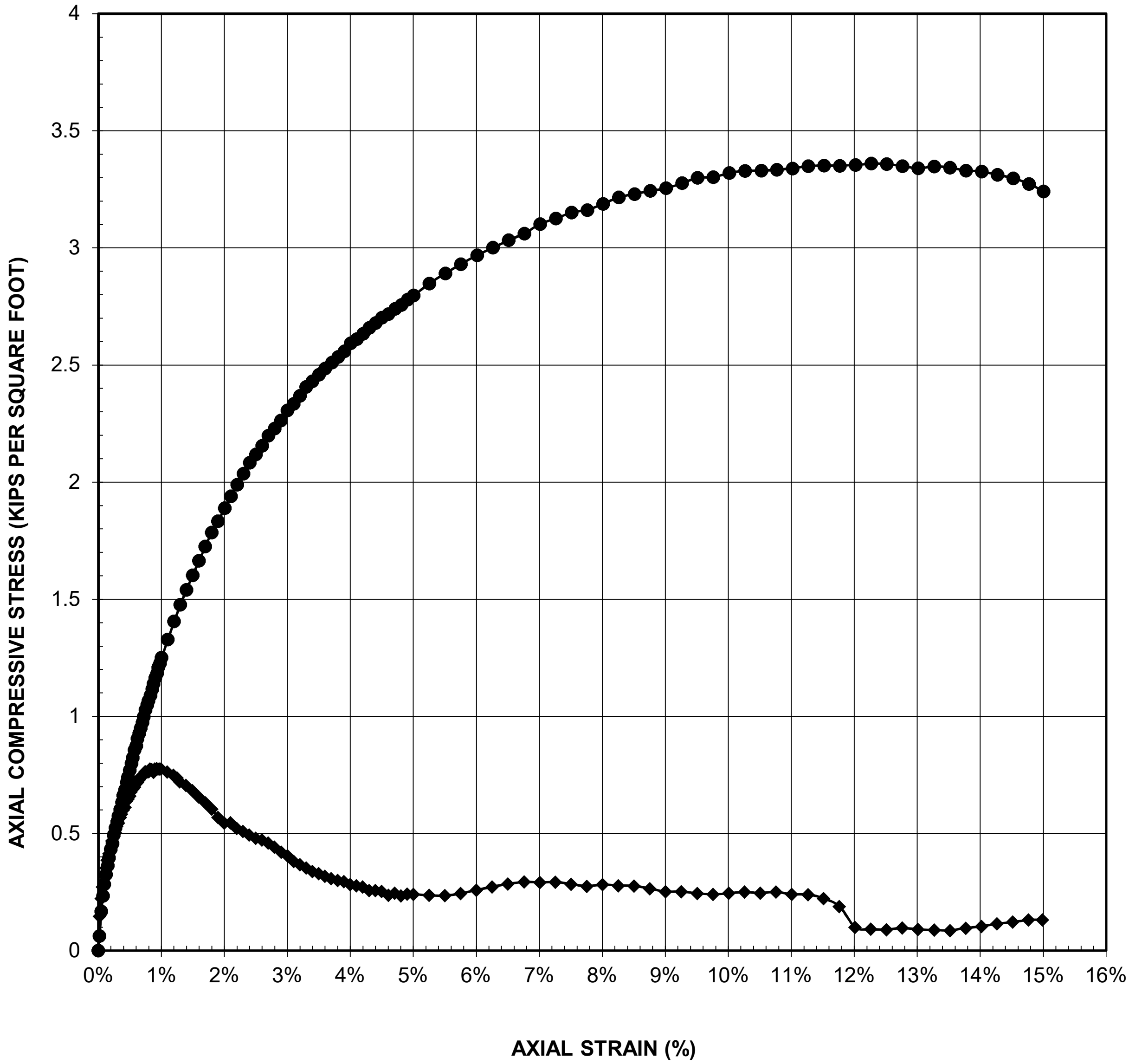

SYMBOL	DESCRIPTION	SOIL TYPE	SAMPLE LOCATION	SAMPLE DEPTH (ft.)	MOISTURE CONTENT w, (%)	DRY DENSITY gd, (pcf)	STRAIN RATE (%/min.)	UNCONFINED COMPRSSIVE STRENGTH (ksf)
◆	Brown sandy lean CLAY	CL	B-1	2.5-4.3	17.2	94.2	1.00	0.78
●	Olive gray to black lean CLAY	CL	B-5	2.5-4.5	22.1	104.2	1.00	3.36

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2166

FIGURE C-23

UNCONFINED COMPRESSION TESTS RESULTS

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2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

APPENDIX D

Percolation Testing

APPENDIX D

PERCOLATION TESTING

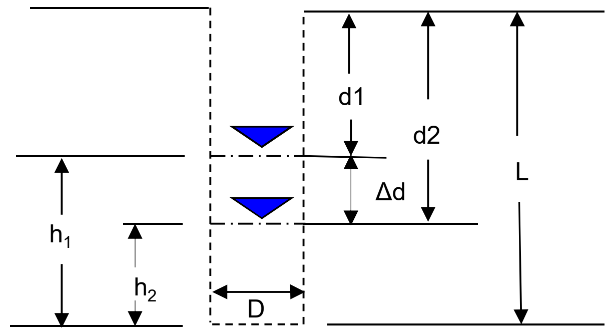
Field Procedure for Percolation Testing

The infiltration characteristics of the site soil were evaluated by field percolation testing. The location of the field percolation test holes is noted on Figure 2. The test hole was excavated with hand tools to a depth of approximately 2 feet, with a diameter of about 8 inches. The subsurface conditions encountered in the test hole consisted of clayey sand. After cleaning the excavation of loose material, water was added to the test hole to achieve a water level approximately 6 inches above the bottom of the test hole. The drop in the water level was recorded over periodic intervals. Water was added to the test hole between measurement intervals to maintain sufficient water levels in the hole for percolation. The percolation rate reported is the percolation rate over the last measurement interval. The infiltration rate is the percolation rate adjusted by a reduction factor to exclude exfiltration occurring through the sidewalls of the test hole. The results of the percolation testing are presented on Figure D-1.

Project =	2519 & 2535 PULGAS AVENUE
Project No. =	403645001
Depth of Boring, L (ft) =	2.0
Diameter of Boring, D (in) =	8.0
Diameter of Pipe (in) =	8.0
Initial Depth to Water, d1 (in), (Final Period) =	18.00
Initial Height of Water, h1 (in), (Final Period) =	6.00
Water Level Drop, Δd (in), (Final Period) =	1.00
Reduction factor, Rf =	2.4

h1 = L - d1 (in inches)

Rf = ((2h1 - Δd)/DIA) +1



Test No. (Hole No.)	Time (hr:min)	Elapsed Time (min)	Depth to Water, d (in)	Water Level, h (in)	Change in Water Level, Δd (in)	Time Interval (hour)	Percolation Rate (inch/hour)	Adjusted Percolation Rate (inch/hour)
P-1	12:00		18.00	6.00				
	12:30	30	20.00	4.00	2.00	0.50	4.0	1.68
	12:30		18.00	6.00				
	1:00	30	19.00	5.00	1.00	0.50	2.0	0.84
	1:00		18.00	6.00				
	1:30	30	19.00	5.00	1.00	0.50	2.0	0.84
	2:00		18.00	6.00				
	2:30	30	19.00	5.00	1.00	0.50	2.0	0.84
	2:30		18.00	6.00				
	3:00	30	19.00	5.00	1.00	0.50	2.0	0.84
	3:00		18.00	6.00				
	3:30	30	19.00	5.00	1.00	0.50	2.0	0.84

FIGURE D-1

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PERCOLATION TEST RESULTS

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

APPENDIX E

Geophysical Survey

APPENDIX E

GEOPHYSICAL SURVEY

Scope
A seismic survey using passive surface wave techniques was performed at the site on November 22, 2019. The survey was performed along one line using passive techniques. The survey line location is noted on Figure 2 of the report. The purpose of the survey was to evaluate the characteristic shear-wave velocity for seismic site classification and to provide a profile of shear wave velocitie with depth at the survey location.

Passive Surface Wave Techniques
The passive surface wave method provided a shear wave velocity model to a depth of approximately 100 feet below the ground surface (bgs) and V_s100 for seismic site classification (CBC, 2019). The passive seismic method carried out included Micro-tremor Array Measurements (MAM) and consisted of one linear profile of seismic data collection. The following sections provide a summary of the methods and analyses used in our study. The seismic model results are provided on Figure E-1.

Field Methods
A Geode 24–Channel Seismograph (Geometrics Inc., San Jose, California) was used for the MAM survey. Twenty four 4.5 Hertz (Hz) vertical component geophone were placed at intervals 15 feet for a total profile length of 345 feet. Approximately twenty-five to thirty records were collected, with a record length of 30 seconds (s) and a 2 millisecond (ms) sampling interval. The field data were digitally recorded in SEG2 format, reviewed in the field for data quality, saved to a hard disk, and documented.

Data Processing and Modeling
The MAM seismic data were processed using SeisImager (Geometrics Inc., San Jose, California) seismic processing software. The dispersive characteristics of surface waves are used to evaluate the subsurface velocity at depth. Longer wavelength (longer-period and lower-frequency) surface waves travel deeper and thus contain more information about deeper velocity structure. Shorter wavelength (shorter-period and higher-frequency) surface waves travel relatively shallow within the earth and thus contain more information about velocity closer to the surface. The dispersion is dependent on the material properties, such as surface wave velocity, relative material densities, and Poisson's ratio. An inversion is performed on the collected passive seismic shear wave records within SeisImager to produce a model of the variation in shear wave velocities with depth. The following data processing flow was used to calculate Average Shear-wave Velocities (AVS) to a depth of approximately 100 feet (Vs100).

- Collated records into list file and edited any bad channels or records,
- Applied 2D Spatial Auto Correlation (SPAC); using a linear array and 24 geophones at 15 feet spacing,
- Phase velocity frequency transformation from 2 to 25 Hz
- Automated velocity picks of raw phase velocity were calculated and updated manually,
- Created an initial model and carried out a non-linear Least Squares Method (LSM) inversion to produce a final shear wave velocity model; convergence of the inversion was judged whether the model achieved an RMS <5% within 5-7 iterations,
- Calculated V_s100 using final shear wave velocity model.

Results

Shear wave data resolution generally decreases with depth, due to the loss of sensitivity of the dispersion curve to changes in shear wave velocity as depth increases. Our MAM seismic modeling results are provided on Figure E-1. The scaled figures indicate our interpretation of the approximate changes in shear wave velocity with depth across the surveyed location.

The model results indicate Vs100 values of 1246 feet/sec for MAM-1 (Figure 2). Accordingly, the site is interpreted to have a Seismic Site Classification of Class C.

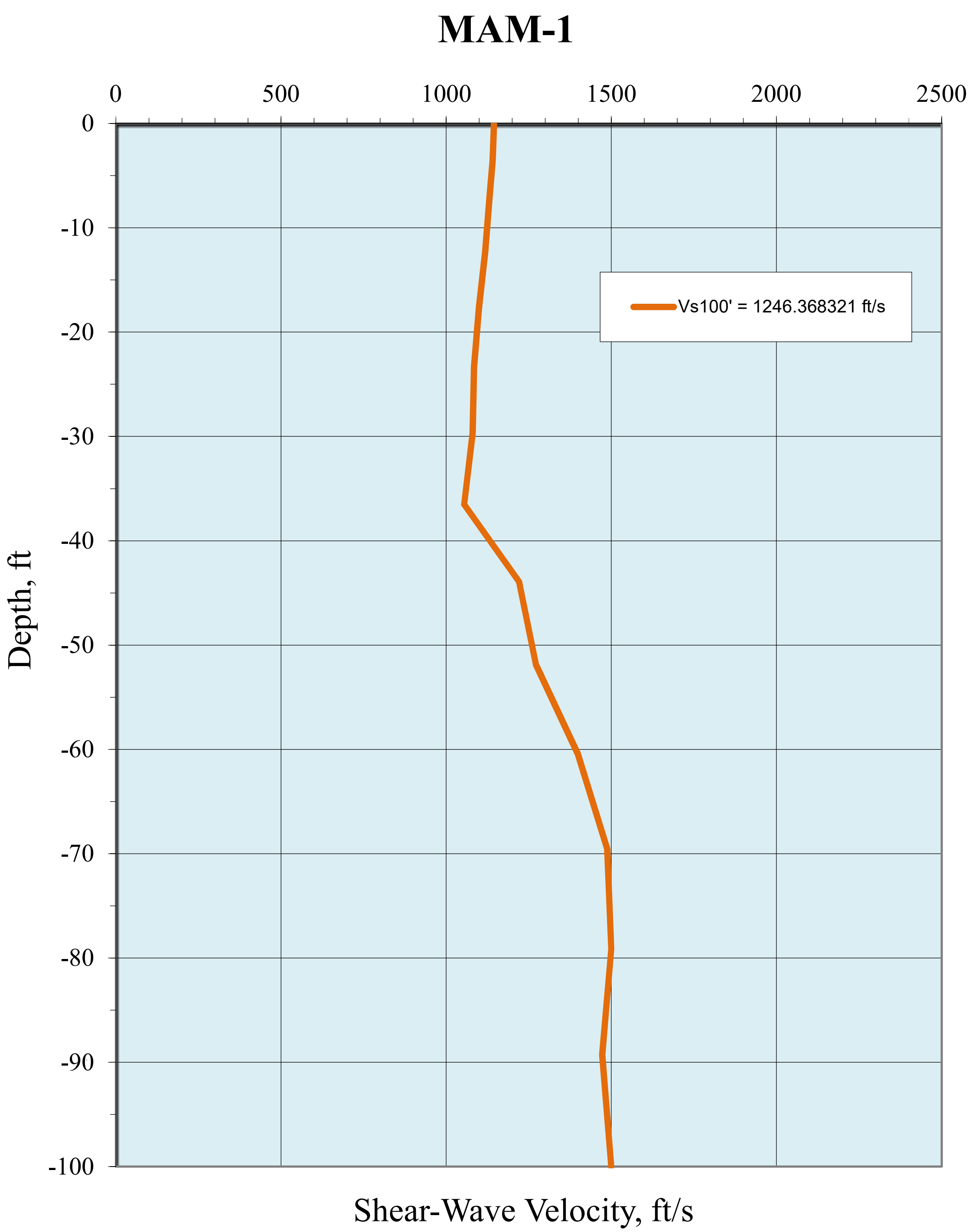

FIGURE E-1

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MAM SHEAR WAVE VELOCITY PROFILE

2535 PULGAS AVENUE
EAST PALO ALTO, CALIFORNIA

403645001 | 5/20

APPENDIX F

Calculations

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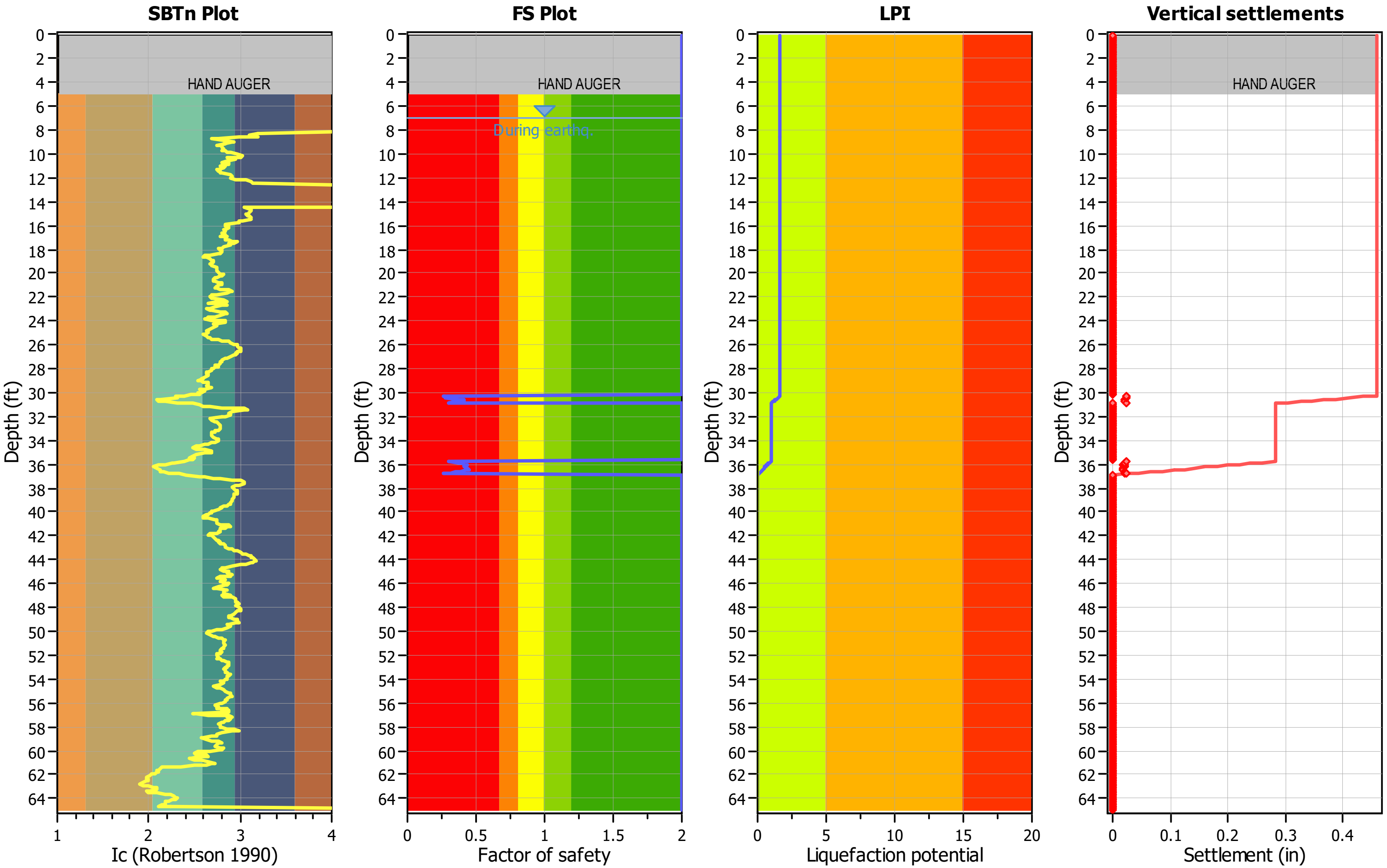
www.ninyoandmoore.com

Project: **403645001 - 2519 & 2535 PULGAS AVENUE**
Location: **EAST PALO ALTO, CALIFORNIA**

CPT: CPT-1
Total depth: 64.96 ft



Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.20 ft	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	7.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.00	Ic cut-off value:	2.40	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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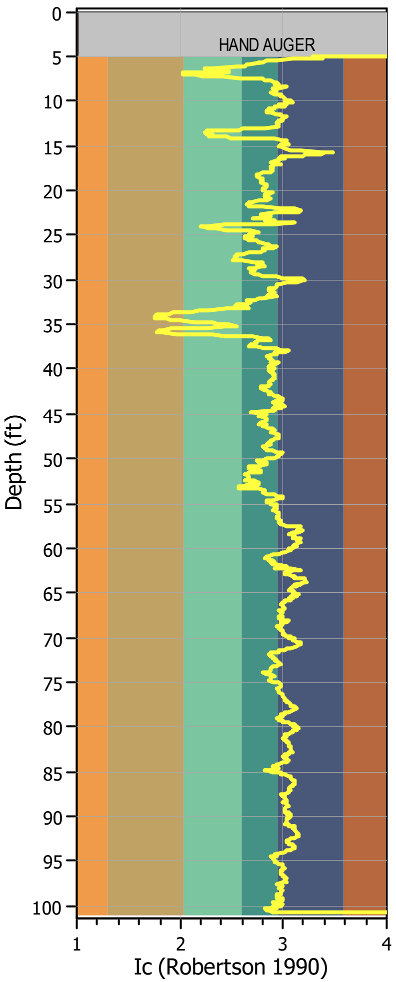
2020 Challenger Drive, Suite 103, Alameda, California 94501
www.ninyoandmoore.com

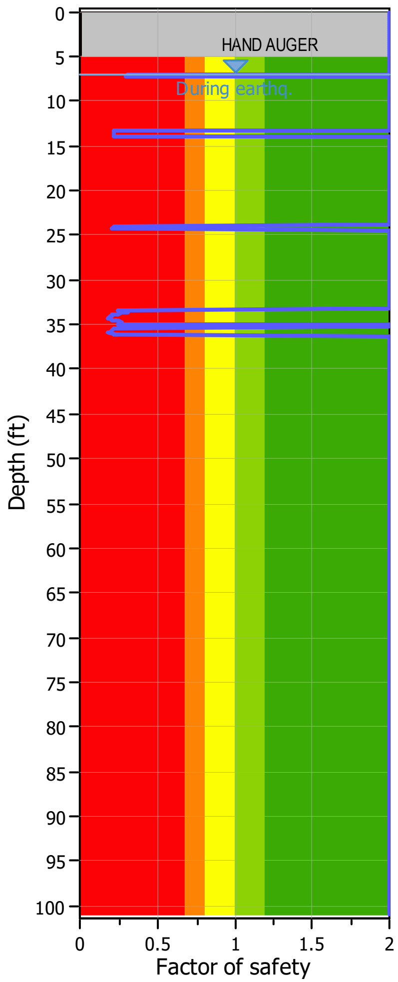
Project: 403645001 - 2519 & 2535 PULGAS AVENUE
Location: EAST PALO ALTO, CALIFORNIA

CPT: CPT-2
Total depth: 100.97 ft

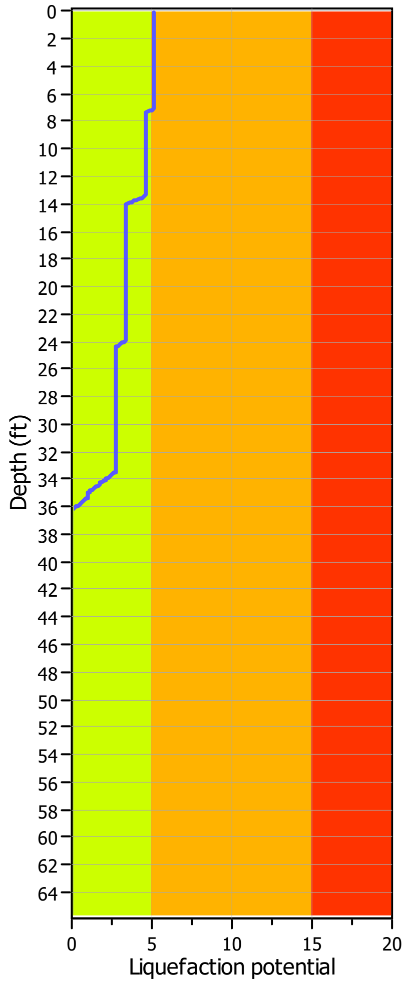
SBTn Plot



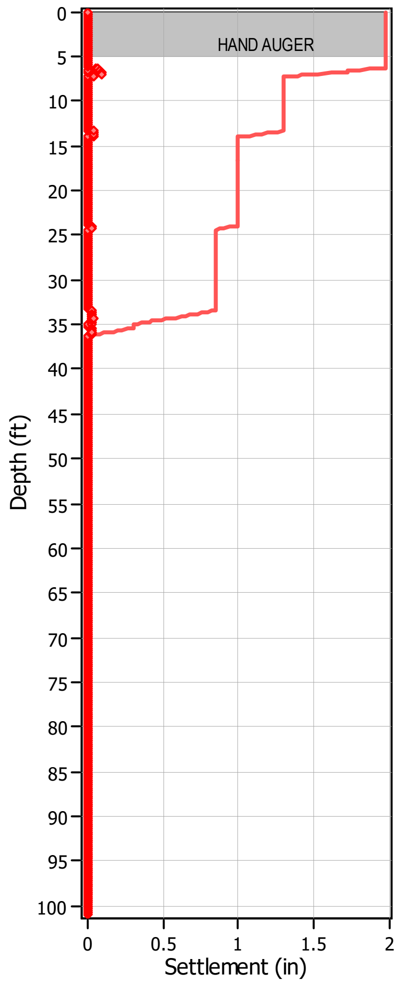
FS Plot



LPI



Vertical settlements



Analysis method:	B&I (2014)	G.W.T. (in-situ):	7.40 ft	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	7.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w:	8.00	Ic cut-off value:	2.40	Trans. detect. applied:	No	Limit depth:	50.00 ft
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

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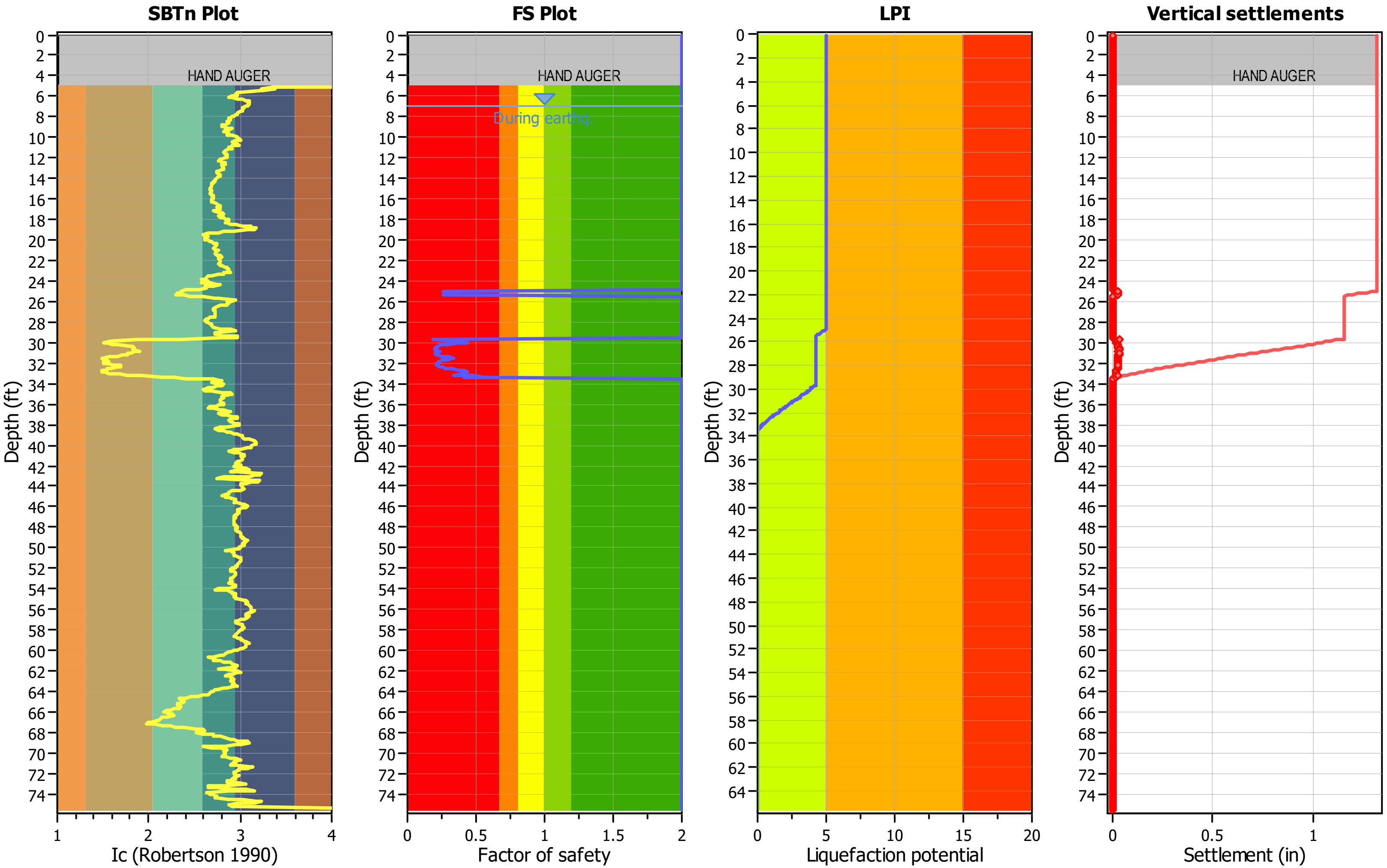
Project: **403645001 - 2519 & 2535 PULGAS AVENUE**
Location: **EAST PALO ALTO, CALIFORNIA**

CPT: CPT-3
Total depth: 75.54 ft



Analysis method:	B&I (2014)	G.W.T. (in-situ):	4.70 ft	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	7.00 ft	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w:	8.00	Ic cut-off value:	2.40	Trans. detect. applied:	No	Limit depth:	50.00 ft
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

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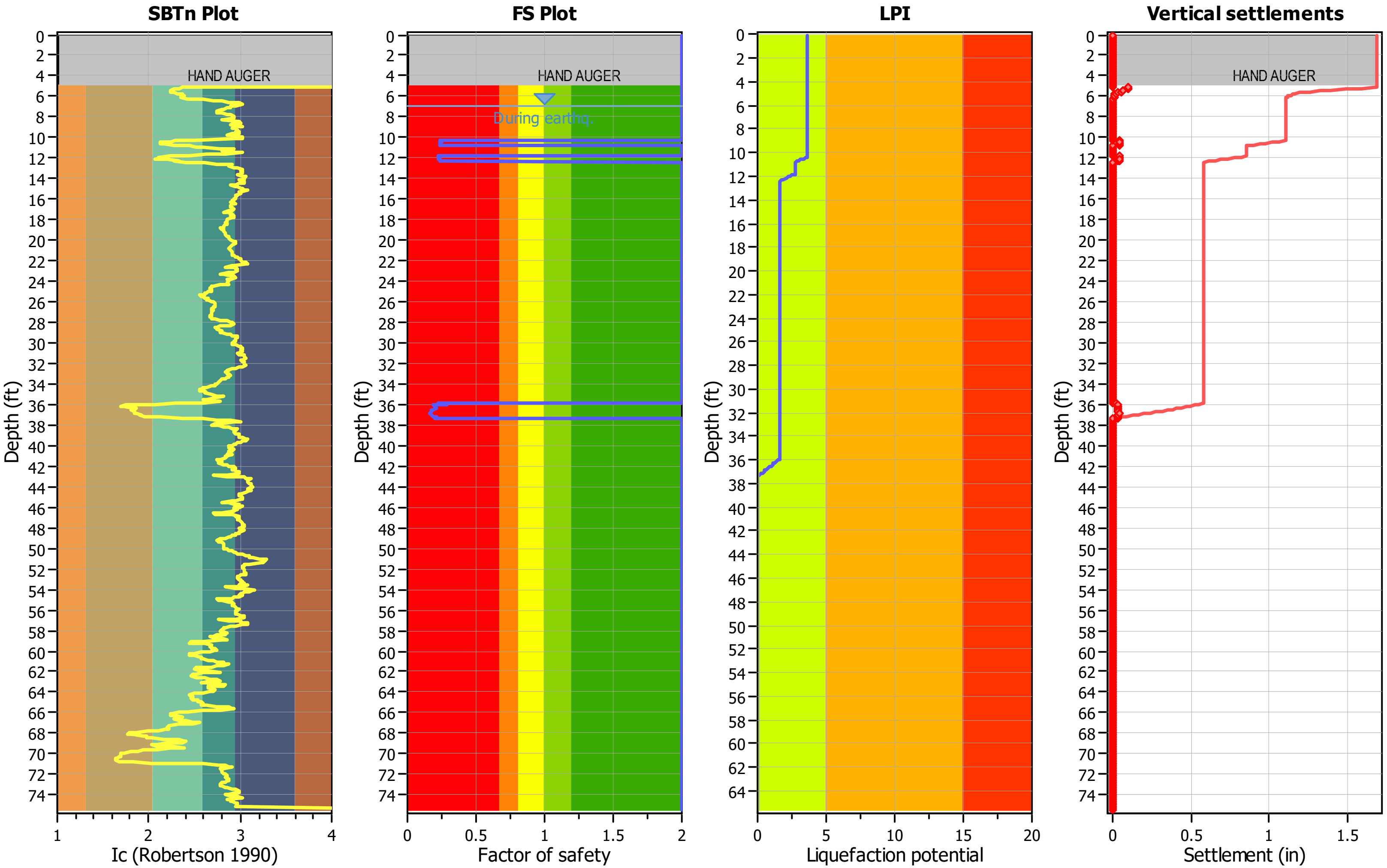
Project: 403645001 - 2519 & 2535 PULGAS AVENUE
Location: EAST PALO ALTO, CALIFORNIA

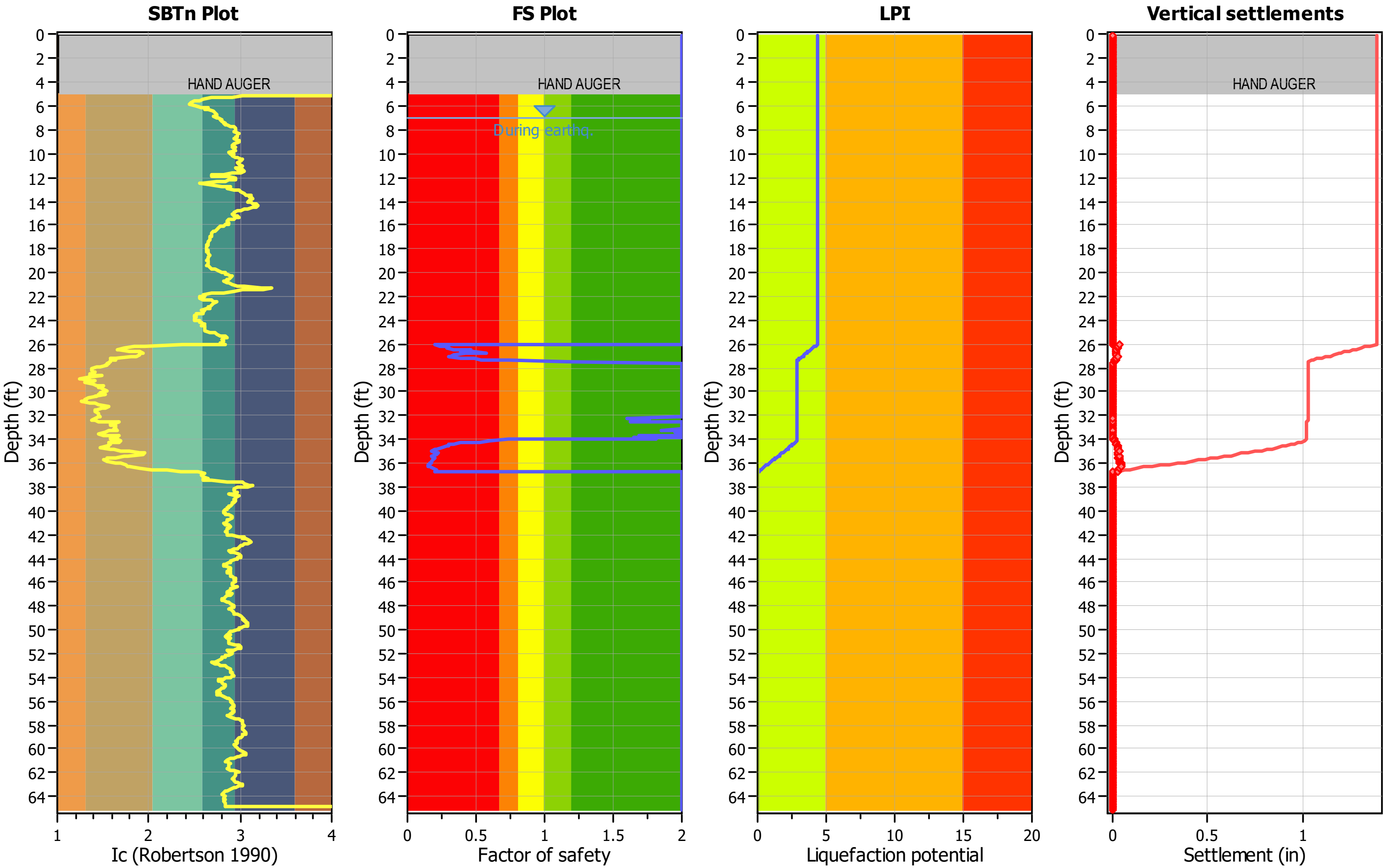
CPT: CPT-4
Total depth: 75.46 ft



Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.40 ft	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	7.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.00	Ic cut-off value:	2.40	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

Project: 403645001 - 2519 & 2535 PULGAS AVENUE
Location: EAST PALO ALTO, CALIFORNIA

CPT: CPT-5
Total depth: 65.12 ft

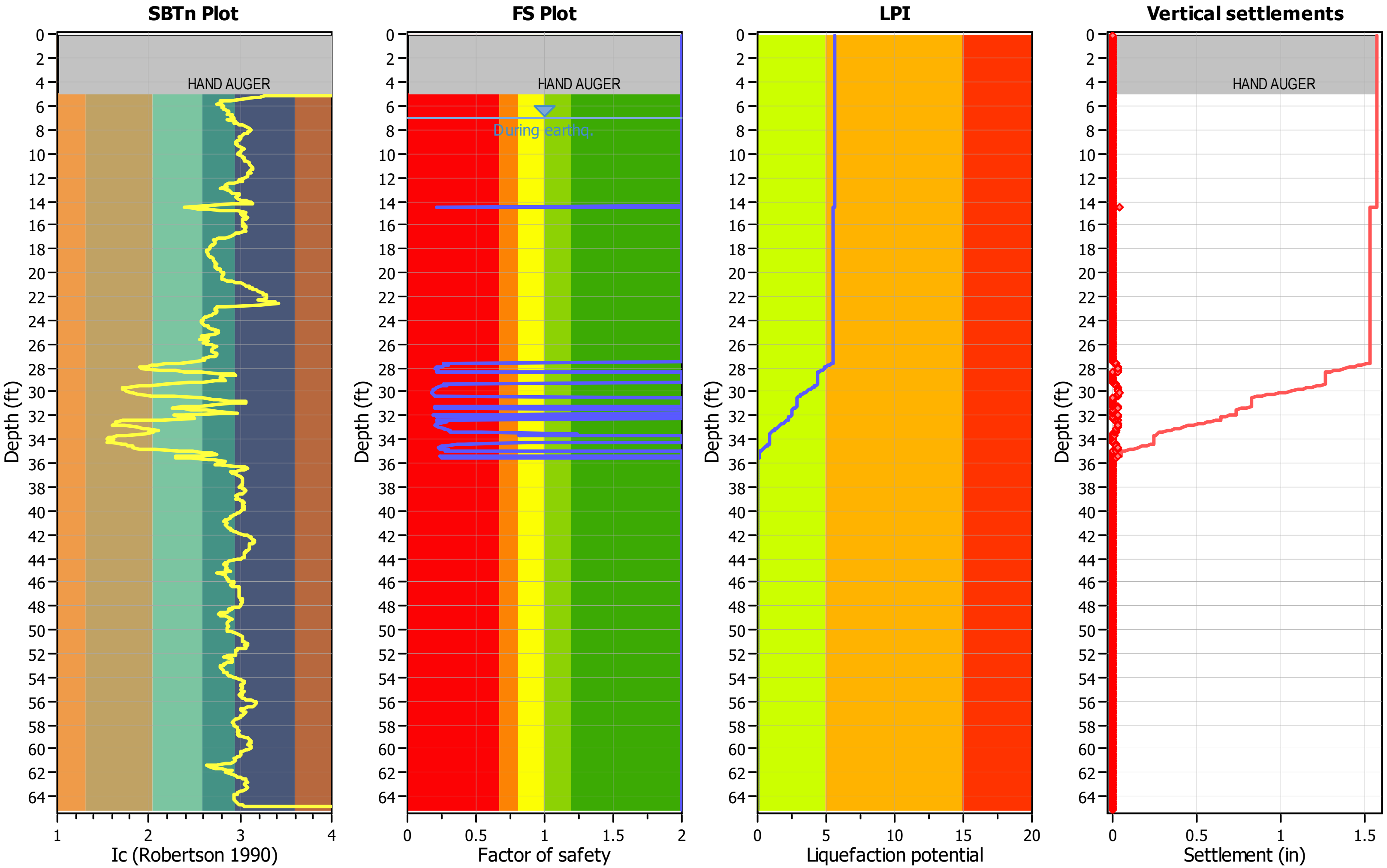


Analysis method:	B&I (2014)	G.W.T. (in-situ):	7.00 ft	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	7.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.00	Ic cut-off value:	2.40	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

Ninyo & Moore
Geotechnical & Environmental Science Consultants
2020 Challenger Drive, Suite 103, Alameda, California 94501
www.ninyoandmoore.com

Project: 403645001 - 2519 & 2535 PULGAS AVENUE
Location: EAST PALO ALTO, CALIFORNIA

CPT: CPT-6
Total depth: 65.12 ft



Analysis method:	B&I (2014)	G.W.T. (in-situ):	7.30 ft	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	7.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	1	Fill weight:	N/A	Limit depth:	50.00 ft
Earthquake magnitude M_w:	8.00	Ic cut-off value:	2.40	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.62	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

Geotechnical & Environmental Sciences Consultants

2020 Challenger Drive, Suite 103 | Alameda, California 94501 | p. 510.343.3000

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Memorandum

ARUP

To	Lorenzo Brooks	Date	May 10, 2021
Copies	Sheba Hafiz Jacob Wood Alexander Murray	Reference number	
From	Mathew Bamm	File reference	
Subject	On-Site Wastewater Treatment Chemical Hazards		

The development and operation of the proposed On-Site Wastewater Treatment Plant will require on-site delivery and use of chemicals to achieve treatment, operation, and maintenance requirements of the facility. The project will include storage and dosing facilities with a control and monitoring system that will control the balance of chemicals in the treatment plant 24 hours a day.

The following chemicals will be stored and used at the plant:

- Calcium Carbonate,
- Ammonium Chloride,
- Magnesium Hydroxide,
- Sodium Hypochlorite,
- Sodium Hydroxide,
- Sodium Dodecyl Sulfate, and
- Citric Acid.

Calcium carbonate will be used while the treatment plant is operating. The chemical will be stored within the treatment plant in a sealed filtration vessel. The calcium carbonate is a dry chemical that will be used in a fine gravel form. Approximately 300lb of the dry chemical will be in use during normal operation. Replacement chemical will be brought to the site as needed.

Ammonium Chloride will be stored on-site. The chemical will be stored in a 50lb sealed container to be used to create a 20% solution as needed. The stored chemical will be in a dry, salt form.

Magnesium Hydroxide will be stored on-site. The chemical will be stored in a 55gal drum and used to create a slurry at 60% concentration.

Memorandum

A Sodium Hypochlorite solution will be stored on-site. The solution will be stored in a 55gal drum at a 30% concentration. When needed for use, the solution will be diluted to a 12% concentration.

A Sodium Hydroxide solution will be stored on-site. The solution will be stored in a 25gal drum at a 30% concentration. When needed for use, the solution will be diluted to a 10-20% concentration.

Sodium Dodecyl Sulfate and Citric Acid will be used for cleaning. These chemicals will not be stored on-site but will be periodically brought in as needed. The Sodium Dodecyl Sulfate used is a dry salt and the Citric Acid will be in a 2% solution.

Table 1 Chemical Descriptions

Chemical	Form	Concentration	Amount Stored
Calcium Carbonate	Dry, Fine Gravel	100%	~300lb
Ammonium Chloride	Dry Salt	100% (Used to create a 20% solution)	50lb
Magnesium Hydroxide	Solid	100% (Used to create a 60% slurry)	55gal
Sodium Hypochlorite	Solution	30% (Used to create a 12% solution)	55gal
Sodium Hydroxide	Solution	30% (Used to create a 10-20% solution)	25gal
Sodium Dodecyl Sulfate	Dry Salt	100%	Periodically brought in as needed for cleaning
Citric Acid	Solution	2%	Periodically brought in as needed for cleaning

Additionally, waste solids from the plant will be stored on-site until hauled away. The estimated solids production is around 50lb (approximately 5gal) per day. These solids will be stored in a sealed container. The storage amount will be determined at the detailed design stage and is dictated by the preferred frequency of solids being hauled off-site.

The development and operation of the proposed Wastewater Treatment Plant will require the storage, use and transportation of chemicals on the project site. The use, storage and transportation of these materials will be conducted in accordance with local, State, and Federal laws and regulations. Implementation of the proposed project in accordance with local, State, and Federal laws and regulations will ensure that the on-site use of chemicals results in a less than significant hazardous materials impact. Precautionary mitigations include installing an emergency shower and eyewash in the equipment room and using double containment vessels to prevent spillage.

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MEMORANDUM

Date: **November 23, 2020** **BKF Job Number: 20190112**

Deliver To: **Carolyn Neer, David J. Powers & Associate, Inc.**

From: **Lokelani Yee, BKF Engineers**
Caleb Beck, BKF Engineers

Subject: **2535 Pulgas Avenue – Flood Displacement Memorandum**

Purpose

The purpose of this memorandum is to review the FEMA designated flood elevation for the 2535 Pulgas Avenue site and determine if development of the project could potentially displace flood water onto adjacent areas currently not included in the 100 year flood zone or potentially increase the depth of flooding in the current flood zone that would negatively impact neighboring properties.

Background

2535 Pulgas Avenue encompasses approximately 3.86 acres in East Palo Alto, situated between Roto-Rooter Plumbing & Water Cleanup, Pitcher Drilling, and Palo Alto Plumbing Heating & Air. The site is currently occupied by Touchatt Trucking Company and includes paved parking areas and two existing single-story buildings. All existing conditions are to be demolished. The proposed development includes a parking lot and a 109,289 sf 4-story office building (Project). The northeast portion of the site is currently included in the Special Flood Hazard Area (SFHA) Zone AE as shown on the FEMA Flood Insurance Rate Map (FIRM) Community Panel Number 060708 0307 F, revised April 5, 2019. The zone designated AE means the area is inundated by the base flood with base flood elevations determined. The Base Flood Elevation (BFE) for the area is defined as elevation 11.0 (Datum NAVD 1988). The zone designation of AE also means that the area is not tidally influenced and does not consider the effects of either wave height or run-up. This is appropriate for the area due to the extent of levee protected marsh between the Bay and the project that attenuate waves from the Bay. The Flood Insurance Study (FIS) for San Mateo County and Incorporated Areas completed by FEMA July 16, 2015 provides more detailed information and analysis to support the BFE and flood zone designation.

Review of the FIS also indicates that flooding in this area of East Palo Alto is tidally influenced from San Francisco Bay because of an incomplete system of levees built along the bay that include numerous low points and openings that allow tides to overtop or bypass the levees. Levees in the project vicinity are shown on **Exhibit 1: Existing Levees**. This system of levees is not recognized or certified by FEMA and the SFHA is mapped as if they do not exist. The flood elevation of 11.0 identified in the FIS is the maximum, 100-year still water elevation in the Bay and does not have an upstream, stormwater runoff hydrologic or hydraulic component. This is illustrated on the FIRM by a large area of flooding that extends along a significant portion of the Peninsula shoreline with a consistent elevation.

As part of the site development process, the portion of the property within the SFHA will be raised by placing approximately 2 feet of fill across the project site. It has not yet been determined if the development team will apply for a Letter of Map Revision – Fill (LOMR-F) for the site with the City and FEMA to document removal of the portion of the property this is within the SFHA. Until FEMA issues the LOMR-F, the City will continue its oversight of the potential for flood displacement on neighboring properties.

Analysis

To determine if raising the project site would impact either the extent or depth of flooding, we first need to understand the cause of flooding in the area. Based on review of the FIS, it is understood that flooding in this area is tidal and directly connected to the static elevation of the Bay. Calculations of the flood elevation are based only on the historic data for tide gauging stations in San Francisco Bay. FEMA determined the extent of flooding shown on the FIRM by applying this elevation to topographic maps. Because there are existing levees that are not recognized by FEMA, the actual extent of flooding during a specific event may not include the entire SFHA. Predicting flood patterns and flood volumes in the SFHA is difficult since the flood patterns are dependent on the number and location of levee failures or overtoppings.

In general, flooding in the vicinity of the project site occurs when a levee is breached or overtopped. When this happens, Bay water flows to the low points behind the levees and continues to pond behind the levee until the tide recedes. When the tide recedes, flood water flows back to the Bay down to the elevation of the remaining portion of the overtopped or breached levee. The remainder of the water impounded behind the levee makes its way to the storm drain at the north termination of Pulgas Ave or infiltrates in low lying, undeveloped areas near the levee.

We reviewed the site topography based on an aerial topographic survey prepared for the project. The existing project site is surrounded by several features that partially protect it from the 100-year tidal flooding event. These include the levees along the Bay and marsh land, the large bermed land that spans from the terminations of Demeter Street and Pulgas Ave, and Tara Street which all are largely at or above the BFE of 11.0. These are all significant facilities that will impede the flow of tidal flood water from the Bay. In order for the project site to flood, tidal flood water would have to pond within the low lying undeveloped areas near the levee and eventually flow onto the Pulgas Ave and Demeter Street properties north of the project site to flood the portion of the existing project site that is within the SFHA; as shown on **Exhibit 2: Existing Storage**.

The limits of the SFHA terminate on the project site. As a result, flood water flow is generally only in the north direction in relation to the project site.

To determine if raising the project site by placing approximately 2 feet of fill material would have a negative effect that may impact the extent or elevation of flooding on adjacent properties, we reviewed the site topography along with the existing drainage pattern and SFHA extents. Based on the existing site topography, placing fill to raise the entirety of the site above elevation 11.0 would eliminate approximately 3,360 CY of existing available floodwater storage; as shown on **Exhibit 3: Proposed Storage**. Removal of this available storage volume could decrease the duration of tidally induced flooding in low laying areas of adjacent properties. Because the tidal flooding results from a specific water elevation in the Bay, the extent and depth of flooding would not change. Since the existing extents of the SFHA terminate on the project site, in the proposed condition, when the tidal flood water recedes the water will flow north across the Demeter Street and Pulgas Ave properties similar to the existing condition and will not be impeded by the development.

To put this change in flooding duration in perspective, we calculated the volume of tidal flood water in the general flood study area identified to be approximately 3,260,700 SF with 156,400 CY of storage volume available; as shown on **Exhibit 4: Flood Analysis Area**. The proposed change in earthwork on the site could decrease this detained volume and potential flood duration by approximately 2.1 percent. The actual volume of tidal flood water remaining after a flood event would be dependent on the elevation of the levee breach or overtopping.

Conclusion

Because flooding in the project vicinity is tidally influenced, earthwork fill to remove the northeast portion of the site from the SFHA will not displace flood water and will not increase the extent or depth of flooding on adjacent properties that could cause an adverse impact. Proposed grading on the site will decrease the available storage volume in the flood area by approximately 2.1 percent and could have a proportionate decrease in the duration of flooding which would not negatively impact adjacent properties.

Attachments:

Exhibit 1: Existing Levees

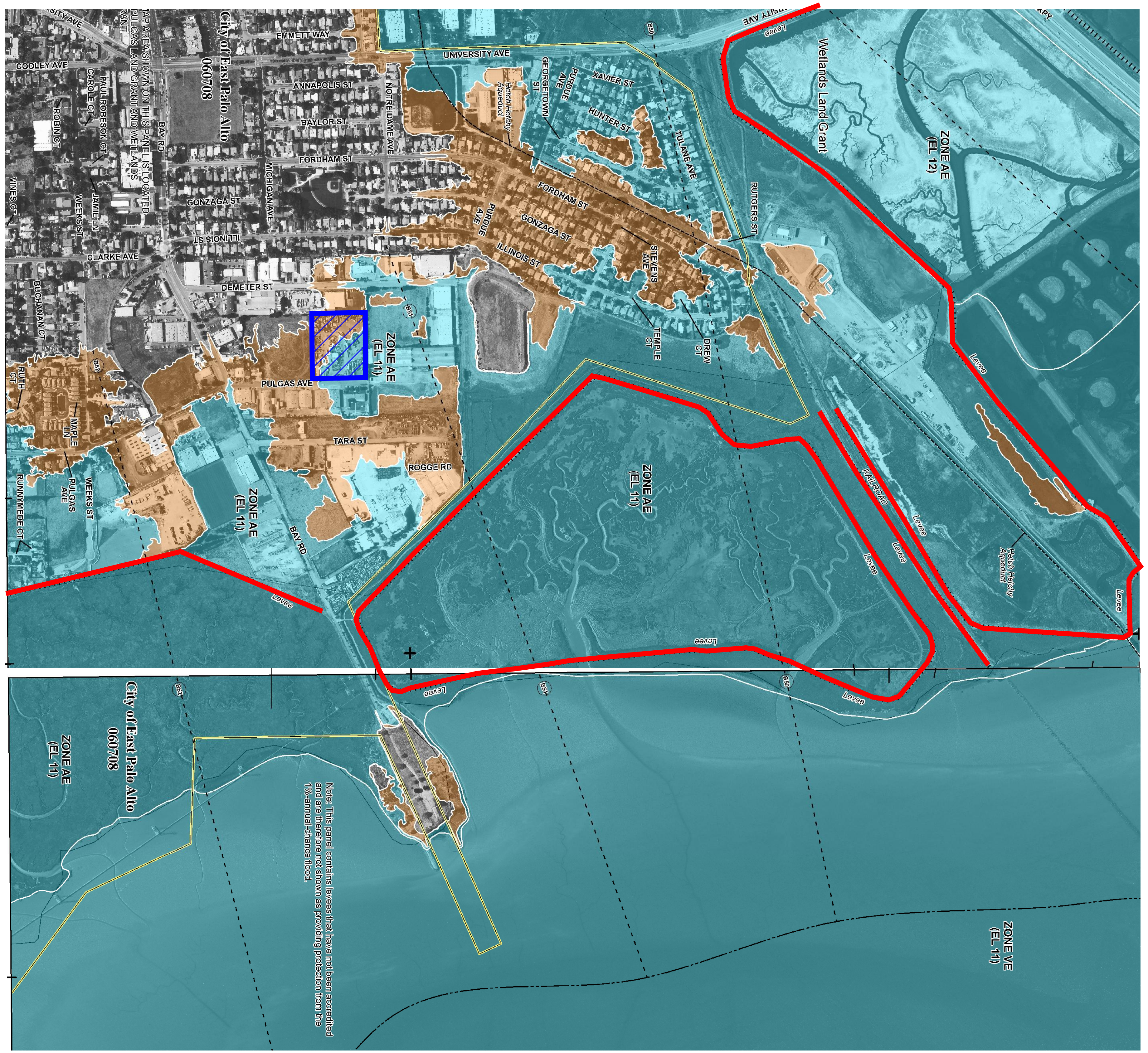
Exhibit 2: Existing Storage

Exhibit 3: Proposed Storage

Exhibit 4: Flood Analysis Area

LEGEND

(cyan fill)	FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA
(red line)	NON–ACCREDITED LEVEE
(blue hatched box)	PROJECT SITE



2535 PULGAS AVE FLOOD DISPLACEMENT
EXISTING LEVEES

CITY OF EAST PALO ALTO   COUNTY OF SAN MATEO   CALIFORNIA

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No.	Revisions

Date
Scale
Design
Drawn
Approved
Job No JOB_NO

Sheet Number:

EXHIBIT 1

DRAWING NAME: \\Bkf-rc\data\2019\190112_Project_Thunder\ENG\EXHIBITS\Flood Displacement\EXTHAERIAL.dwg
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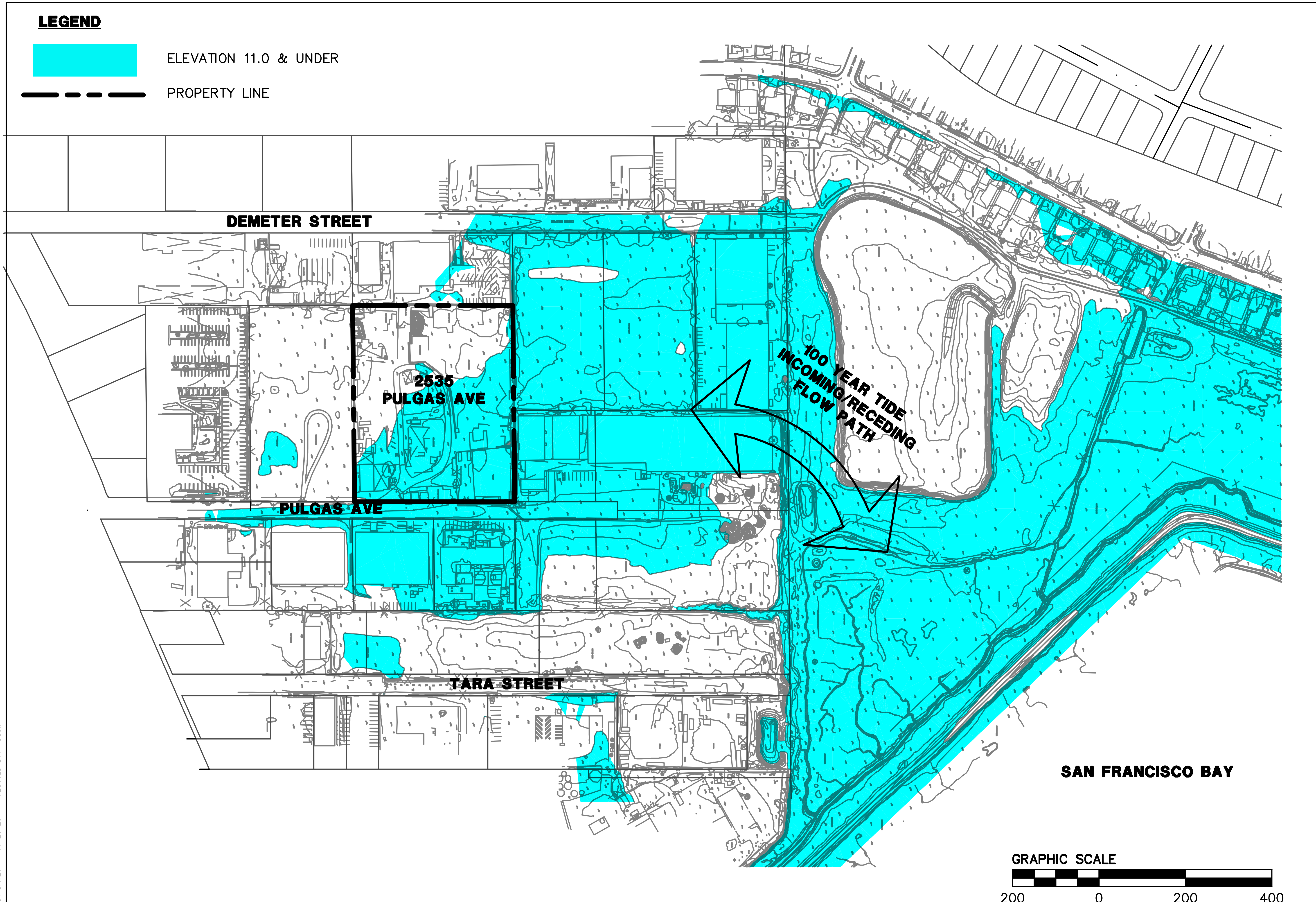

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2535 PULGAS AVE FLOOD DISPLACEMENT EXISTING STORAGE

CITY OF EAST PALO ALTO COUNTY OF SAN MATEO CALIFORNIA

Revisions	No.

Date
Scale
Design
Drawn
Approved
Job No JOB_NO

Sheet Number:
EXHIBIT 2

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PLOT DATE: 11-23-20 PLOTTED BY: beck

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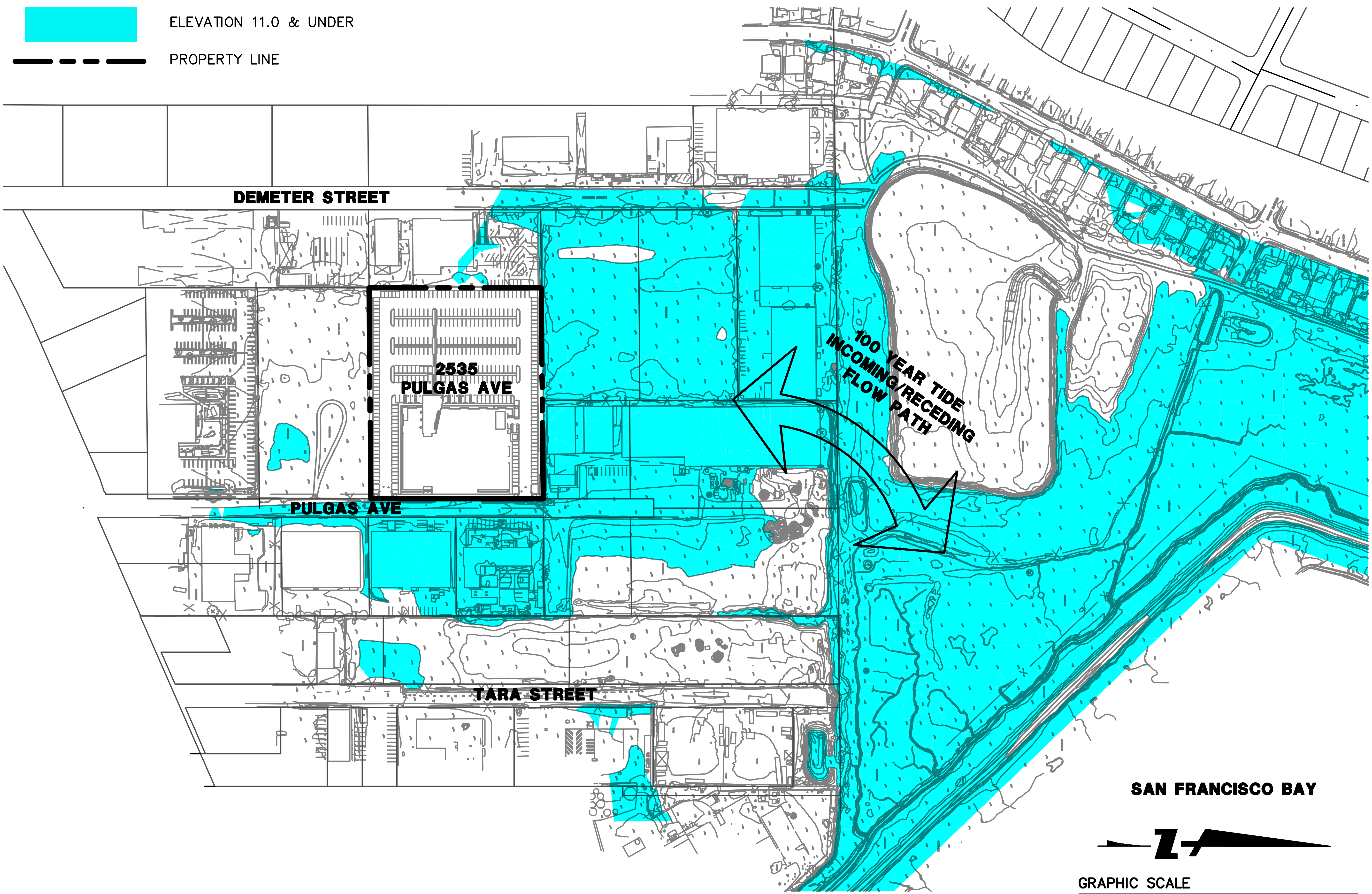
LEGEND

ELEVATION 11.0 & UNDER

PROPERTY LINE



GRAPHIC SCALE

200 0 200 400

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2535 PULGAS AVE FLOOD DISPLACEMENT PROPOSED STORAGE

CITY OF EAST PALO ALTO COUNTY OF SAN MATEO CALIFORNIA

Revisions

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Scale
Design
Drawn
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Job No JOB_NO

Sheet Number:

EXHIBIT 3

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PLOT DATE: 11-23-20 PLOTTED BY: beck

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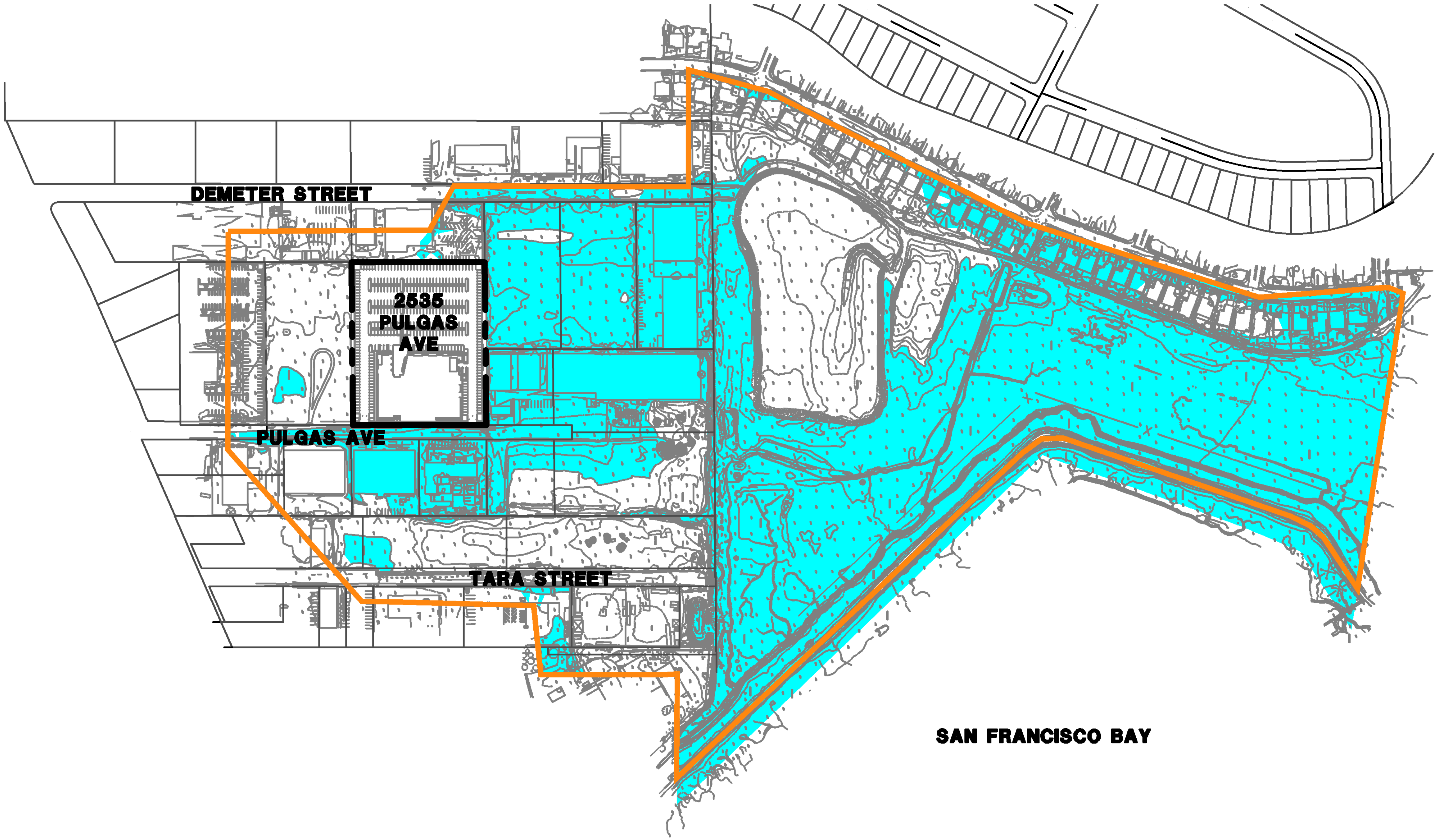
LEGEND

(cyan fill)	ELEVATION 11.0 & UNDER
(dashed black line)	PROPERTY LINE
(orange line)	FLOOD ANALYSIS AREA

TOTAL AREA: 3,260,700 SF
EXISTING STORAGE: 156,440 CY
PROPOSED STORAGE: 153,080 CY

FLOOD REDUCTION = 2.1%



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PLOT DATE 11-23-20 PLOTTED BY beck

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2535 PULGAS AVE FLOOD DISPLACEMENT FLOOD ANALYSIS AREA

CITY OF EAST PALO ALTO COUNTY OF SAN MATEO CALIFORNIA

Revisions
No.
Date
Scale
Design
Drawn
Approved
Job No

Sheet Number:
EXHIBIT 4

2535 PULGAS AVENUE NOISE AND VIBRATION ASSESSMENT

EAST PALO ALTO, CALIFORNIA

February 18, 2021

Prepared for:

Carolyn Neer, MUP, AICP Candidate
Associate Project Manager
David J. Powers & Associates, Inc.
1871 The Alameda, Suite 200
San José, CA 95126

Prepared by:

Cameron Heyvaert and
Carrie J. Janello

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality

429 East Cotati Avenue
Cotati, CA 94931
(707) 794-0400

I&R Job No.: 19-138

INTRODUCTION

A four-story office building is proposed at 2535 Pulgas Avenue in East Palo Alto, California. The proposed project would provide approximately 110,000 square feet of office space and 357 parking spaces throughout a surface parking lot. The 3.86-acre site is currently developed with two single-story buildings and associated storage areas. These would be demolished as part of the proposed project.

This report evaluates the project's potential to result in significant noise and vibration impacts with respect to California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and groundborne vibration, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions; 2) the General Plan Consistency Section discusses noise and land use compatibility utilizing policies in the City of East Palo Alto's General Plan; and 3) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents measures, where necessary, to mitigate the impacts of the project on sensitive receptors in the vicinity.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (*frequency*) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (*DNL* or L_{dn}) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Sleep and Speech Interference

The thresholds for speech interference indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12 to 17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57 to 62 dBA L_{dn} with open windows and 65 to 70 dBA L_{dn} if the windows are closed. Levels of 55 to 60 dBA are common along collector streets and secondary arterials, while 65 to 70 dBA is a typical value for a primary/major arterial. Levels of 75 to 80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 50 dBA L_{dn}. At a L_{dn} of about 60 dBA, approximately 12 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 25 to 30 percent of the population. There is, therefore, an increase of about 2 percent per dBA between a L_{dn} of 60 to 70 dBA. Between a L_{dn} of 70 to 80 dBA, each decibel increase increases by about 3 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the L_{dn} is 60 dBA, approximately 30 to 35 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 3 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 4 percent increase in the percentage of the population highly annoyed.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2018.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous or frequent intermittent vibration levels produce. The guidelines in Table 3 represent syntheses of vibration criteria for human response and potential damage to buildings resulting from construction vibration.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to cause damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as paint flaking or minimal extension of cracks in building surfaces; minor, including limited surface cracking; or major, that may threaten the structural integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher. The damage criteria presented in Table 3 include several categories for ancient, fragile, and historic structures, the types of structures most at risk to damage. Most buildings are included within the categories ranging from "Historic and some old buildings" to "Modern industrial/commercial buildings". Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.25	Strongly perceptible to severe	Threshold at which there is a risk of damage to historic and some old buildings.
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Background

This section describes the relevant guidelines, policies, and standards established by State Agencies, Santa Clara County, and the City of East Palo Alto. The State CEQA Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. The California Environmental Quality Act (CEQA) contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(b) Generation of excessive groundborne vibration or groundborne noise levels;

(c) For a project located within the vicinity of a private airstrip or an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels.

2019 California Building Cal Green Code. The State of California established exterior sound transmission control standards for new non-residential buildings as set forth in the 2019 California Green Building Standards Code (Section 5.507.4.1 and 5.507.4.2). The sections that pertain to this project are as follows:

> **5.507.4.1 Exterior noise transmission, prescriptive method.** Wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 when the building falls within the 65 dBA L_{dn} noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway noise source, as determined by the local general plan noise element.
>
> **5.507.4.2 Performance method.** For buildings located, as defined by Section 5.507.4.1, wall and roof-ceiling assemblies exposed to the noise source making up the building envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level ($L_{eq\ (1\text{-}hr)}$) of 50 dBA in occupied areas during any hour of operation.

The performance method, which establishes the acceptable interior noise level, is the method typically used when applying these standards.

Vista 2035 East Palo Alto General Plan. The City of East Palo Alto adopted the 2035 General Plan Final Version in March 2017. The Safety and Noise Chapter of the General Plan[1] provides goals and policies to reduce noise within the community. The goals and policies that apply to the proposed project are as follows:

Goal SN-6: Minimize the effects of noise through proper land use planning.

Intent: To ensure that new noise-sensitive land uses in the City are located in a compatible noise environment or adequately mitigated in order to provide a compatible exterior and interior noise environment.

> **Policy 6.1. Noise standards.** Use the Interior and Exterior Noise Standards (Table 10-1) for transportation noise sources. Use the City's Noise Ordinance for evaluating non-transportation noise sources when making planning and development decisions. Require that applicants demonstrate that the noise standards will be met prior to project approval.
>
> **Policy 6.2. Compatibility standards.** Utilize noise/land use compatibility standards and the Noise Ordinance as guides for future development decisions.
>
> **Policy 6.3. Noise control.** Provide noise controls measures, such as berms, walls, and sound attenuating construction in areas of new construction or rehabilitation.

[1] City of East Palo Alto, *Vista 2035 East Palo Alto General Plan*, Safety and Noise Chapter, Adopted October 4, 2016. Final Version March 2017.

Policy 6.4. Vibration impacts. The City shall require new developments to minimize vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, a vibration limit of 0.08 in/sec PPV will be used to minimize the potential for cosmetic damage to the building. A vibration limit of 0.30 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

Policy 6.5. Airport-adjacent land uses. Maintain the non-residential designation for land near the airport in order to prevent new noise-sensitive residential uses from being constructed in areas with excessive aircraft noise.

Table 10-1. Interior and Exterior Noise Standards

Land Use	Noise Standards[1]	
	Interior[2, 3]	Exterior
Residential – Single family, multifamily, duplex, mobile home	CNEL 45 dB	CNEL 65 dB[4]
Residential – Transient lodging, hotels, motels, nursing home, hospitals	CNEL 45 dB	CNEL 65 dB[4]
Private offices, church sanctuaries, libraries, board rooms, conference rooms, theaters, auditoriums, concert halls, meeting halls, etc.	Leq(12) 45 dB(A)	-
Schools	Leq(12) 45 dB(A)	Leq(12) 67 dB(A)[5]
General offices, reception, clerical, etc.	Leq(12) 50 dB(A)	-
Bank lobby, retail store, restaurant, typing pool, etc.	Leq(12) 55 dB(A)	-
Manufacturing, kitchen, warehousing, etc.	Leq(12) 65 dB(A)	-
Parks, playgrounds	-	CNEL 65 dB[5]
Golf courses, outdoor spectator sports, amusement parks	-	CNEL 70 dB[5]

Notes:

1. CNEL: Community Noise Equivalent Level; Leq (12): The A-weighted equivalent sound level averaged over a 12-hour period (usually the hours of operation).
2. Noise standard with windows closed. Mechanical ventilation shall be provided per UBC requirements to provide a habitable environment.
3. Indoor environment excluding bathrooms, toilets, closets, and corridors.
4. Outdoor environment limited to rear yard of single family homes, multifamily patios, and balconies (with a depth of 6' or more) and common recreation areas.
5. Outdoor environment limited to playground areas, picnic areas and other areas of frequent human use.

Source: Title 24, California Code of Regulations

Goal SN-7: Minimize transportation- and non-transportation-related noise impacts, especially on noise-sensitive land uses.

Intent: To maintain and improve the noise environment at noise-sensitive land uses throughout the City.

Policy 7.1. Noise ordinance. Continually enforce and periodically review the City's Noise Ordinance for adequacy (including requiring construction activity to comply with established work schedule limits). Amend as needed to address community needs and development patterns.

Policy 7.2. CEQA acoustical analysis. Require an acoustical analysis to evaluate mitigation measures for noise-generating projects that are likely to cause the following criteria to be exceeded or to cause a significant adverse community response:

- Cause the L_{dn}/CNEL at noise-sensitive uses to increase by 3 dBA or more and exceed the “normally acceptable” level.

- Cause the L_{dn}/CNEL at noise-sensitive uses to increase by 5 dBA or more and remain “normally acceptable.”

Policy 7.7. Site design review. Utilize site design review to identify potential noise impacts on new development, especially from nearby transportation sources. Encourage the use of noise barriers (walls, berms, or landscaping), setbacks and/or other buffers.

Policy 7.11. Construction noise. The City shall require that contractors use available noise suppression devices and techniques and limit construction hours near residential uses. Reasonable noise reduction measures shall be incorporated into the construction plan and implemented during all phases of construction activity to minimize the exposure of neighboring properties. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

- Involve substantial noise-generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses. A typical construction noise logistics plan would include, but not be limited to, the following measures to reduce construction noise levels as low as practical:

- Limit construction activity to weekdays between 7:00 a.m. and 7:00 p.m. and Saturdays and holidays between 9:00 a.m. and 7:00 p.m., with no construction on Sundays;

- Utilize "quiet" models of air compressors and other stationary noise sources where such technology exists;

- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment;

- Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from adjacent land uses;

- Locate staging areas and construction material areas as far away as possible from adjacent land uses;

- Prohibit all unnecessary idling of internal combustion engines;

- If impact pile driving is proposed, multiple-pile drivers shall be considered to expedite construction. Although noise levels generated by multiple pile drivers would be higher than the noise generated by a single pile driver, the total duration of pile driving activities would be reduced;

- If impact pile driving is proposed, temporary noise control blanket barriers shall shroud pile drivers or be erected in a manner to shield the adjacent land uses. Such noise control blanket barriers can be rented and quickly erected;

- If impact pile driving is proposed, foundation pile holes shall be pre-drilled to minimize the number of impacts required to seat the pile. Pre-drilling foundation pile holes is a standard construction noise control technique. Pre-drilling reduces the number of blows required to seat the pile. Notify all adjacent land uses of the construction schedule in writing;

- Designate a "disturbance coordinator" who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem are implemented.

- Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction.

City of East Palo Alto Municipal Code. Chapter 8.52, Noise Control, of the City's Municipal Code seeks to protect the citizens of East Palo Alto from unnecessary, excessive, and annoying noise; to maintain quiet in areas where noise levels are low; and to implement programs to reduce unacceptable noise. The regulations limit the amount of noise that may be created as measured at the exterior of any dwelling unit, school, hospital, church, or public library. Table 4 provides the Municipal Code's exterior noise standards. In addition, Chapter 8.52 limits the creation of noise that results in excessive noise levels within any dwelling unit. Table 5 provides the standards for interior noise in dwelling units. Exemptions to these standards are provided for activities such as special events and noise sources due to construction activities not taking place between 8:00 p.m. and 7:00 a.m.[2]

[2] City of East Palo Alto, 2017, *East Palo Alto Municipal Code*, Chapter 8.52, Noise Control.

TABLE 4 Receiving Land Use: Noise Level Standards for Single or Multiple Family Residence, School, Hospital, Church, or Public Library Properties

Category	Cumulative Number of Minutes in Any 1-Hour Time Period	Noise Level Standards, dBA	
		Daytime (7:00 am – 10:00 pm)	Nighttime (10:00 pm – 7:00 am)
1	30	55	50
2	15	50	55
3	5	65	60
4	1	70	60
5	0	75	70

Notes:

A. In the event the measured background noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted in 5 dBA increments so as to encompass the background noise level.

B. Each of the noise level standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.

C. If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards in this table.

Source: City of East Palo Alto Municipal Code, 2017.

While Table 4 summarizes the levels provided in the Municipal Code for each category, the original Municipal Code document has two typos: Category 2 should be 60 dBA during daytime hours and 55 dBA during nighttime hours, and Category 4 should be 70 dBA during daytime hours and 65 dBA during nighttime hours. For any analysis involving these categories, the corrected levels are used.

Section 15.04.125 of the City's Municipal Code limits construction activity to the hours of 7:00 a.m. to 6:00 p.m. Monday through Friday and 9:00 a.m. to 5:00 p.m. on Saturdays. No construction activity is allowed on Sundays or national holidays.

TABLE 5 Interior Noise Level Standards – Dwelling Unit

Category	Cumulative Number of Minutes in Any 1-Hour Time Period	Noise Level Standards, dBA	
		Daytime (7:00 am – 10:00 pm)	Nighttime (10:00 pm – 7:00 am)
1	5	45	40
2	1	50	45
3	0	55	50

Notes:

A. In the event the measured background noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted in 5 dBA increments so as to encompass the background noise level.

B. Each of the noise level standards specified above shall be reduced by 5 dBA for simple tone noises, consisting primarily of speech or music, or for recurring or intermittent impulsive noises.

C. If the intruding noise source is continuous and cannot reasonably be stopped for a period of time whereby the background noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards in this table.

Source: City of East Palo Alto Municipal Code, 2017.

Existing Noise Environment

The project site currently consists of a tow trucking building and associated tow lot. The project site is bound by commercial and industrial uses to the north and west, and vacant land to the south. Additional commercial and industrial uses are located to the east, opposite Pulgas Avenue. The nearest residential land uses are located approximately 390 feet to the west of the site.

Due to regional shelter-in-place restrictions implemented by the State of California at the time of this study, traffic volumes along the surrounding roadways were reduced and not representative of typical conditions. Therefore, a noise monitoring survey was not completed to document ambient noise levels at the project site. Instead, the City's General Plan and noise data collected as part of previous projects in the vicinity were reviewed to establish the existing noise environment.

According to the noise contours included in the Noise Element of the City's General Plan, existing noise levels at the project site would range from 55 to 60 dBA CNEL, as shown in Figure 1.

A noise monitoring survey for the East Palo Alto General Plan Update Draft EIR[3] was completed in 2015. Among the measurements completed, one long-term noise measurement (LT-12) was made at Jack Farrell Park from Tuesday, April 23rd, 2015 to Tuesday, April 28th, 2015. The measurement was made approximately 165 feet west of the centerline of Illinois Street and 340 feet east of the centerline of Fordham Street. The average CNEL ranged from 58 to 60 dBA. Typical daytime hourly average noise levels ranged from 50 to 61 dBA L_{eq}, and typical nighttime hourly average noise levels ranged from 44 to 60 dBA L_{eq}.

Additional noise monitoring surveys were completed for projects at 2020 Bay Road and at 1950 Bay Road in 2017. Due to the nature of the roadways in this area and the buildout of the area, the noise measurements made for these previous projects would be representative of the existing conditions in the project vicinity. Figure 2 shows the project site and the long-term measurements made in 2015 (LT-12) and in 2017 (LT-1 through LT-3).

Long-term noise measurements LT-1 and LT-2 were made from Thursday, April 20, 2017 to Monday, April 24, 2017. LT-1 was made from a pole along Bay Road at the southern boundary of 2020 Bay Road, approximately 15 feet from the centerline of the roadway. Hourly average noise levels at this location typically ranged from 50 to 70 dBA L_{eq} during the day and from 42 to 57 dBA L_{eq} at night. The average community noise equivalent level was 63 dBA CNEL on the weekdays and ranged from 60 to 61 dBA CNEL on the weekends.

LT-2 was made from a pole along Bay Road near the intersection of Bay Road and Pulgas Avenue. LT-2 was approximately 40 feet north of the centerline of Bay Road and approximately 125 feet west of the centerline of Pulgas Avenue. Vehicular traffic volumes were substantially higher at this measurement location along this section of Bay Road. Hourly average noise levels at this location typically ranged from 59 to 73 dBA L_{eq} during the day and from 51 to 68 dBA L_{eq} at night. The average community noise equivalent level was 71 dBA CNEL on the weekdays and ranged from 67 to 69 dBA CNEL on the weekends.

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[3] Illingworth & Rodkin, Inc., "City of East Palo Alto General Plan Update EIR Draft Noise and Vibration Assessment," November 2015.

Long-term noise measurement LT-3 was made from a tree located in front of 530 Pulgas Avenue, approximately 30 feet from the roadway centerline, from Wednesday, April 5, 2017 to Thursday, April 6, 2017. Hourly average noise levels at this location typically ranged from 61 to 68 dBA L_{eq} during the day and from 49 to 60 dBA L_{eq} at night. The average community noise equivalent level measured from Wednesday, April 5, 2017 to Thursday, April 6, 2017 was 66 dBA CNEL.

The daily trend in noise levels measured at LT-1 is shown in Figure 3 through 7. The daily trend in noise levels measured at LT-2 is shown in Figure 8 through 12. The daily trend in noise levels for LT-3 is shown in Figure 13. LT-12 daily trends are shown in Figure 14.

FIGURE 1 Project Site in Relation to East Palo Alto General Plan Traffic Noise Contours

Figure 10-6 - Existing (2015) Traffic Noise

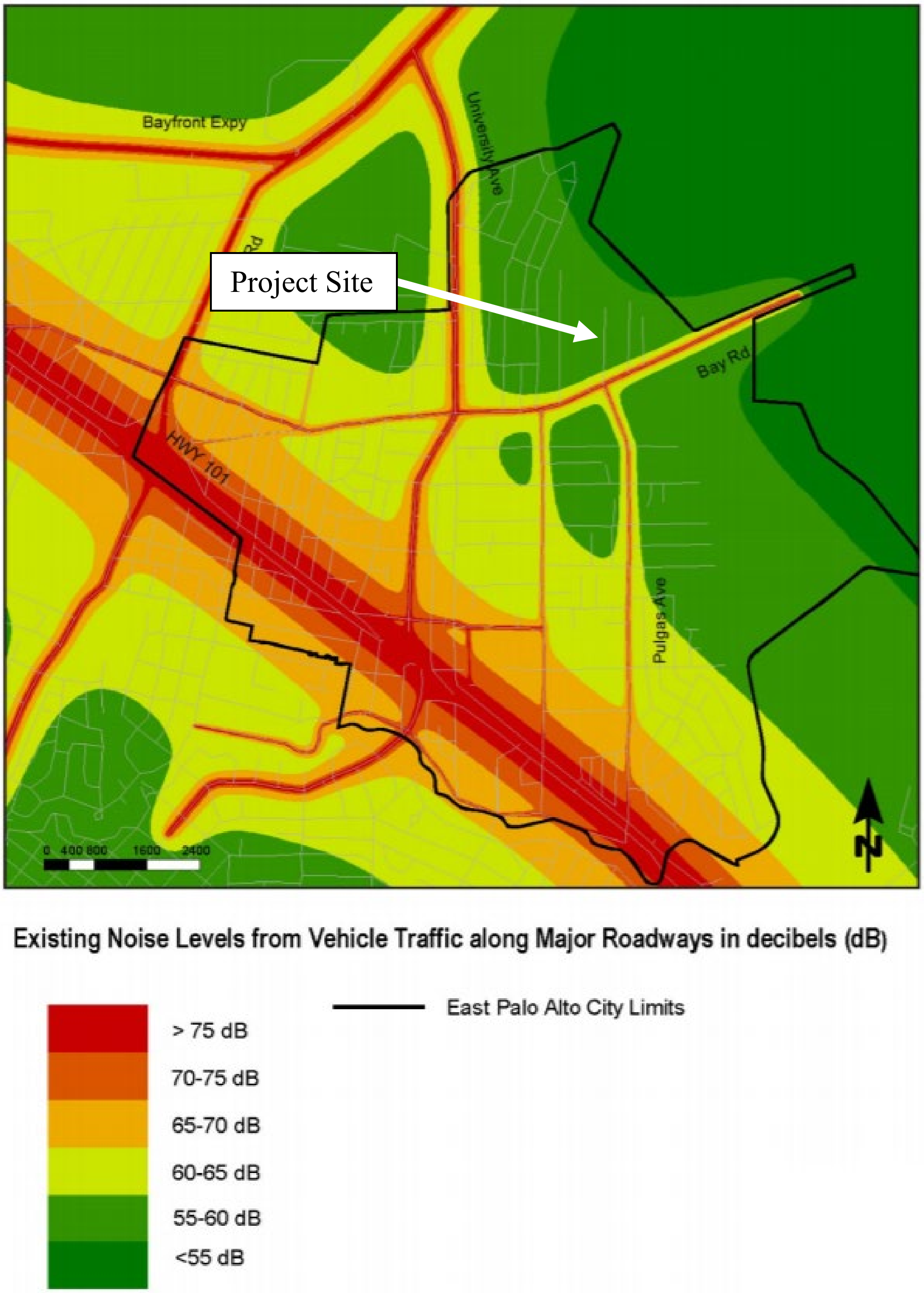


FIGURE 2 Project Site and Surrounding Area

FIGURE 3 Daily Noise Trends at LT-1, Thursday, April 20, 2017

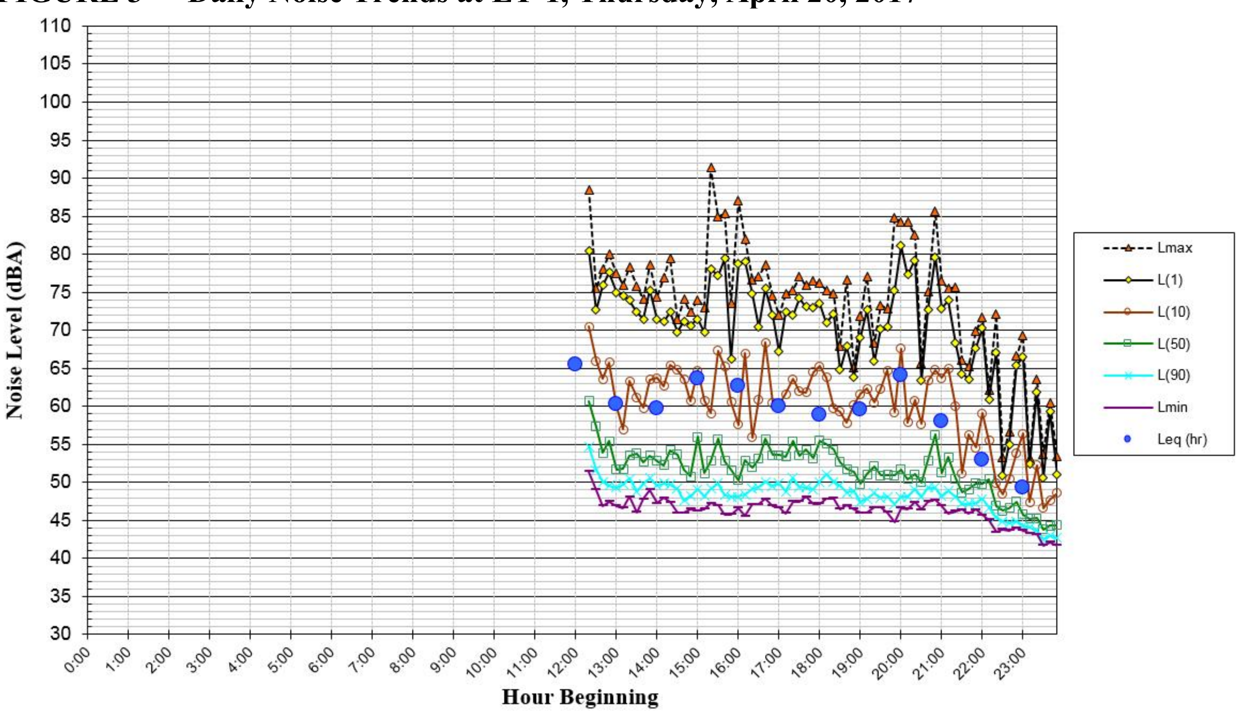


FIGURE 4 Daily Noise Trends at LT-1, Friday, April 21, 2017

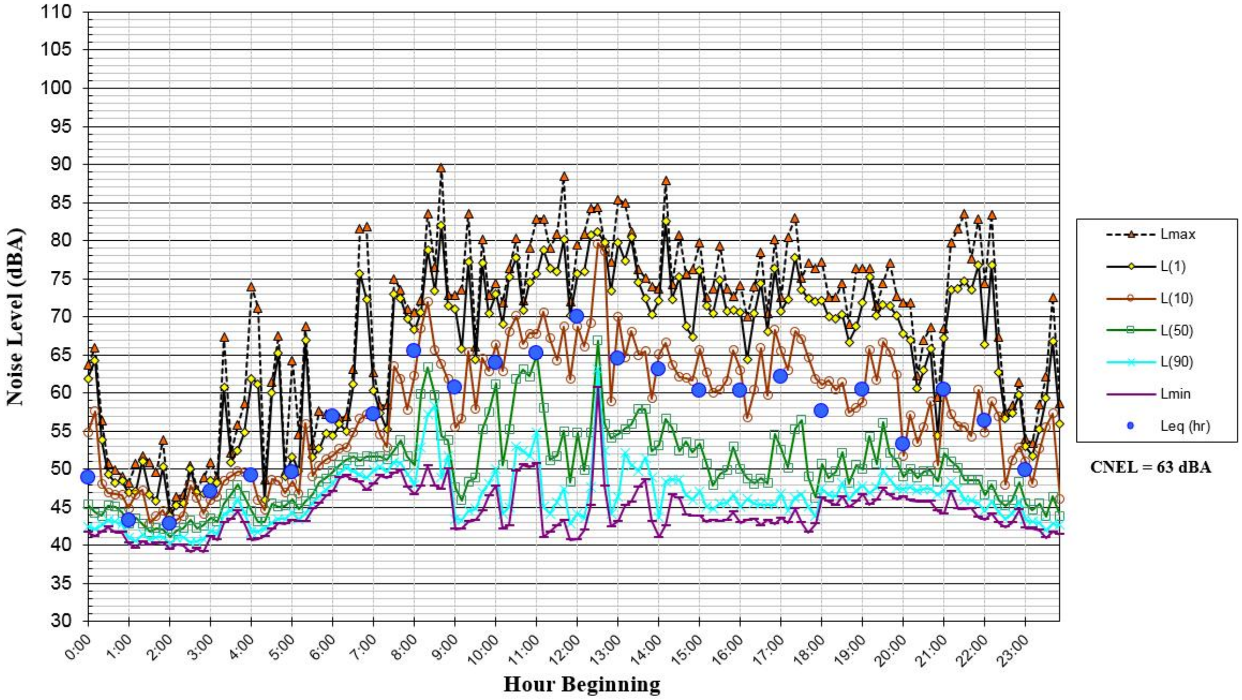


FIGURE 5 Daily Trend in Noise Levels at LT-1, Saturday, April 22, 2017

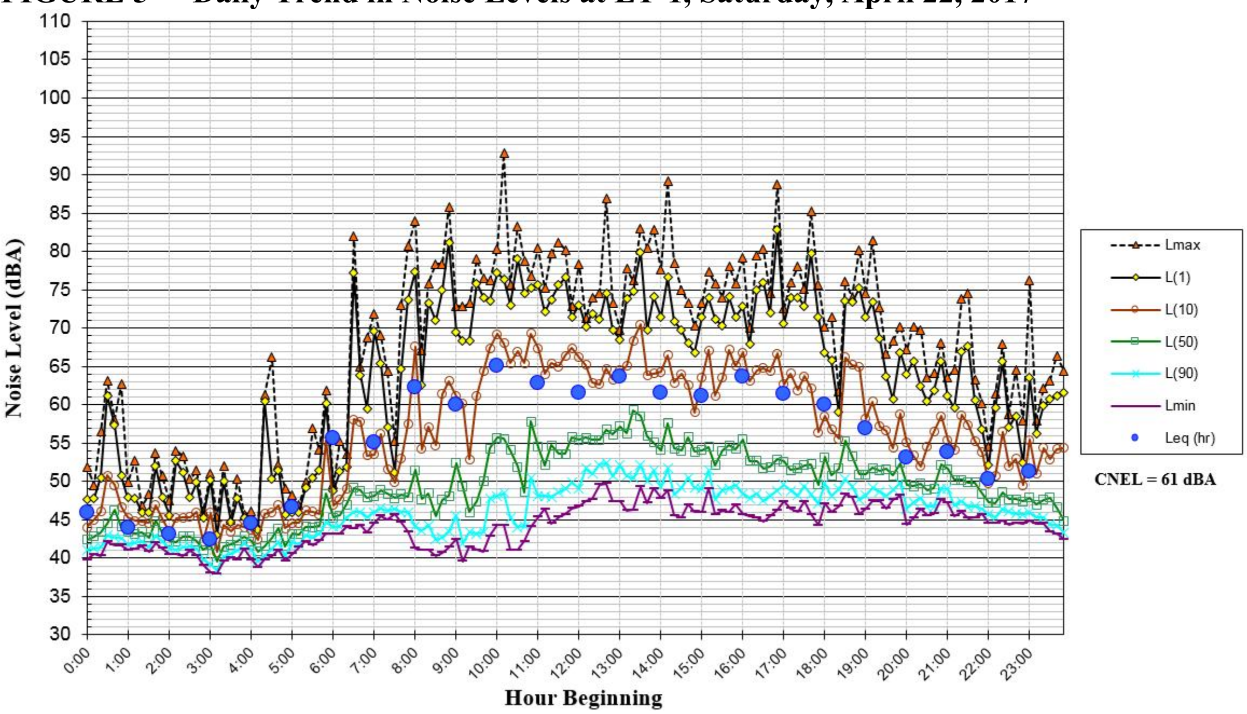


FIGURE 6 Daily Trend in Noise Levels at LT-1, Sunday, April 23, 2017

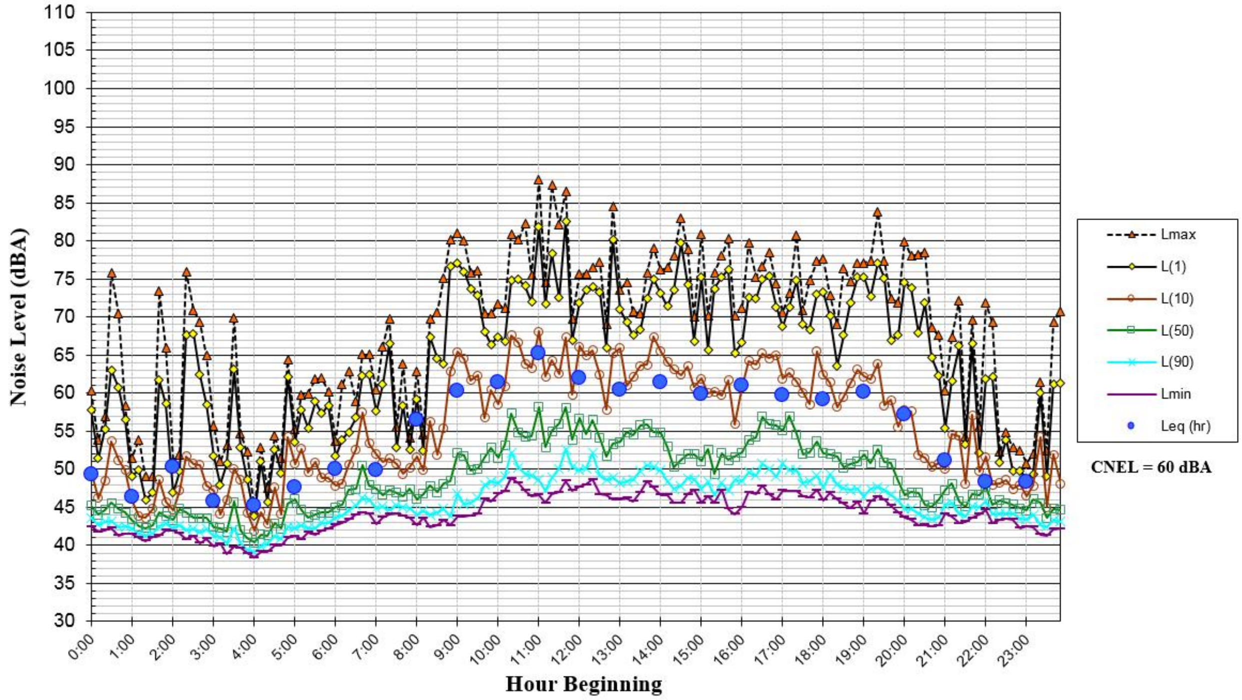


FIGURE 7 Daily Trend in Noise Levels at LT-1, Monday, April 24, 2017

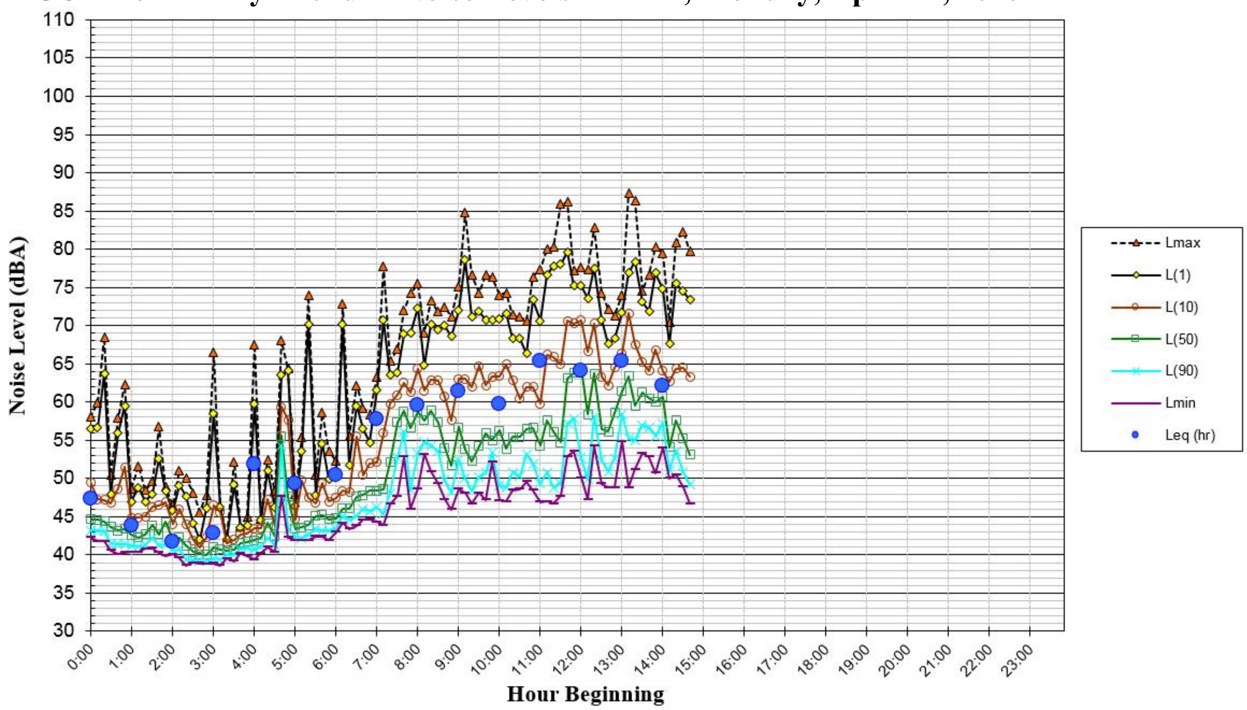


FIGURE 8 Daily Trend in Noise Levels at LT-2, Thursday, April 20, 2017

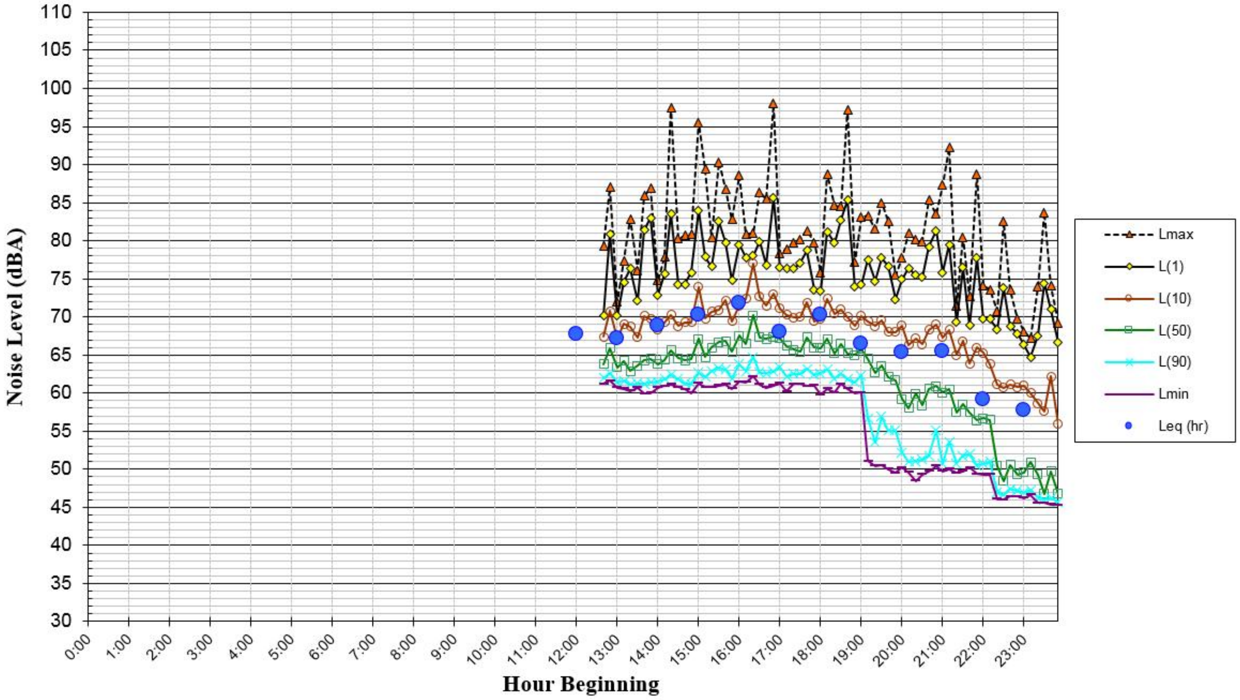


FIGURE 9 Daily Trend in Noise Levels at LT-2, Friday, April 21, 2017

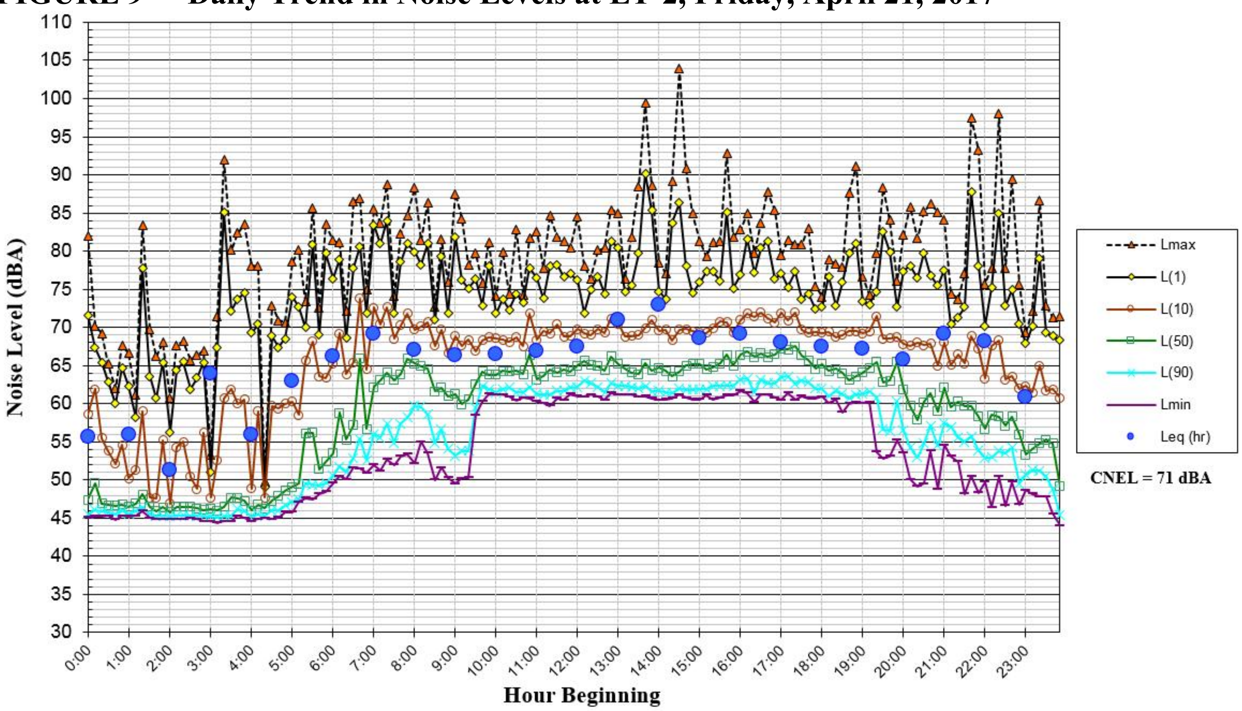


FIGURE 10 Daily Trend in Noise Levels at LT-2, Saturday, April 22, 2017

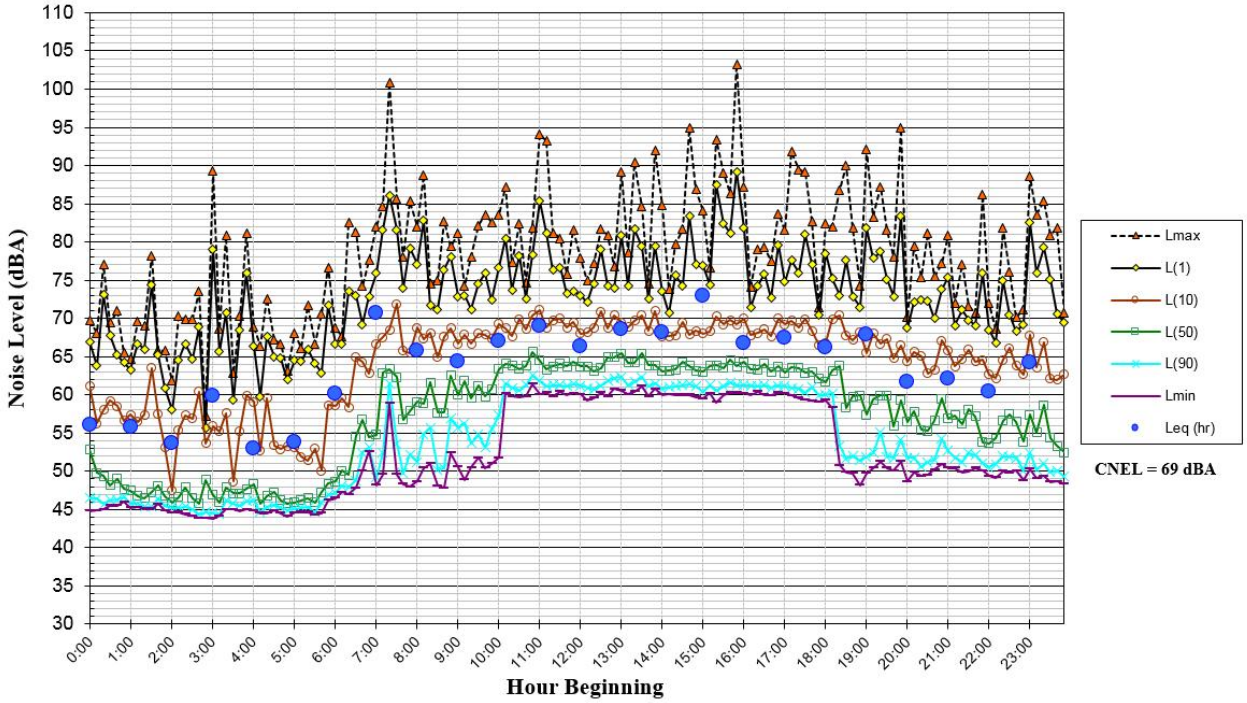


FIGURE 11 Daily Trend in Noise Levels at LT-2, Sunday, April 23, 2017

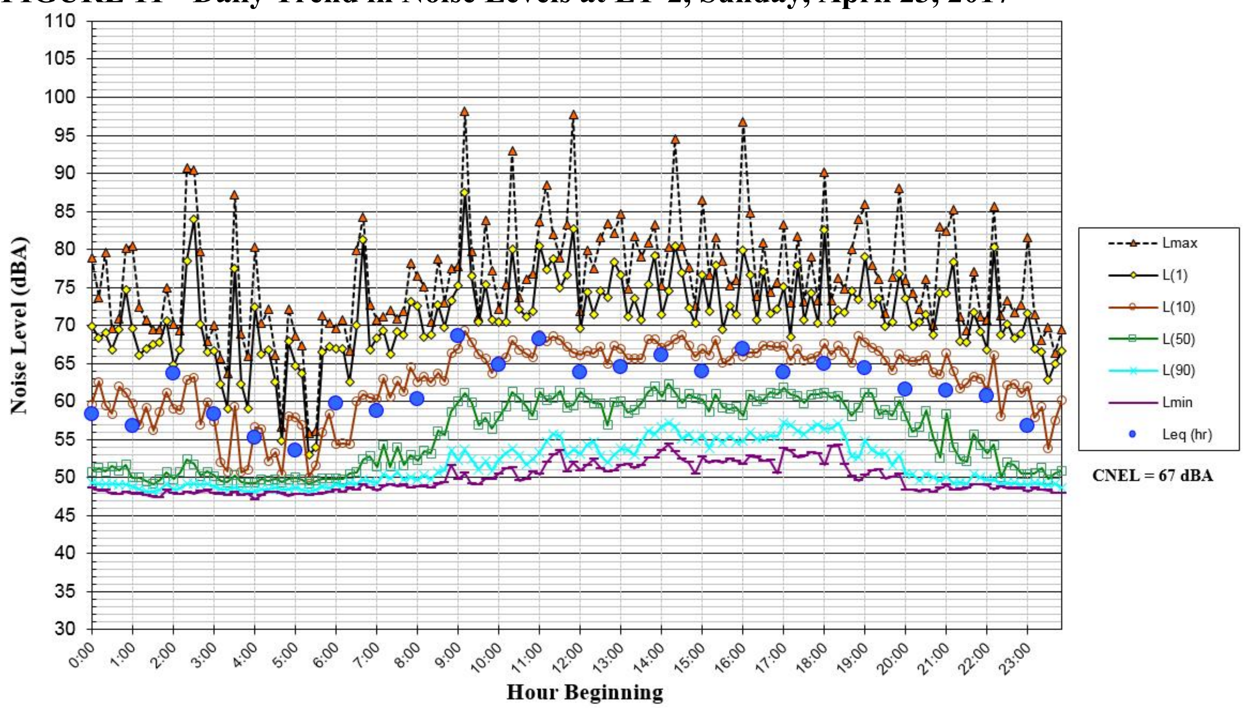


FIGURE 12 Daily Trend in Noise Levels at LT-2, Monday, April 24, 2017

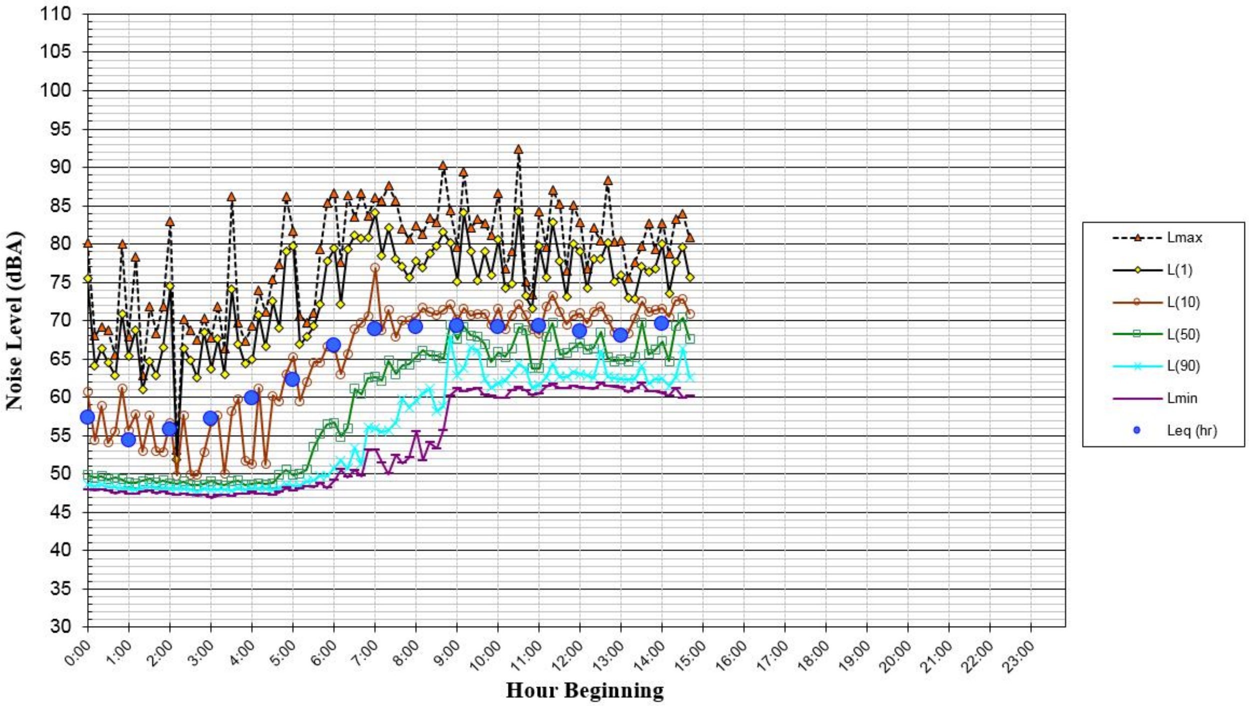


FIGURE 13 Daily Trend in Noise Levels at LT-3, Wednesday, April 5, 2017 through Thursday, April 6, 2017

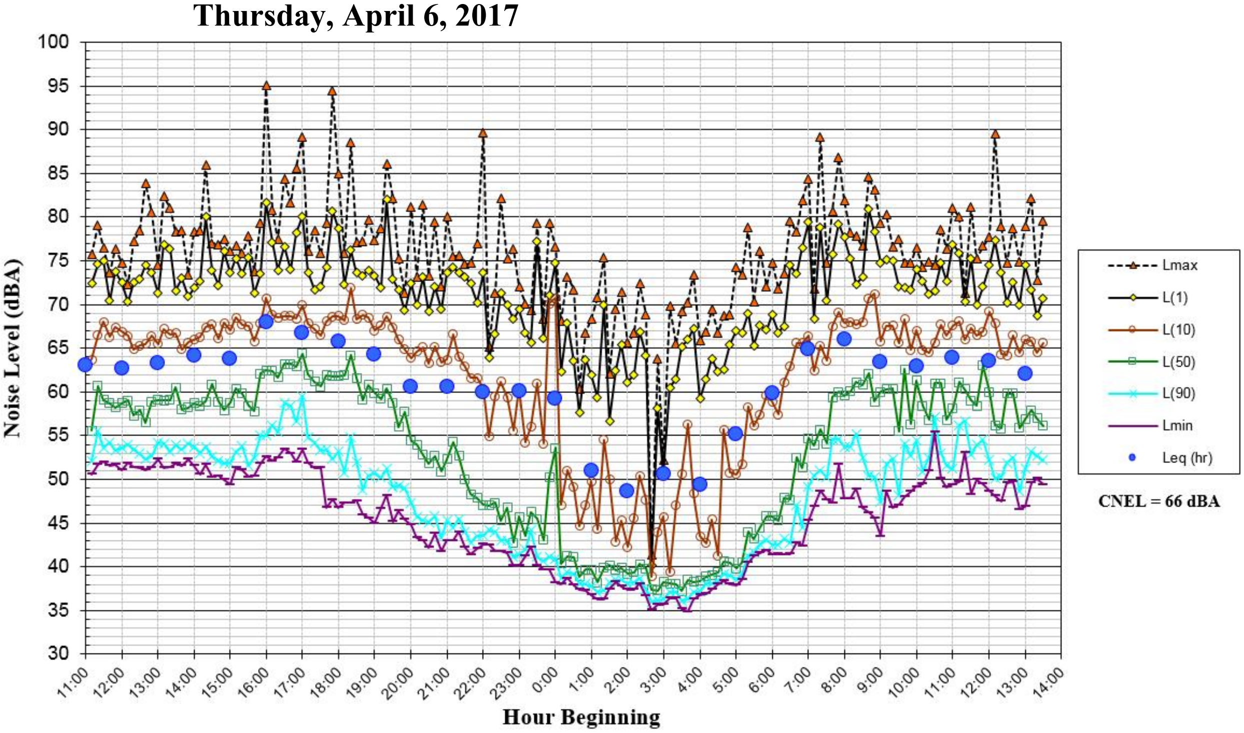
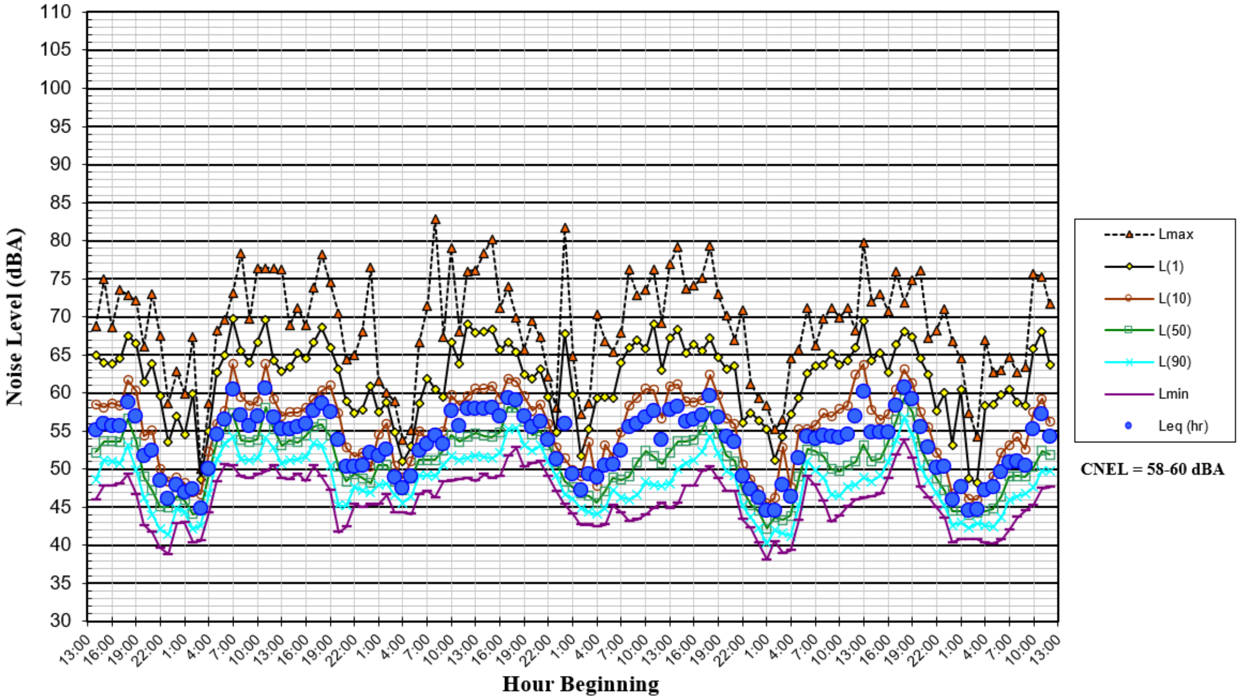


FIGURE 14 Daily Noise Trends at L-12, Thursday, April 23, 2015 through Tuesday, April 28, 2015



GENERAL PLAN CONSISTENCY ANALYSIS

Noise and Land Use Compatibility

Table 10-1 of the City of East Palo Alto General Plan does not specify exterior noise level thresholds for common outdoor use areas of office buildings. The proposed project does include an outdoor playground area, and exterior noise levels are limited to 65 dBA CNEL, according to Table 10-1.

The 2019 Cal Green Code requires interior noise levels for nonresidential uses to be maintained at or below 50 dBA $L_{eq(1\text{-}hr)}$. Additionally, interior noise levels for private offices should be maintained at or below 45 dBA $L_{eq(12)}$, according to Table 10-1 of the City's General Plan. $L_{eq(12)}$ is the A-weighted equivalent sound level averaged over a 12-hour period (usually the daytime hours of operation).

The future noise environment at the project site would continue to result primarily from vehicular traffic along nearby roadways, such as Bay Road and Pulgas Avenue, and industrial uses generated at the surrounding sites. Aircraft associated with nearby airports would also continue to affect the noise environment at the site. Using the traffic data provided for the proposed project and the traffic study completed for the Ravenswood/4 Corners TOD Specific Plan EIR, [4] within which the

[4] *The Planning Center DC&E*, "Ravenswood/4 Corners TOD Specific Plan Final EIR," July 30, 2012.

proposed project falls, the future exterior noise level increase was calculated for the cumulative plus project scenario.

For purposes of estimating the worst-case scenario, the cumulative plus project traffic scenario was modeled in SoundPLAN Version 8.2, a three-dimensional ray-tracing computer program, to estimate future peak hour noise levels. Based on these results, future traffic conditions in the project site vicinity are anticipated to be approximately 62 dBA CNEL at the building's eastern façade.

Future Exterior Noise Environment

The proposed project site plan shows a play area surrounded by a 7-foot-tall fence along the southwest façade of the four-story office building. The play area would be mostly shielded by the existing and future buildings at the project site and surrounding properties. Depending on construction materials, the fence may provide additional acoustic shielding. A receptor positioned at the center of the play area would have future exterior noise levels below 60 dBA CNEL under future project conditions, assuming no attenuation from the privacy fence. This would meet the City's exterior noise thresholds for playgrounds.

The City does not have an exterior noise level threshold for office buildings because these spaces are not normally areas of frequent human use that would benefit from a lower noise level; therefore, the outdoor activity areas proposed by the project would be compatible with the future noise environment.

Future Interior Noise Environment

The eastern building façade located adjacent to Pulgas Avenue would be approximately 30 feet from the centerline of the roadway. Based on the long-term noise measurement LT-2 taken near the intersection of Pulgas Avenue and Bay Road, the peak hour L_{eq} would be 2 dBA higher than the 24-hour community noise equivalent level. Therefore, the highest hourly average noise level at the eastern building façade would be 64 dBA $L_{eq(1\text{-}hr)}$ during daytime hours. Conservatively, this peak hour noise level was assumed for each hour during the daytime hours of operation. Under this assumption, the eastern façade would be exposed to future exterior noise levels up to 64 dBA $L_{eq(12)}$.

Standard construction materials for commercial uses would provide about 25 dBA of noise reduction in interior spaces. The inclusion of adequate forced-air mechanical ventilation systems is normally required so that windows may be kept closed at the occupant's discretion and would provide an additional 5 dBA reduction. Standard construction materials in combination with forced-air mechanical ventilation would satisfy the threshold of 50 dBA $L_{eq(1\text{-}hr)}$ for general offices and 45 dBA $L_{eq(12)}$ for private offices.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

The following criteria were used to evaluate the significance of noise and vibration resulting from the project:

- A significant noise impact would be identified if the project would generate a substantial temporary or permanent noise level increase over ambient noise levels at existing noise-sensitive receptors surrounding the project site and that would exceed applicable noise standards presented in the General Plan or Municipal Code at existing noise-sensitive receptors surrounding the project site.
    - A significant noise impact would be identified if construction-related noise would temporarily increase ambient noise levels at sensitive receptors. The City of East Palo Alto considers large or complex projects involving substantial noise-generating activities and lasting more than 12 months significant when within 500 feet of residential land uses or within 200 feet of commercial land uses or offices.
    - According to Policy 7.2 of the City's General Plan, a significant impact would occur if the permanent noise level increase due to project-generated traffic was 3 dBA CNEL and exceed the "normally acceptable" level or was 5 dBA CNEL or greater and remained "normally acceptable." Based on Table 10-1, it is assumed that the 65 dBA CNEL exterior noise standard would be considered "normally acceptable" for residential land uses.
    - A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code.
- A significant impact would be identified if the construction of the project would generate excessive vibration levels surrounding receptors. Policy 6.4 of the City's General Plan limits vibration levels to 0.08 in/sec PPV for sensitive historic structures and to 0.30 in/sec PPV for buildings of normal conventional construction to minimize the potential for cosmetic damage.
- A significant noise impact would be identified if the project would expose people residing or working in the project area to excessive aircraft noise levels.

Impact 1a: **Temporary Construction Noise.** Existing residential land uses located within 500 feet of the project site and commercial uses located within 200 feet of the project site would be exposed to a temporary increase in ambient noise levels due to project construction activities for a period exceeding one year. **This is a significant impact.**

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

Section 15.04.125 of the City's Municipal Code limits construction activities to between 7:00 a.m. and 6:00 p.m. on weekdays and to between 9:00 a.m. and 5:00 p.m. on Saturdays. Construction activities are prohibited on Sundays and national holidays. During these allowable hours, construction noise would be exempt from the City's exterior and interior noise level standards at single- or multi-family residences, schools, hospitals, churches, and public libraries. Additionally, Policy 7.11 of the City's General Plan states that a significant construction noise impact would occur if substantial noise-generating construction activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) occurred within 500 feet of residential uses or 200 feet of commercial or office uses for more than 12 months. Further, large complex projects would require a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints to be in place prior to the start of construction and to be implemented during construction to reduce noise impacts on neighboring residents and other uses.

The Ravenwood Family Health Center to the south and single-family residences to the west were identified as the nearest noise-sensitive receptors to the project site. Ambient noise levels at the health center would typically range from 59 to 73 dBA L_{eq} during daytime hours (LT-2). Noise levels at the single-family residences would typically range from 50 to 61 dBA L_{eq} during daytime hours (LT-12).

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The highest maximum noise levels generated by project construction would typically range from about 80 to 90 dBA L_{max} at a distance of 50 feet from the noise source. A list of typical maximum instantaneous noise levels measured at 50 feet are provided in Table 6. Table 7 shows the hourly average noise level ranges, by construction phase for various types of construction projects. Typical hourly average construction-generated noise levels for commercial office buildings are about 75 to 89 dBA L_{eq}, as measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.). Construction-generated noise levels drop off at a rate of about 6 dBA per doubling of the distance between the source and receptor. Shielding by buildings or terrain can provide an additional 5 to 10 dBA noise reduction at distant receptors.

Based on the expected construction schedule provided for the proposed project, demolition would start at the beginning of May 2021, and paving would conclude in August 2022, which would total approximately 15 months. Table 8 summarizes the number of days anticipated for each construction phase and the estimated noise levels calculated at the property lines of the nearest sensitive receptors. Equipment for each phase was used as inputs into the Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM) to predict the combined average noise level. To model worst-case conditions, it was assumed that all equipment per phase would be operating simultaneously. For construction noise, the use of multiple pieces of equipment simultaneously would add together as a collective noise source. While every piece of equipment per phase would likely be scattered throughout the site, the noise-sensitive receptors surrounding the site would be subject to the collective noise source generated by all equipment operating at once. Therefore, to assess construction noise impacts at the receiving property lines of noise-sensitive receptors, the collective worst-case hourly average noise level for each phase was positioned at the geometrical center of the site and propagated to the nearest property line of the surrounding land uses. These noise level estimates are also shown in Table 8. Note, these levels do not assume reductions due to intervening buildings, terrain, or existing barriers.

Estimated construction noise levels shown in Table 8 would exceed ambient levels by more than 5 dBA L_{eq} throughout construction, which is expected to last approximately 15 months. Since project construction is located within 500 feet of residential land uses or within 200 feet of commercial uses and is expected to exceed one year in duration, this would be considered a significant construction noise impact.

TABLE 6 Construction Equipment, 50-foot Noise Emission Limits

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes: [1] Measured at 50 feet from the construction equipment, with a "slow" (1 sec.) time constant.
[2] Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.
[3]Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

TABLE 7 Typical Ranges of Construction Noise Levels at 50 Feet, L_{eq} (dBA)

	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial Parking Garage, Religious Amusement & Recreations, Store, Service Station		Public Works Roads & Highways, Sewers, and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	83	83	84	84	84	83	84	84
Excavation	88	75	89	79	89	71	88	78
Foundations	81	81	78	78	77	77	88	88
Erection	81	65	87	75	84	72	79	78
Finishing	88	72	89	75	89	74	84	84

I - All pertinent equipment present at site.
II - Minimum required equipment present at site.

Source: U.S.E.P.A., Legal Compilation on Noise, Vol. 1, p. 2-104, 1973.

TABLE 8 Estimated Construction Noise Levels at Nearby Land Uses

Phase	No. of Work Days	Calculated Hourly Average L_{eq} at Noise-Sensitive Receptors, dBA L_{eq}				
		Industrial North (180 ft)	Industrial West (215 ft)	Industrial East (265 ft)	Health Center South (435 ft)	Residential West (615 ft)
Demolition	10	75	71	67	73	64
Grading & Excavation	30	76	73	68	74	65
Trenching & Foundation	55	72	69	64	71	61
Building – Exterior	185	73	70	65	72	62
Building – Interior & Architectural Coating	140	66	62	58	64	55
Paving	10	74	70	66	72	63

Mitigation Measure 1a:

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life. Due to the distance from the nearest noise-sensitive receptors and the size of the proposed project, this would not be considered a large complex construction project requiring a construction noise logistics plan. However, implementing the standard noise controls provided in Policy 7.11 as project conditions of approval would reduce noise levels emanating from the project site. The applicable standard noise controls shall include, but not be limited to, the following measures to reduce construction noise levels as low as practical:

- Limit construction activity to weekdays between 7:00 a.m. and 7:00 p.m. and Saturdays and holidays between 9:00 a.m. and 7:00 p.m., with no construction on Sundays;

- Utilize "quiet" models of air compressors and other stationary noise sources where such technology exists;

- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment;

- Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from adjacent land uses;

- Locate staging areas and construction material areas as far away as possible from adjacent land uses;

- Prohibit all unnecessary idling of internal combustion engines;

- Designate a “disturbance coordinator” who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem are implemented.

- Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction.

With the implementation of standard noise controls in GP Policy 7.11 and the Municipal Code allowable construction hours, the temporary construction noise impact would be reduced to a less-than-significant level.

Impact 1b: **Permanent Noise Level Increase.** The proposed project is not expected to cause a substantial permanent noise level increase at the existing residential land uses in the project vicinity. **This is a less-than-significant impact.**

According to Policy 7.2, a significant impact would occur if the permanent noise level increase due to project-generated traffic is 3 dBA CNEL and exceeds the “normally acceptable” level or is 5 dBA CNEL or greater and remains “normally acceptable.” While the General Plan does not define what level would be “normally acceptable,” it is assumed that the 65 dBA CNEL exterior noise standard in Table 10-1 would be considered “normally acceptable.”

Existing noise levels measured at the noise-sensitive receptors surrounding the site would exceed 65 dBA CNEL at the property lines nearest local roadways, as measured at LT-2 and LT-12. Under future conditions, the noise environment at these nearby noise-sensitive receptors would continue to exceed 65 dBA CNEL. Therefore, a significant impact would occur if project-generated traffic increases noise levels along local roadways by 3 dBA CNEL or more. For reference, a 3 dBA CNEL noise increase would be expected if the project would double existing traffic volumes along a roadway.

The traffic study of the proposed project included existing and existing plus project peak hour traffic volumes at 25 intersections in the vicinity of the project site. The traffic study included traffic volumes both with and without the planned loop road identified in the Ravenswood / 4 Corners TOD Specific Plan. By comparing the peak hour traffic volumes for the existing plus project traffic scenario to the existing traffic scenario, project-generated permanent noise increase was calculated. While traffic volumes along Demeter Street and Pulgas Avenue, north of Bay Road, with the planned loop road, and along Pulgas Avenue, north of Bay Road, without the planned loop road, would double under existing plus project conditions, these roadway segments have very low volumes compared to Bay Road. The Ravenswood Family Health Center, which is the only noise-sensitive receptor located along these roadway segments, traffic noise along Bay Road would be the dominant noise source, and the doubling of the traffic volumes along Demeter Street and Pulgas Avenue would result in less than 1 dBA CNEL increase at this noise-sensitive receptor. Therefore, noise-sensitive receptors in the vicinity of the project would not be impacted by project-generated traffic noise increases.

Along every other roadway segment included in the traffic study, a noise level increase of 1 dBA CNEL or less was calculated. Therefore, project-generated traffic noise increases of 3 dBA CNEL or more are not expected to occur at noise-sensitive receptors in the project vicinity. This is a less-than-significant impact.

Mitigation Measure 1b: None required.

Impact 1c: Noise Levels in Excess of Standards. The proposed project would not exceed the standards established in the City's General Plan or Municipal Code at the nearby sensitive receptors. **This is a less-than-significant impact.**

Tables 4 and 5 summarize the Municipal Code's thresholds for exterior and interior noise levels, respectively, as measured on the receiving land uses. Since mechanical equipment could run during daytime and nighttime hours, the exterior noise level thresholds would be 55 dBA L_{50} during daytime hours (between 7:00 a.m. and 10:00 p.m.) and 50 dBA L_{50} during nighttime hours (between 10:00 p.m. and 7:00 a.m.). The interior noise level thresholds would be 45 dBA L_{50} during the daytime hours and 40 dBA L_{50} during nighttime hours. On-site operations, which would occur during daytime hours only, would be expected to occur for 30 minutes or more in any given hour; therefore, the exterior noise level threshold would be 55 dBA L_{50}, and the interior threshold would be 45 dBA L_{50}.

Mechanical Equipment Noise

The Ravenswood Family Health Center is located approximately 300 feet to the south of the project site and single-family residences are located approximately 400 feet to the west of the project site.

The proposed project would include mechanical equipment, such as heating, ventilation, and air conditioning systems (HVAC), an emergency generator, a transformer, and solar panels. The site plan shows the transformer located on the ground-level along the northern building façade and a mechanical penthouse and solar panel arrays on the rooftop. While the specific locations for the HVAC units and emergency generator are not identified in the site plan, it is assumed that both would be located within the mechanical penthouse. The penthouse would be constructed with a perforated screen wall to conceal the equipment.

Rooftop HVAC equipment noise levels for commercial office buildings typically range from 50 to 60 dBA L_{eq} at a distance of 50 feet where there is direct line-of-site to the mechanical equipment. In addition, the project applicant has indicated that the emergency generator would have a capacity of 100 kW. Based on file data, sound pressure levels from the generator would be approximately 76 to 78 dBA at 5 feet, assuming a Level I or Level II acoustical enclosure. The generator would be tested periodically and would provide emergency power to the building in the event of a power failure. The mechanical penthouse, which is anticipated to house the mechanical equipment units and emergency generator, would be approximately 350 feet from the property line of the nearest noise-sensitive receptor. At this distance, and assuming there is no acoustical shielding from the mechanical screens, noise from the exterior mechanical equipment and emergency generator would be less than 50 dBA L_{eq}.

A solar panel system would also be constructed on the rooftop of the proposed building. Noise levels generated by solar panels are low and would be inaudible at the nearest sensitive receptors to the south and to the west. Transformers up to 1,000 kVA typically generate noise levels up to 64 dBA at a distance of 3.28 feet (1 meter). The transformer would be approximately 500 feet from the property line of the nearest noise-sensitive receptor. At this distance, the transformer would be inaudible above ambient noise levels.

The proposed mechanical equipment would meet the City's exterior noise threshold for daytime and nighttime. Noise generated by the rooftop mechanical equipment, emergency generator, solar panel system, and external transformer would be less than 50 dBA at property lines of the nearest noise-sensitive receptors to the south and west. Assuming standard commercial construction materials for the existing health center to the south of the project site and standard residential construction materials for the existing single-family residences to the west of the project site, the expected interior noise levels due to the mechanical equipment noise would be less than 40 dBA L_{eq}. This would meet the City's interior noise threshold for daytime and nighttime. This would be a less-than-significant impact.

Operational Noise

An outdoor carpentry area and an outdoor play area will be constructed as a part of the job training center. Both areas would be located to the west of the building and would be surrounded by fences with heights of 10 feet and 7 feet, respectively.

According to the project applicant, the carpentry class would include basic carpentry tools such as saws, hammers, jigsaws, etc. The training cohorts would last approximately 11 weeks, with approximately 3 to 4 weeks spent inside a classroom and 7 to 8 weeks spent outside for hands-on training. The classes would occur between the hours of 8:30 a.m. and 3:15 p.m. Measurements from a previous study at a carpenters training center indicate that typical noise levels intermittently range from 55 to 65 dBA at a distance of approximately 75 feet. Circular saws and hammering contributed to the majority of measured noise levels. At approximately 300 feet, this would result in noise levels of 53 dBA or less. Considering that carpentry noise is anticipated to be intermittent, noise levels from the carpenters training center would be less than 55 dBA L_{50} during daytime hours (between 7:00 a.m. and 10:00 p.m.). Depending on the construction materials and methods for the fence, additional noise attenuation could be provided.

The play area would serve up to 24 kids during daytime operational hours. While the noise levels would vary based on the occupancy at any given time, noise levels from similar studies indicated that playground activity could generate hourly average noise levels up to 65 dBA L_{eq} at 50 feet. At times, children shouting may exceed this noise level, while at other times the outdoor play area would not be in use. At approximately 300 feet, this would result in noise levels that are 49 dBA or less, which would meet the City's 55 dBA L_{50} threshold during daytime hours.

Truck Delivery Noise

A loading zone is proposed at the northwest corner of the building, adjacent to the carpentry yard. Large truck deliveries would occur approximately three to four times per year in order to unload lumber and metal. Based on the infrequency of truck deliveries, and distance from the nearest sensitive receptors to the south and west, truck deliveries would not be anticipated to increase traffic noise levels near the project site. This is a less-than-significant impact.

Mitigation Measure 1c: None required.

Impact 2: Exposure to Excessive Groundborne Vibration due to Construction. Construction-related vibration levels resulting from activities at the project site would exceed 0.3 in/sec PPV at the nearest sensitive receptor. **This is a potentially significant impact.**

The construction of the project may generate vibration when heavy equipment or impact tools (e.g. hoe rams) are used in close proximity to existing buildings. Construction activities would include grading, foundation work, paving, and new building framing and finishing. According to the list of construction equipment expected to be used for the proposed project, pile driving, which can cause excessive vibration, would not be required.

Policy 6.4 of the City's General Plan limits vibration levels to 0.08 in/sec PPV at sensitive historic structures and to 0.30 in/sec PPV at buildings of normal conventional construction to minimize the potential for cosmetic damage.

Table 9 presents typical vibration source levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. At a distance of 25 feet, jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 9 also includes vibration levels calculated at the nearest buildings surrounding the site, as measured from the property boundary where the nearest construction equipment could be used.

The industrial buildings to the north would be as close as approximately 15 feet from construction equipment. At this distance, vibration levels would be as high as 0.368 in/sec PPV. Other industrial buildings include industrial buildings located approximately 30 feet to the west and 70 feet to the east, and a health center located approximately 365 feet to the south. Vibration levels at these distances would occasionally be perceptible but would likely not cause damage to the buildings.

TABLE 9 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Estimated Vibration Levels at Surrounding Structures, in/sec PPV			
			Industrial North (15 ft)	Industrial West (30 ft)	Industrial East (70 ft)	Health Center South (365 ft)
Clam shovel drop		0.202	0.354	0.165	0.065	0.011
Hydromill (slurry wall)	in soil	0.008	0.014	0.007	0.003	0.000
	in rock	0.017	0.030	0.014	0.005	0.001
Vibratory Roller		0.210	0.368	0.172	0.068	0.011
Hoe Ram		0.089	0.156	0.073	0.029	0.005
Large bulldozer		0.089	0.156	0.073	0.029	0.005
Caisson drilling		0.089	0.156	0.073	0.029	0.005
Loaded trucks		0.076	0.133	0.062	0.024	0.004
Jackhammer		0.035	0.061	0.029	0.011	0.002
Small bulldozer		0.003	0.005	0.002	0.001	0.000

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., February 2021.

A study completed by the US Bureau of Mines analyzed the effects of blast-induced vibration on buildings in USBM RI 8507.[5] The findings of this study have been applied to buildings affected by construction-generated vibrations.[6] As reported in USBM RI 8507[5] and reproduced by

[5] Siskind, D.E., M.S. Stagg, J.W. Kopp, and C.H. Dowding, Structure Response and Damage Produced by Ground Vibration form Surface Mine Blasting, RI 8507, Bureau of Mines Report of Investigations, U.S. Department of the Interior Bureau of Mines, Washington, D.C., 1980.

[6] Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996.

Dowding,[6] Figure 15 presents the damage probability, in terms of “threshold damage,” “minor damage,” and “major damage,” at varying vibration levels. Threshold damage, which is described as cosmetic damage in this report, would entail hairline cracking in plaster, the opening of old cracks, the loosening of paint or the dislodging of loose objects. Minor damage would include hairline cracking in masonry or the loosening of plaster, and major structural damage would include wide cracking or shifting of foundation or bearing walls. As shown in Figure 15, no threshold damage, minor or major damage was observed with maximum vibration levels of 0.37 in/sec PPV or below.

Typical construction equipment, as shown in Table 9, would have the potential to produce vibration levels of 0.3 in/sec PPV or more at the existing building immediately north of the project site. While no minor or major damage would be expected to occur at this building, there is the potential to result in threshold or cosmetic damage. This is a significant impact.

At this location, and in other surrounding areas within 200 feet, vibration levels would potentially be perceptible. By use of administrative controls, such as notifying neighbors of scheduled construction activities and scheduling construction activities with the highest potential to produce perceptible vibration during hours with the least potential to affect nearby businesses, perceptible vibration can be kept to a minimum.

Mitigation Measure 2:

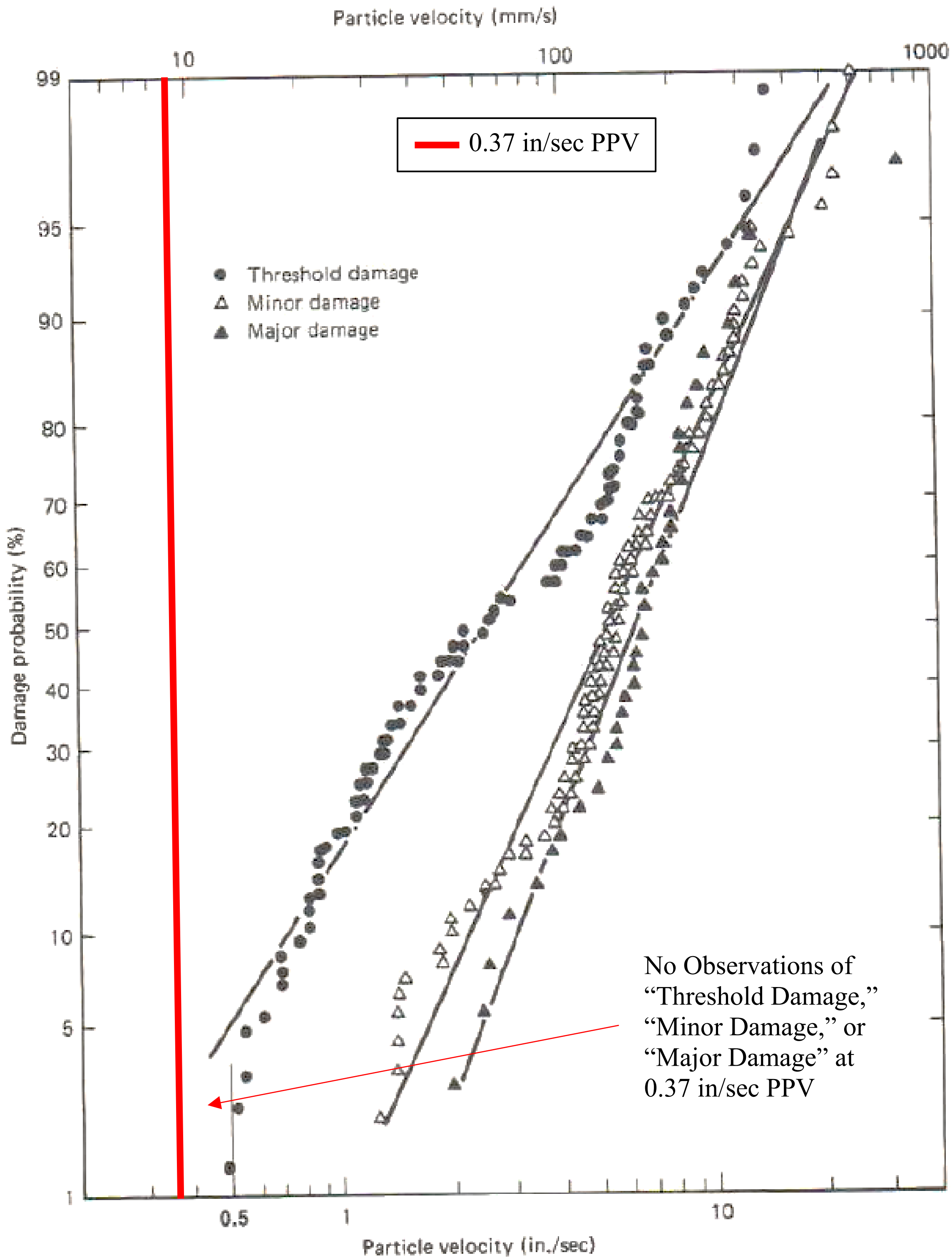
Mitigation Measure NOI-4a of the Ravenswood/4 Corners TOD Specific Plan EIR provided the following mitigation for construction vibration:

- Avoid impact pile driving, where feasible. Drilled piles cause lower vibration levels where geological conditions permit their use. *(pile driving not expected for this project)*

- Avoid using vibratory rollers and tampers near sensitive areas, where feasible.

The implementation of these measures would reduce the impact to a less-than-significant level.

FIGURE 15 Probability of Cracking and Fatigue from Repetitive Loading



Source: Dowding, C.H., Construction Vibrations, Prentice Hall, Upper Saddle River, 1996, as modified by Illingworth & Rodkin, Inc., February 2021.

Impact 3: **Excessive Aircraft Noise.** The project would not expose people working in the project area to excessive aircraft noise levels. **This is a less-than-significant impact.**

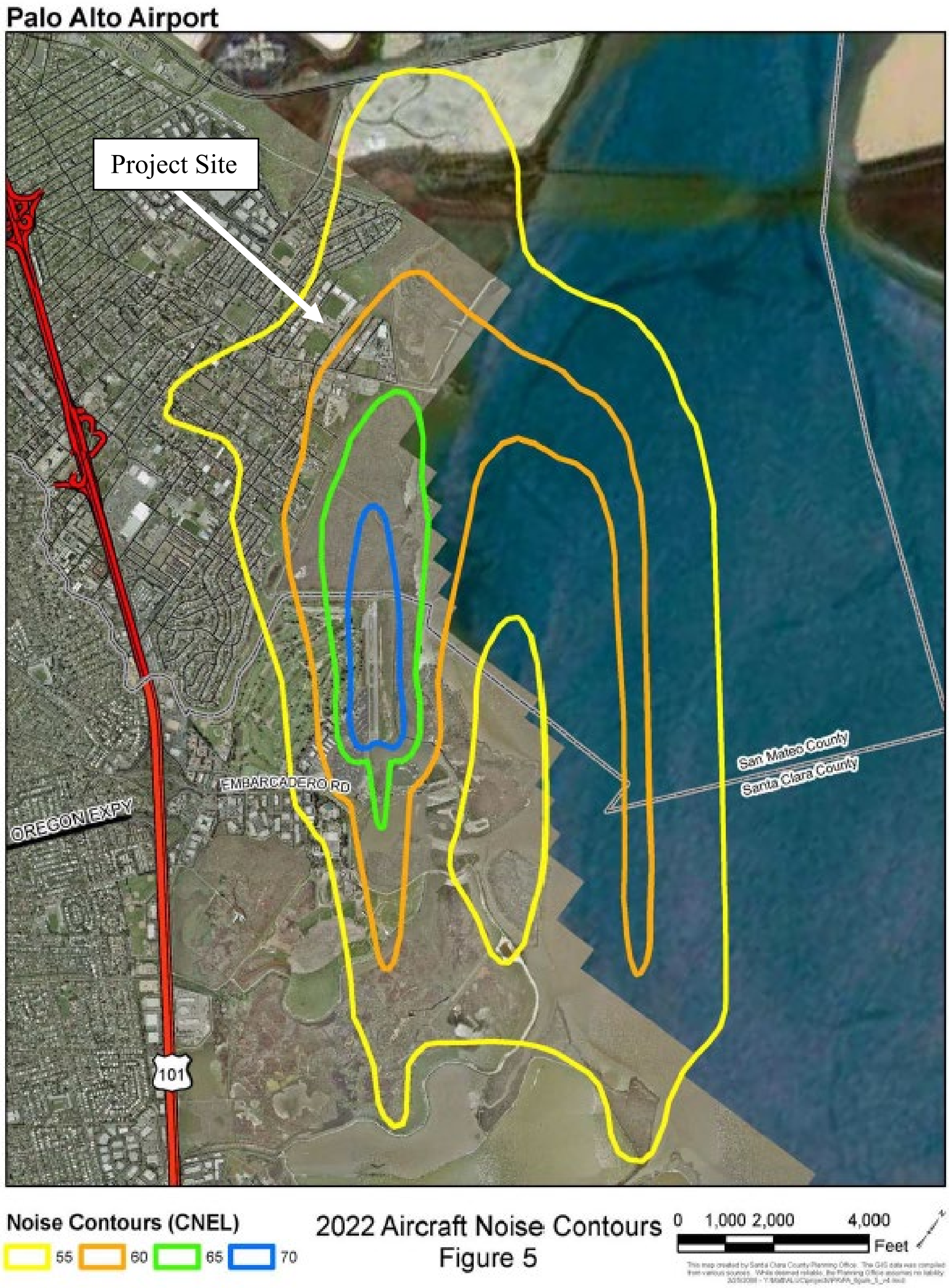
The Palo Alto Airport is a general aviation airport located approximately 1.0 mile southeast of the project site. The project site lies within the 55 dBA CNEL noise contour but outside of the 60 dBA CNEL noise contour for 2022, as shown in Figure 16. This means aircraft noise associated with this airport would result in noise levels between 55 and 60 dBA CNEL by the year 2022. According to Table 4-1 of the Palo Alto Comprehensive Plan from 1998, office buildings located within the 55 to 60 dBA CNEL noise contours would be considered generally acceptable. Further, standard construction materials would achieve a 25 to 30 dBA exterior-to-interior noise reduction with the windows closed. Therefore, interior noise levels at the proposed building during daytime hours would be below the City's 45 dBA $L_{eq(12)}$ threshold.

Other airports in the vicinity of the project site include the Moffett Federal Airfield (5 miles southeast), Norman Y. Mineta San José International Airport (12 miles southeast), San Carlos Airport (7 miles northwest), and San Francisco International Airport (15 miles northwest). The project site lies outside the areas of influence for each of the airports, and the noise environment at the site would not substantially increase due to aircraft noise from these airports.

Exterior and interior noise levels resulting from aircraft would be compatible with the proposed project.

Mitigation Measure 3: **None required.**

FIGURE 16 2022 CNEL Noise Contours for Palo Alto Airport Relative to Project Site



Cumulative Impacts

Cumulative noise impacts could result from cumulative traffic conditions and cumulative construction projects.

A significant cumulative traffic noise impact would occur if two criteria are met: 1) if the cumulative traffic noise level increase was 3 dBA CNEL or greater for future levels exceeding 65 dBA CNEL or was 5 dBA CNEL or greater for future levels at or below 65 dBA CNEL; and 2) if the project would make a "cumulatively considerable" contribution to the overall traffic noise increase. A "cumulatively considerable" contribution would be defined as an increase of 1 dBA CNEL or more attributable solely to the proposed project.

Cumulative traffic noise level increases were calculated by comparing the cumulative no project traffic volumes and the cumulative plus project volumes to existing traffic volumes. Several roadway segments would result in a 3 dBA CNEL increase under both cumulative conditions (with and without the proposed project). However, since these increases would occur with and without the proposed project, this would not result in a cumulatively considerable contribution. As discussed in Impact 1b above, traffic volumes under the cumulative plus project scenario would double along Pulgas Avenue, north of Bay Road. However, this increase in traffic volumes would result in a permanent noise increase of less than 1 dBA CNEL at the nearest noise-sensitive receptor, due to Bay Road dominating the noise environment. Therefore, the project would not cause a significant cumulative noise increase at noise-sensitive uses in the project vicinity.

There are several construction projects planned near the 2535 Pulgas Avenue project site. Projects are proposed at 2519 Pulgas Avenue (shared property line to the south) and 1804 Runnymede Street (2,500 feet to the southeast). A project is currently under construction at 965 Weeks Street (1,300 feet to the southwest). Assuming worst-case-scenario, all four projects could be constructed simultaneously for a short duration of time.

Noise from the construction of the proposed project at 1804 Runnymede Street would not be audible at sensitive receptors near the 2535 Pulgas Avenue project site. Noise from the construction of the proposed project at 965 Weeks Street would occasionally be audible at residential receptors along Illinois Street to the southwest of the 2535 Pulgas Avenue project site and at the health center along Bay Road to the south but would not measurably contribute to the noise environment. In a similar manner, the construction of the proposed project at 2519 Pulgas Avenue would occasionally be audible at sensitive receptors south of Bay Road but would not measurably contribute to the noise environment. Residential receptors along Illinois Street to the west and at the health center to the south would have additional exposure to temporary noise increases if the construction of the projects overlapped. However, due to the distance between the proposed projects and the residences to the west, this exposure would be minimal. The health center would be adjacent to the 2519 Pulgas Avenue project site, which would be located between 2535 Pulgas Avenue and the sensitive receptor. Therefore, the 2519 Pulgas Avenue construction would dominate the noise exposure at the health center. With the implementation of standard noise controls in GP Policy 7.11 and the allowable hours of construction in the Municipal Code, noise and vibration impacts due to cumulative construction would be reduced. This would be a less-than-significant cumulative construction noise impact.

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May 6, 2021

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Via email: **cneer@davidjpowers.com**

Subject: **2535 Pulgas Avenue (Jobtrain) Sanitary Sewer Scenarios, East Palo Alto, CA Addendum to the Noise and Vibration Assessment**

Dear Ms. Neer:

In February 2021, *Illingworth & Rodkin, Inc*. drafted a noise and vibration assessment for the 2535 Pulgas Avenue (Jobtrain) office building project[1] in East Palo Alto, California. The applicant is considering two potential scenarios for the sanitary sewer service at the project site.

The preferred option would be to connect to the East Palo Alto Sanitary District (EPASD), which would include connecting to the existing six-inch sanitary sewer main along Pulgas Avenue. The applicant would be paying for improvements downstream along Bay Road and the Bay Trail. These improvements would qualify for a statutory exemption under CEQA and would not require further analysis. If this first option is not feasible, then the second option would be to construct an on-site sanitary sewer treatment plant to serve the office building demand.

This addendum letter discusses the potential impact generated by the second option to construct an on-site sanitary sewer treatment plant.

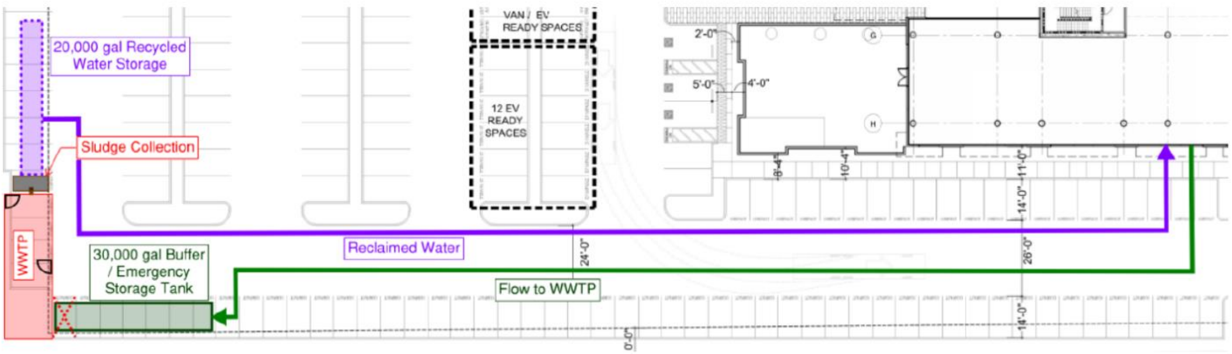
On-Site Sanitary Sewer Treatment Option

The on-site treatment facility would have a treatment capacity of 6,000 gallons per day and would be located in the southwest corner of the project site, as shown in Figure 1. The on-site sanitary sewer plant would have four main components: 1) 30,000-gallon buffer/emergency storage tank; 2) wastewater treatment plant; 3) sludge collector; and 4) 20,000-gallon recycled water storage tank. Two pipes would connect the on-site sanitary sewer treatment plant to the office building transporting sewage from the office building to the treatment plant and returning processed,

[1] Illingworth & Rodkin, Inc., "2535 Pulgas Avenue Noise and Vibration Assessment," February 18, 2021.

reclaimed water from the treatment plant back to the office building. In total, all four components of the sanitary sewer facility would occupy approximately 2,490 square feet and have a maximum height of 23 feet above grade. The maximum depth of excavation necessary to accommodate the on-site sanitary sewer system foundation would be approximately 2 feet below the existing grade. Approximately 15.37 cubic yards of soil would be exported during construction of the on-site sanitary sewer treatment plant foundation.

FIGURE 1 On-Site Sanitary Sewer Treatment Option



Operational Noise

The City's Municipal Code includes thresholds for exterior and interior noise levels at receiving land uses. A wastewater treatment plant (WWTP) would operate continuously during daytime and nighttime hours. Therefore, the exterior noise level thresholds would be 55 dBA L_{50} during daytime hours (between 7:00 a.m. and 10:00 p.m.) and 50 dBA L_{50} during nighttime hours (between 10:00 p.m. and 7:00 a.m.) at the nearest noise-sensitive receptors, and the interior noise level thresholds would be 45 dBA L_{50} during the daytime hours and 40 dBA L_{50} during nighttime hours at the nearest noise-sensitive receptors.

The storage tanks and underground piping shown in Figure 1 is not expected to generate noise; however, the WWTP building would include pumps, compressors, fans, electrical equipment, and likely odor control equipment. Specific equipment planned at the site, location for the equipment, and noise levels generated by the equipment are unknown at this time. Major WWTP facilities generate a collective noise level of 85 dBA L_{eq} at 5 feet. While this noise level is expected to be conservative for this relatively small facility, this source level is used here for a credible worst-case assessment. With equipment at the WWTP building being located indoors, the building façade would provide about 20 dBA reduction outdoors.

The nearest property lines of noise-sensitive receptors would be 240 feet to the south (Ravenswood Family Health Center) and 415 feet to the west (nearest residences). At these property lines, operational noise levels would be 31 and 27 dBA L_{eq}, respectively, assuming the equipment would be housed indoors. Therefore, exterior noise levels at the nearby noise-sensitive receptors would be below 50 dBA L_{eq}, and interior noise levels at the nearest noise-sensitive receptors would be below 40 dBA L_{eq}. This option would not result in a significant operational impact at the nearest noise-sensitive receptors.

Construction Noise

For the WWTP option, components would be delivered to the site premanufactured and would be assembled on-site. The maximum depth of excavation necessary to accommodate the on-site sanitary sewer system foundation would be approximately 2 feet below the existing grade. Approximately 15.37 cubic yards of soil would be exported during construction of the on-site sanitary sewer treatment plant foundation. Total construction is expected to last for a period of about 2.5 to 3 months.

Noise impacts resulting from construction depend upon the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance between construction noise sources and noise-sensitive areas. Construction noise impacts primarily result when construction activities occur during noise-sensitive times of the day (e.g., early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or when construction lasts over extended periods of time.

Section 15.04.125 of the City's Municipal Code limits construction allowable hours to 7:00 a.m. to 6:00 p.m. on weekdays and 9:00 a.m. to 5:00 p.m. on Saturdays. No construction is allowed on Sundays. For large, complex projects, Policy 7.11 of the City's General Plan recommends construction hours to be limited to 7:00 a.m. to 7:00 p.m. on weekdays and to 9:00 a.m. to 7:00 p.m. on Saturdays and holidays, with no work allowed on Sundays. Additionally, Section 8.52 of the City's Municipal Code exempts construction noise occurring between 7:00 a.m. and 8:00 p.m. from the exterior and interior thresholds established in the Municipal Code for receiving land uses such as residences, schools, hospitals, churches, or public libraries. It is assumed that all construction activities would occur between these allowable hours.

The Ravenwood Family Health Center to the south and single-family residences to the west were identified as the nearest noise-sensitive receptors to the project site. Ambient noise levels at the health center would typically range from 59 to 73 dBA L_{eq} during daytime hours. Noise levels at the single-family residences would typically range from 50 to 61 dBA L_{eq} during daytime hours.

Construction activities generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The highest maximum noise levels generated by project construction would typically range from about 80 to 90 dBA L_{max} at a distance of 50 feet from the noise source, and typical hourly average noise levels would range from 78 to 88 dBA L_{eq} for sewer systems, as measured at a distance of 50 feet from the center of the work site during busy construction periods (e.g., earth moving equipment, impact tools, etc.). A list of typical maximum instantaneous noise levels and hourly average noise level ranges were provided in the February 2021 noise assessment.

Table 1 summarizes the phasing information and the equipment expected to be used during each phase. The equipment was used as inputs into the FHWA's Roadway Construction Noise Model (RCNM) to predict the combined average noise level for each phase. To model worst-case conditions, it was assumed that all equipment per phase would be operating simultaneously. For construction noise, the use of multiple pieces of equipment simultaneously would add together as a collective noise source. While every piece of equipment per phase would likely be scattered throughout the site, the noise-sensitive receptors surrounding the site would be subject to the collective noise source generated by all equipment operating at once. Therefore, to assess construction noise impacts at the receiving property lines of noise-sensitive receptors, the collective worst-case hourly average noise level for each phase was positioned at the geometrical center of each building and propagated to the nearest property line of the surrounding land uses.

The results of the RCNM model for each phase of construction of the sewer system, as estimated at a distance of 50 feet, are summarized in Table 1. The construction of the sewer system would overlap with the Jobtrain Project. The range in noise levels in Table 1 reflect the maximum noise levels during the overlapping periods. The noise levels in Table 1 were propagated from the center of the project site to the property lines of the surrounding land uses. These are summarized in Table 2.

TABLE 1 Summary of Construction Equipment Estimated for Each Construction Phase, Calculated at a Distance of 50 feet

Phase of Construction	Equipment (Quantity)	Combined L_{eq}, dBA
Demolition (5/3/2021-5/28/2021)	Concrete/Industrial Saw (1) Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (3)	87 to 90[a]
Site Preparation (5/29/2021-6/1/2021)	Grader (1) Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (1)	85 to 89[b]
Grading/ Excavation (6/2/2021-6/7/2021)	Grader (1) Rubber-Tired Dozer (1) Tractor/Loader/Backhoe (1)	85
Trenching/ Foundation (6/8/2021-6/11/2021)	Tractor/Loader/Backhoe (1) Excavator (1)	82 to 88[c]
Paving (6/12/2021-6/25/2021)	Cement and Mortar Mixer (1) Paver (1) Paving Equipment (1) Roller (1) Tractor/Loader/Backhoe (1)	86 to 89[d]

[a] Range reflects the demolition phase for the sewer system only and when completed simultaneously with the demolition phase of the Jobtrain Project and the grading/excavation phase of the Jobtrain Project.
[b] Range reflects the site preparation phase for the sewer system only and when completed simultaneously with the grading/excavation phase of the Jobtrain Project.
[c] Range reflects the trenching/foundation phase for the sewer system only and when completed simultaneously with the grading/excavation phase of the Jobtrain Project.
[d] Range reflects the paving phase for the sewer system only and when completed simultaneously with the grading/excavation phase of the Jobtrain Project.

TABLE 2 Construction Noise Levels Estimated at Nearby Sensitive Land Uses

Phase of Construction	Calculated Hourly Average L_{eq} at Noise-Sensitive Receptors, dBA				
	North Industrial (180ft)	West Industrial (215ft)	East Industrial (265ft)	South Health Center (435ft)	West Residential (615ft)
Demolition	76 to 79	73 to 76	69 to 72	75 to 78	66 to 69
Site Preparation	73 to 78	70 to 75	66 to 70	72 to 76	63 to 67
Grading/ Excavation	73	70	66	72	63
Trenching/ Foundation	71 to 77	67 to 74	63 to 69	69 to 76	60 to 66
Paving	74 to 78	71 to 75	67 to 71	73 to 77	64 to 68

[a] Range reflects the demolition phase for the sewer system only and when completed simultaneously with the demolition phase of the Jobtrain Project and the grading/excavation phase of the Jobtrain Project.
[b] Range reflects the site preparation phase for the sewer system only and when completed simultaneously with the grading/excavation phase of the Jobtrain Project.
[c] Range reflects the trenching/foundation phase for the sewer system only and when completed simultaneously with the grading/excavation phase of the Jobtrain Project.
[d] Range reflects the paving phase for the sewer system only and when completed simultaneously with the grading/excavation phase of the Jobtrain Project.

Estimated construction noise levels shown in Table 2 would exceed ambient levels at the health center and residences by more than 5 dBA L_{eq} at times during the construction of the sewer system. While construction of the sewer system is not expected to last for more than one year, project construction of the Jobtrain Project would last longer than one year. The project would require the inclusion of construction best management practices as project conditions of approval.

Policy 7.11 of the City's General Plan requires the implementation of a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints to reduce noise impacts on neighboring residents and other uses. A typical construction noise logistics plan would include, but not be limited to, the following measures to reduce construction noise levels as low as practical:

Standard Construction Noise Controls

- Limit construction activity to weekdays between 7:00 a.m. and 7:00 p.m. and Saturdays and holidays between 9:00 a.m. and 7:00 p.m., with no construction on Sundays;

- Utilize "quiet" models of air compressors and other stationary noise sources where such technology exists;

- Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment;

- Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from adjacent land uses;

- Locate staging areas and construction material areas as far away as possible from adjacent land uses;

- Prohibit all unnecessary idling of internal combustion engines;

- Designate a "disturbance coordinator" who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures warranted to correct the problem are implemented.

- Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction.

With the implementation of standard noise controls in GP Policy 7.11 and the Municipal Code allowable construction hours, the temporary construction noise impact would be reduced to a less-than-significant level.

Construction Vibration Assessment

The construction of the WWTP option may generate perceptible vibration when heavy equipment or impact tools (e.g., jackhammers, hoe rams) are used. The proposed WWTP option is not expected to require pile driving, which can cause excessive vibration.

For structural damage, the California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No known ancient buildings or buildings that are documented to be structurally weakened adjoin the project area. Conservatively, groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impact.

Table 3 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Construction activities for the WWTP option, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) may generate substantial vibration in the immediate vicinity. While specific equipment listed in Table 1 for the proposed project may not be included in Table 3, all vibration levels for each piece of equipment expected to be used in the proposed project would be represented by the vibration levels summarized in Table 3, falling within the range of 0.003 and 0.210 in/sec PPV at a distance of 25 feet. Vibration levels perceived at receptors would vary depending on soil conditions, construction methods, and equipment used. Table 3 also summarizes the distances to the 0.3 in/sec PPV threshold for all nonhistorical buildings.

TABLE 3 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Minimum Distance to Meet 0.3 in/sec PPV (feet)
Clam shovel drop		0.202	18
Hydromill (slurry wall)	in soil	0.008	1
	in rock	0.017	2
Vibratory roller		0.210	19
Hoe ram		0.089	9
Large bulldozer		0.089	9
Caisson drilling		0.089	9
Loaded trucks		0.076	8
Jackhammer		0.035	4
Small bulldozer		0.003	<1

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., May 2021.

During each phase of construction, all off-site buildings would be 30 feet or more from the nearest construction site. At these distances, vibration levels would be at or below 0.172 in/sec PPV, which would be below the 0.3 in/sec PPV threshold. Table 4 summarizes construction vibration levels at all nearby off-site structures. While these levels may be perceptible to off-site occupants, damage to the structures would not be expected.

For existing health center to the south and the residences to the west, which are both more than 300 feet from the sewer alignment, vibration levels would at or below 0.01 in/sec PPV. The 0.3 in/sec PPV threshold is not expected to be exceeded by construction activities of the on-site sewer system at any off-site buildings. This would be a less-than-significant impact.

TABLE 4 Vibration Source Levels for Construction Equipment Propagated to the Nearest Off-Site Buildings Surrounding the Jobtrain Site

Equipment		Estimated Vibration Levels at Surrounding Structures, in/sec PPV			
		North Industrial (330ft)	East Industrial (85ft)	West Industrial (30ft)	South Health Center (390ft)
Clam shovel drop		0.012	0.053	0.165	0.010
Hydromill (slurry wall)	in soil	0.0005	0.002	0.007	0.0004
	in rock	0.001	0.004	0.014	0.001
Vibratory Roller		0.012	0.055	0.172	0.010
Hoe Ram		0.005	0.023	0.073	0.004
Large bulldozer		0.005	0.023	0.073	0.004
Caisson drilling		0.005	0.023	0.073	0.004
Loaded trucks		0.004	0.020	0.062	0.004
Jackhammer		0.002	0.009	0.029	0.002
Small bulldozer		0.0002	0.001	0.002	0.0001

Source: Transit Noise and Vibration Impact Assessment Manual, Federal Transit Administration, Office of Planning and Environment, U.S. Department of Transportation, September 2018, as modified by Illingworth & Rodkin, Inc., May 2021.

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Please feel free to contact us with any questions on the analysis or if we can be of further assistance.

Sincerely,

Carrie J. Janello
Senior Consultant
Illingworth & Rodkin, Inc.

(19-138)

HEXAGON TRANSPORTATION CONSULTANTS, INC.

2519 & 2535 Pulgas Avenue Office Development

Traffic Impact Analysis

Prepared for:

David J. Powers & Associates, Inc.

December 6, 2019

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Executive Summary

This report presents the results of the traffic study prepared for the proposed office development located at 2519 and 2535 Pulgas Avenue in East Palo Alto, California. A portion of the project site is currently occupied by Toubar Equipment Company, which will be removed by the project. The remainder of the project site is currently vacant. The proposed project would construct 100,000 square feet (s.f.) of office space at 2519 Pulgas Avenue. The new office space is expected to be occupied by JobTrain (50,000 s.f.), Ravenswood Family Health Center (25,000 s.f.), and an Emerson Collective entity or another office tenant (25,000 s.f.). The project will also include underground parking spanning the entire site. Vehicular access to and from the project site would be provided via three driveways on Pulgas Avenue. The site is within the Ravenswood/4 Corners TOD Specific Plan area and is zoned as Ravenswood Employment Center.

The traffic study was conducted for the purpose of identifying potential traffic impacts related to the proposed development and recommending improvements, if necessary. The impacts of the project were evaluated following the standards and methodologies set forth by the Cities of East Palo Alto, Palo Alto, and Menlo Park, and the City/County Association of Governments of San Mateo County (C/CAG). The C/CAG administers the San Mateo County Congestion Management Program (CMP). The traffic study includes an analysis of AM and PM peak hour traffic conditions during weekdays at 25 intersections in the vicinity of the project site. The study also evaluated potential project impacts on five freeway segments and the project's effect on ramp queues at the US 101/University Avenue interchange.

Project Trip Generation

For the project space proposed to be occupied by the Ravenswood Family Health Center administrative offices and by an Emerson collective entity or other office tenant, the trip generation rates published in the Institute of Transportation Engineers' (ITE) manual entitled *Trip Generation Manual, 10th Edition (*2017) for General Office Building (Land Use 710) were used. Trip generation rates for the JobTrain office facility were based on driveway counts conducted in August 2019 at the existing JobTrain location at 1200 O'Brien Drive in Menlo Park.

In addition, the proposed project will be required to develop a comprehensive Transportation Demand Management (TDM) plan to reduce vehicle trips. The City of East Palo Alto is currently considering an updated TDM Policy that could require trip reductions that exceed the current 25 percent requirement set forth in the City's code. However, to be conservative, this analysis assumes that the project site will achieve a 25 percent reduction in peak-hour trips. Based on the mode split estimate provided by the applicant, the observed trip generation rate at the existing JobTrain facility already reflects a 19% trip reduction due to the students and staff use of alternative modes of transportation. Therefore, a 25 percent reduction was applied to the proposed general office component and the proposed JobTrain trip estimates were reduced by 6 percent for a total TDM trip reduction of 25% per the City's existing ordinance.

The magnitude of traffic that is being generated by the existing business on the site was estimated based on driveway counts conducted in August 2019. After applying the TDM trip reductions and subtracting trips generated by existing uses, the proposed project is expected to generate a net total of 883 daily trips with 144 trips (132 in and 12 out) during the AM peak hour and 63 trips (11 in and 52 out) during the PM peak hour.

Existing Plus Project Intersection Levels of Service

Existing plus project conditions were evaluated both without and with the planned loop road identified in the Ravenswood / 4 Corners TOD Specific Plan. Table ES-1 presents a summary of the intersection levels of service under existing and existing plus project conditions. Both without and with the loop road, the proposed project would cause a significant adverse impact at nine study intersections. Each of the recommended mitigation measures is presented below. Unless stated otherwise, the mitigation measures would be required both without and with the loop road.

5. Euclid Avenue and Donohoe Street/East Bayshore Road

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the impact to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. A new traffic signal shall be installed at this intersection and coordinated with other closely spaced traffic signals along Donohoe Street. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. Furthermore, the westbound approach shall be restriped to add an exclusive right-turn lane.

With the implementation of these improvements, the Euclid/Donohoe intersection is expected to operate at an acceptable LOS D or better during both the AM and PM peak hours.

6. US 101 Northbound On-Ramp and Donohoe Street

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the impact to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. A new traffic signal shall be installed at this intersection and coordinated with other closely spaced traffic signals along Donohoe Street. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. In order to align with the proposed driveway for the University Plaza Phase II site on the north side of Donohoe Street, the US 101 on ramp shall be shifted approximately 30 feet to the east. In addition, the westbound approach on Donohoe Street shall be restriped to accommodate a short exclusive left-turn pocket (approximately 60 feet in length), a shared left/through lane, and an exclusive through lane. These improvements would require widening of the US

101 northbound on ramp to accommodate two lanes that taper down to a single lane before this ramp connects with the loop on ramp from northbound University Avenue.

With the recommended improvements, the intersection is expected to operate at an acceptable level (LOS C) during both the AM and PM peak hours.

8. Pulgas Avenue and Bay Road

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. Due to the relatively low traffic volumes on the uncontrolled approaches on Bay Road compared to the traffic volume on the stop-controlled northbound Pulgas Avenue approach, the installation of a new traffic signal is not recommended at this time. While a new traffic signal would be needed ultimately under cumulative conditions to support planned development farther east (e.g. in the Waterfront Office land use district), installation of all-way stop control is recommended to mitigate the significant project impact under near-term conditions. With all-way stop control, the intersection would operate at an acceptable LOS C during the PM peak hour under existing plus project conditions both without and with the loop road.

14. University Avenue and Donohoe Street

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The westbound approach on Donohoe Street shall be widened to accommodate dual left-turn lanes, one exclusive through lane, one shared through/right lane, and one exclusive right-turn lane to allow for simultaneous left-turn movements on Donohoe Street. These improvements would require right-of-way acquisition along the south side of Donohoe Street between University Avenue and the US 101 northbound off ramp.

The recommended mitigation measure would improve the intersection operations to LOS D during the PM peak hour. During the AM peak hour, the intersection is expected to operate at LOS F, however, the average delay would be less than under existing conditions. Thus, the improvements would satisfactorily mitigate the project impacts.

15. University Avenue and US 101 Southbound Ramps

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The recommended Donohoe Street improvements at Euclid Avenue, at the US 101 northbound on ramp, at University Avenue, at the US 101 northbound off ramp and at Cooley Avenue would improve traffic flow on University Avenue and eliminate the queue spillback that extends from Donohoe Street past the US 101 southbound ramps. The Donohoe Street improvements would reduce the delay and cause the University/US 101 southbound ramps intersection to operate at LOS D during the AM and PM peak hour. No additional improvements are required to mitigate the significant project impact at this intersection.

16. University Avenue and Woodland Avenue

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The recommended Donohoe Street improvements at Euclid Avenue, at the US 101 northbound on ramp, at University Avenue, at the US 101 northbound off ramp and at Cooley Avenue would improve traffic flow on University Avenue and eliminate the queue spillback that extends from Donohoe Street past Woodland Avenue. While the University/Woodland intersection is expected to continue to operate at LOS F during the PM peak hour, the Donohoe Street improvements would reduce the average delay at the University/Woodland intersection below that under existing conditions without the project. No additional improvements are required to mitigate the significant project impact at this intersection.

17. University Circle and Woodland Avenue

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The recommended Donohoe Street improvements at Euclid Avenue, at the US 101 northbound on ramp, at University Avenue, at the US 101 northbound off ramp and at Cooley Avenue would improve traffic flow on University Avenue, and as a result reduce the queues on Woodland Avenue. The mitigation measure would improve the intersection operations to LOS B during the PM peak hour. No additional improvements are required to mitigate the significant project impact at this intersection.

18. US 101 Northbound Off Ramp/University Plaza Phase I driveway and Donohoe Street

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The westbound approach on Donohoe Street at the US 101 northbound off ramp shall be widened to accommodate four through lanes to improve the vehicular throughput at this intersection. This improvement would require median modifications and narrowing the eastbound Donohoe Street approach to Cooley Avenue to include two through lanes and a full length left-turn lane. In addition, the traffic signals shall be coordinated with adjacent traffic signals on Donohoe Street. With the proposed improvements, the intersection of US 101 northbound off ramp and Donohoe Street is expected to operate at an acceptable level (LOS D or better) during the AM and PM peak hours.

20. East Bayshore Road and Donohoe Street

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The recommended Donohoe Street improvements at Euclid Avenue, at the US 101 northbound on ramp, at University Avenue, at the US 101 northbound off ramp, and at Cooley Avenue would improve traffic flow on Donohoe Street and cause the East Bayshore/Donohoe intersection to operate at LOS B during the AM peak hour under existing plus project conditions. No additional improvements are required to mitigate the significant project impact at this intersection.

Cumulative Plus Project Intersection Levels of Service

Cumulative conditions assume the construction of mitigation measures identified in the Ravenswood / 4 Corners TOD Specific Plan EIR but do not assume the completion of the planned loop road. However, the loop road was evaluated as a potential mitigation measure. Under cumulative plus project conditions, nine study intersections would be impacted by the proposed project (See Table ES-2). The proposed mitigation measures are presented below.

2. University Avenue and Loop Road (Future)

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the intersection would still operate at LOS E with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the impact to a less than significant level.

The significant cumulative impact at this intersection could be fully mitigated by widening the planned westbound loop road approach to include an exclusive right-turn pocket and one shared left/right-turn lane. With these improvements, the intersection would operate at an acceptable LOS D during the PM peak hour under cumulative plus project conditions.

4. University Avenue and Bay Road

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the impact to a less than significant level.

The construction of the planned loop road would reduce the traffic volume at the University/Bay intersection causing a decrease in the average vehicle delay during the AM peak hour. However, the intersection delay under cumulative plus project conditions with the loop road would be greater than under cumulative no project conditions. Therefore, construction of the loop road would only partially mitigate the impact at this intersection.

The significant cumulative impact at this intersection could be fully mitigated by constructing the planned loop road and converting the right-turn lane on eastbound Bay Road to a shared through-right turn lane. This improvement would not require additional right-of-way beyond that described in the Ravenswood/4 Corners TOD Specific Plan. With this improvement, the intersection would operate at an acceptable LOS D during the AM peak hour. The intersection would continue to operate at an unacceptable LOS E with the recommended improvement during the PM peak hour, however the average delay would be less than under cumulative no project conditions.

8. Pulgas Avenue and Bay Street

Mitigation: Cumulative conditions assume the installation of a traffic signal at this intersection, which was identified as a mitigation measure in the Ravenswood/Four Corners TOD Specific Plan DEIR.

Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact during the AM peak hour even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

The construction of the planned loop road would have only a minor effect on the traffic volumes and delay at the Pulgas/Bay intersection. Therefore, construction of the loop road would not mitigate the significant adverse impact at this intersection.

The significant cumulative impact at this intersection could be mitigated by constructing the planned loop road, adding an exclusive left-turn lane on the westbound Bay Road approach, and modifying the northbound Pulgas Avenue approach to include one exclusive left-turn lane and one shared left/through/right-turn lane. Split phase signal control shall be used on the north and south approaches. These improvements will require the acquisition of additional right of way at the northeast corner to allow for curb, gutter, sidewalk, and signal equipment. However, the needed right of way would not require the demolition of the existing building on the northeast corner. With these improvements, the intersection would operate at an acceptable LOS D during the PM peak hour under cumulative plus project conditions. During the AM peak hour, the intersection would continue to operate at an unacceptable LOS E with the recommended improvement, however the average delay would be less than under cumulative no project conditions.

9. Pulgas Avenue and Weeks Street

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

The construction of the planned loop road would have only a minor effect on the traffic volumes and delay at the Pulgas/Weeks intersection. Therefore, construction of the loop road would not mitigate the significant adverse impact at this intersection.

The significant cumulative impact at this intersection could be mitigated by constructing the planned loop road and installing a new traffic signal at this intersection. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. With these improvements, the intersection would operate at an acceptable level (LOS B) during the AM and PM peak hours under cumulative plus project conditions.

10. Pulgas Avenue and Runnymede Street

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

The construction of the planned loop road is not expected to affect the traffic volumes or delay at this intersection. A new traffic signal shall be installed at this intersection. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. With these improvements, the intersection would operate at an acceptable LOS C or better during the AM and PM peak hours under cumulative plus project conditions.

11. Pulgas Avenue and O'Connor Street

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations. In order to reduce the project impacts to a less than significant level under cumulative plus project conditions without any physical improvements to the intersection, the TDM Plan would need to reduce PM peak-hour trips by 35 percent.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. As an alternative to an enhanced TDM Plan, the significant cumulative impact at this intersection could be mitigated by installing a new traffic signal at this intersection. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. With these improvements, the intersection would operate at an acceptable level (LOS C) during the AM and PM peak hours under cumulative plus project conditions.

18. US 101 Northbound Off Ramp/University Plaza Ph I Driveway and Donohoe Street

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The westbound approach on Donohoe Street at the US 101 northbound off ramp shall be widened to accommodate four through lanes to improve the vehicular throughput at this intersection. This improvement would require median modifications and narrowing the eastbound Donohoe Street approach to Cooley Avenue to include two through lanes and a full length left-turn lane. In addition, the traffic signals shall be coordinated with adjacent traffic signals on Donohoe Street.

In addition, improvements also would be needed at other intersections along Donohoe Street at Euclid Avenue, at the US 101 northbound on ramp, at the US 101 northbound off ramp, and at Cooley Avenue as follows:

Euclid/Donohoe/East Bayshore

In order to prevent queues from extending through adjacent intersections, a new traffic signal shall also be installed at the Euclid/Donohoe/East Bayshore intersection and coordinated with other nearby traffic signals along Donohoe Street. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. Furthermore, the westbound approach shall be restriped to add an exclusive right-turn lane.

US 101 NB On-Ramp/University Plaza Ph II Driveway & Donohoe St

A new traffic signal shall be installed at the intersection of US 101 NB On-Ramp and Donohoe Street and coordinated with other closely spaced traffic signals along Donohoe Street. In order to align with the proposed driveway for the University Plaza Phase II site on the north side of Donohoe Street, the US 101 on ramp shall be shifted approximately 30 feet to the east. In addition, the westbound approach on Donohoe Street shall be restriped to accommodate a short exclusive left-turn pocket (approximately 60 feet in length), a shared left/through lane, and an exclusive through lane. These improvements would require widening of the US 101 northbound on ramp to accommodate two lanes that taper down to a single lane before this ramp connects with the loop on ramp from northbound University Avenue. All these improvements would improve traffic flow along the Donohoe Street corridor.

University Avenue and Donohoe Street

The westbound Donohoe Street approach shall be widened to accommodate dual left-turn lanes, one exclusive through lane, one shared through/right-turn lane, and one exclusive right-turn lane to allow for simultaneous left-turn movements on Donohoe Street (as identified in the C/CAG Willow Road and University Avenue Traffic Operations Study). These improvements would require right-of-way acquisition along the south side of Donohoe Street between University Avenue and the US 101 northbound off ramp. In addition, the inner left-turn lane on the northbound University Avenue approach shall be extended by an additional 250 feet. The northbound approach on University Avenue consists of dual left-turn lanes, with the inner left-turn lane measuring 175 feet and the outer left-turn lane measuring 125 feet. With the extension of the inner left-turn lane by an additional 250 feet, the two northbound left-turn lanes would provide for a total of 550 feet of queue storage capacity, or 22 vehicles. This additional storage would prevent left-turn queues from spilling over into the adjacent through lane and impeding the through traffic on University Avenue. Extension of the northbound left-turn lane can be accommodated within the existing right-of-way, by cutting into the raised median on University Avenue. This improvement would not require any additional right-of-way acquisition or reconfiguration of the US 101 overpass.

Cooley Avenue and Donohoe Street

The eastbound Donohoe Street approach to Cooley Avenue shall be restriped to include two through lanes and a full length left-turn lane and the traffic signal shall be coordinated with adjacent traffic signals on Donohoe Street.

With all these proposed improvements, the intersection of US 101 northbound off ramp and Donohoe Street is expected to operate at acceptable levels during the AM peak hour. During the PM peak hour, the intersection would continue to operate at an unacceptable LOS F. However, the average delay would be lower than under cumulative no project conditions.

20. East Bayshore Road and Donohoe Street

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The recommended Donohoe Street improvements at Euclid Avenue, at the US 101 northbound on ramp, at University Avenue, at the US 101 northbound off ramp, and at Cooley Avenue would improve traffic flow on Donohoe Street and reduce delay at the East Bayshore/Donohoe intersection. The intersection would continue to operate at an unacceptable LOS F during the AM and PM peak hours under cumulative plus project conditions with the recommended improvements. However, the average delay per vehicle would be lower than under cumulative no project conditions during the AM and PM peak hours.

21. Clarke Avenue and Bay Street

Mitigation: Cumulative conditions assume the installation of a traffic signal at this intersection, which was identified as a mitigation measure in the Ravenswood/Four Corners TOD Specific Plan DEIR.

Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact during the AM peak hour even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

The construction of the planned loop road would reduce the traffic volume at the Clarke/Bay intersection causing a decrease in the average vehicle delay during both peak hours. With the loop road, the intersection would operate at an acceptable LOS D during the AM and PM peak hours under cumulative plus project conditions. Therefore, construction of the loop road would fully mitigate the impact at this intersection.

Freeway Segment Impacts

The analysis of freeway segments shows that the project would not cause significant impact at any of the study freeway segments in San Mateo or Santa Clara County

Potential Impacts on Pedestrians, Bicycles and Transit

The project site plan shows that the project would provide new sidewalk along its frontage on Pulgas Avenue and would connect to the existing sidewalk. However, there is a small segment on the west side of Pulgas Avenue immediately north of Bay Road that has no sidewalk. It is recommended that a new sidewalk be constructed to connect the project site to the nearest bus stops on Bay Road.

New traffic signals are proposed at several study intersections to mitigate significant cumulative impacts on intersection levels of service. Along with a new traffic signal, appropriate pedestrian and bicycle accommodations should be provided. This includes crosswalks, pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops.

Designated bicycles facilities in the immediate vicinity of the project site include bike lanes on Bay Road west of Clarke Avenue and the Bay Trail, a bike and pedestrian path that runs along the west boundary of the Baylands Nature Preserve area about one quarter mile east of the project site. There is also a short paved mixed-use trail known as the Rail Spur that extends from Bay Road to Pulgas Avenue. The bicycle facilities in the vicinity of the project site are not well-connected. However, many of the residential streets south of the project site are conducive to bicycle travel due to their low traffic volumes and low speeds. The East Palo Alto General Plan 2035 shows planned Class II bike lanes along the entirety of Bay Road and Pulgas Avenue. The General Plan also highlights planned Class III bike routes along Weeks Street, Cooley Avenue, East Bayshore Road, Euclid Avenue, and Runnymede Street between Cooley Avenue and Euclid Avenue. These additions to the bicycle network would improve bike access to the site.

The existing pavement width on Bay Road between Clarke and Pulgas Avenues is adequate to allow for the addition of bike lanes by restriping. Additional right of way and roadway widening would be needed in order to provide the planned bike lanes on Bay Road east of Pulgas Avenue in addition to the recommended sidewalks and westbound left-turn lane. The City should work with property owners adjacent to Bay Road east of Pulgas Avenue to ensure the construction of the planned bike lanes as properties are redeveloped.

The existing pavement width on Pulgas Avenue south of Bay Road is sufficient to accommodate the addition of bike lanes and a northbound left-turn lane. This improvement would require the elimination of on-street parking on both sides of Pulgas Avenue.

Vehicle Miles Travelled (VMT) Analysis

The average VMT per worker in San Mateo County is 27.10, and the average VMT per worker in East Palo Alto is 27.89. Thus, the average forecasted daily VMT of 28.72 miles per worker for the project area is 6 percent greater than the Countywide average and 3 percent greater than the Citywide average VMT per worker.

While the MTC model provides the average VMT per capita for the project's zone, that does not mean that the project's VMT per capita would match that of the project's zone. VMT for a specific project is affected by a number of factors including location, development density, land use diversity, multimodal infrastructure, parking policies/pricing, and TDM programs. The project will implement a TDM plan that will reduce vehicle trips by at least 25 percent below a typical office development, which would reduce the project's VMT by a similar amount.

Turn Pocket Queuing Analysis

The estimated 95th percentile queue for the southbound left-turn movement at the intersection of University Avenue and Bay Road exceeds the existing vehicle storage capacity by at least two vehicles during the AM and PM peak hours under existing conditions. The addition of project traffic would cause the 95th percentile queue to increase by one vehicle during the AM peak hour. The project would not cause a noticeable increase in vehicle queues during the PM peak hour. A second left-turn lane on southbound University Avenue was identified as a mitigation measure in the Ravenswood/4 Corners TOD Specific Plan EIR and is assumed under cumulative conditions. Even so, the estimated 95th percentile queue length under cumulative conditions is expected to exceed the storage in the dual left-turn lanes. The dual turn pocket cannot be extended because it is end-to-end with the northbound left-turn pocket leading to the East Palo Alto Library.

Under existing and existing plus project conditions, the eastbound left-turn pocket at the intersection of Pulgas Avenue and Bay Road is expected to provide adequate storage under existing conditions and existing plus project conditions during the AM and PM peak hours. The analysis of the cumulative and cumulative plus project conditions reflect the planned signalization. The estimated 95th percentile queue exceeds the existing vehicle storage capacity by at least two vehicles during the AM peak hour under cumulative no project conditions. The addition of project traffic would cause the 95th percentile queue to exceed the available storage by five vehicles during the AM peak hour and by one vehicle during the PM peak hour. The left-turn pocket could be extended by eliminating a segment of the existing landscaped median.

Vehicular Site Access and Circulation

Site Access

Vehicular site access was evaluated to determine the adequacy of the site driveway with regard to traffic volumes. Based on the traffic expected to be generated by the proposed office building, the center driveway would operate acceptably with only a single lane in and a single lane out. The provision of additional driveway lanes may be needed if/when future development occurs that would increase the usage of the proposed garage.

It is recommended that the driveway ramp be modified to include flat landing pads immediately adjacent to Pulgas Avenue and at the garage gate control positions. Furthermore, the retaining walls adjacent to the center driveway must be low enough to avoid obscuring the view of drivers exiting the garage as well as pedestrians walking on the sidewalk adjacent Pulgas Avenue.

> **Recommendation:** Prior to final design, the driveway widths, ramp slope, radii and throat depth should be measured to confirm that they comply with City of East Palo Alto standards and are adequate to handle truck traffic. In order to ensure there would be sufficient sight distance at the project driveways, any landscaping, hardscape elements, parking, and signage location should be consistent with City of East Palo Alto vision triangle standards.

On-Site Circulation

The on-site circulation was reviewed in accordance with generally accepted traffic engineering standards. Generally, the underground parking garage would provide adequate connectivity for vehicles.

The garage site plan shows that the center driveway ramp would intersect the eastern most parking aisle creating two dead end aisles each approximately 200 to 250 feet long. Long dead end aisles should be avoided whenever possible since it is difficult for drivers to determine if there is a parking space available before committing to driving down the dead end aisle. Vehicles that do not find an available space would have to back out of the aisle or complete a multi-point turn as there is not sufficient space to easily turn around at the end of the aisle. Furthermore, as currently shown, it would be difficult for drivers who park in a space at the end of dead-end aisle to exit the space since there is no room for them to turn while backing up.

The orientation of the secondary garage ramp along the southern edge of the site is problematic. As shown, this ramp would be directly parallel and adjacent to the service road. The perimeter service road is shown to have two-way circulation around the site except for the segment immediately adjacent to the garage ramp, which is shown with one-way (clockwise) circulation. The one-way circulation would be required at this location to avoid conflicts between vehicles coming up the ramp and vehicles traveling in the same (easterly) direction along the service road. However, the site plan does not show any logical transition from two-way to one-way flow on the service road. It is recommended that the northern and western segments of the service road be converted to one-way (clockwise) circulation or that space be added at the southwest corner of the site where the service road changes from two-way to one-way flow to allow vehicles traveling in a counterclockwise direction to turn around. In addition, the orientation of the secondary ramp would lead to vehicle conflicts at the foot of the ramp in the underground parking garage where the ramp would be immediately adjacent and parallel to an east-west drive aisle. Vehicles coming down the ramp would not be able to see vehicles approaching along the adjacent drive aisle and vice versa. Furthermore, the unusual geometry may lead to driver confusion over who has the right of way. It is recommended that the site plan be modified to improve the ramp connections to the perimeter service road and to the underground parking garage.

The site plan shows a truck loading area adjacent to the southwest corner of the proposed office building that would be accessed via the perimeter service road. The site plan also includes a passenger loading zone with space for about two vehicles along the south side of the service road near the northern edge of the site. This location is not very convenient as it is about 400 feet from the proposed building entries and there are no pedestrian pathways leading to the passenger loading zone. The dimensions of the freight and passenger loading spaces are not listed on the site plan. East Palo Alto's development code requires offices greater than 90,000 s.f. to provide three loading spaces for equipment and materials (each measuring 10 ft wide x 40 ft long x 14 ft of vertical clear space) and three passenger loading spaces (each 10 ft wide x 20 ft long x 12 ft of vertical clear space).

> **Recommendation:** The site plan should be modified to ensure adequate on-site circulation for vehicles, pedestrians, and bicycles. In particular, the site plan should avoid dead-end aisles, prevent vehicle conflicts at the top and bottom of garage ramps, and ensure that drive aisle and loading space dimensions comply with City of East Palo Alto standards.

Parking Analysis

City of East Palo Alto Parking Code Requirements

The required parking supply was determined using the parking rates specified in the East Palo Alto Municipal Code Section 18.30.050 (A). For office developments, the City Code requires 1 parking space per 300 square feet. The same parking requirement is set forth for professional office space in the Waterfront Office land use district within the Ravenswood/4 Corners TOD Specific Plan. The proposed office building would contain 100,000 square feet. Therefore, the project would require 334 parking spaces. The project proposes to provide a total of 668 parking spaces, which would meet the City's standard parking requirement. The site plan does not show the dimensions of vehicle parking spaces nor any bicycle parking.

> **Recommendation:** Prior to final design, the vehicle parking space dimensions should be measured to confirm that they comply with City of East Palo Alto standards. Furthermore, bicycle parking should be added in accordance with the bicycle parking requirements set forth in the Ravenswood/4 Corners TOD Specific Plan.

Table ES- 1
Intersection Level of Service Summary under Existing Conditions

							Existing Plus Project								Existing Plus Project - Mitigated			
					Existing		without Loop Road				with Loop Road				without Loop Road		with Loop Road	
#	Intersection	LOS Standards	Peak Hour	Count Date	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS
1	University Avenue and Bayfront Expressway [Menlo Park] (CMP)	D	AM	04/25/19	**>80***	**F**	**>80***	**F**	0.2	n/a	--	--	--	--				
			PM	04/25/19	**263.0**	**F**	**265.1**	**F**	2.1	n/a	--	--	--	--				
2	University Avenue and Loop Road [Future Signal]	D	AM	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.0	A	n/a	n/a	n/a	n/a		
			PM	n/a	n/a	n/a	n/a	n/a	n/a	n/a	6.8	A	n/a	n/a	n/a	n/a		
3	University Avenue and Purdue Avenue [5]	D	AM	05/21/19	18.9	C	19.0	C	n/a	n/a	17.6	C	n/a	n/a				
	(One-way Stop [1])		PM	05/21/19	**47.5**	**E**	**48.1**	**E**	n/a	n/a	**42.2**	**E**	n/a	n/a				
4	University Avenue and Bay Road	D	AM	04/17/19	41.7	D	43.9	D	7.9	0.032	42.8	D	2.0	0.026				
			PM	04/16/19	48.4	D	48.8	D	0.7	0.010	46.8	D	-2.7	-0.038				
5	Euclid Avenue and Donohoe Street/East Bayshore Road [2,4]	D	AM	05/21/19	**52.3**	**F**	**114.6**	**F**	n/a	n/a	--	--	--	--	45.7	D	45.7	D
	(All-way Stop)		PM	05/21/19	32.6	D	32.6	D	n/a	n/a	--	--	--	--	12.1	B	12.1	B
6	US 101 NB On-Ramp/University Plaza Ph II dwy & Donohoe St [2,3,4]	D	AM	05/21/19	**64.7**	**F**	**69.7**	**F**	n/a	n/a	--	--	--	--	26.5	C	26.5	C
	(Uncontrolled)		PM	05/21/19	10.2	B	9.7	B	n/a	n/a	--	--	--	--	23.3	C	23.3	C
7	Demeter Street and Bay Road	D	AM	05/09/19	10.2	C	10.4	C	n/a	n/a	17.0	C	1.6	0.202				
	(Two-way Stop [1])		PM	05/09/19	13.0	C	13.4	C	n/a	n/a	17.2	C	0.7	0.107				
8	Pulgas Avenue and Bay Road	D	AM	02/28/19	13.8	B	26.6	D	n/a	n/a	--	--	--	--	11.5	B	11.5	B
	(Two-way Stop [1])		PM	02/28/19	32.4	D	**56.0**	**F**	n/a	n/a	--	--	--	--	18.5	C	18.5	C
9	Pulgas Avenue and Weeks Street [4]	D	AM	05/09/19	12.5	B	12.9	B	n/a	n/a	--	--	--	--				
	(Two-way Stop [1])		PM	05/09/19	13.7	B	13.8	B	n/a	n/a	--	--	--	--				
10	Pulgas Avenue and Runnymede Street [4]	D	AM	05/09/19	15.0	C	16.1	C	1.0	0.051	--	--	--	--				
	(All-way Stop)		PM	05/09/19	16.4	C	16.6	C	0.2	0.004	--	--	--	--				
11	Pulgas Avenue and O'Connor Street	D	AM	05/09/19	13.6	B	13.9	B	0.2	0.006	--	--	--	--				
	(All-way Stop)		PM	05/09/19	15.7	C	15.9	C	0.2	0.003	--	--	--	--				
12	Pulgas Avenue and East Bayshore Road	D	AM	09/25/18	19.9	B	20.1	C	0.0	-0.001	--	--	--	--				
			PM	09/25/18	23.9	C	24.5	C	0.7	0.006	--	--	--	--				
13	Embarcadero Road and East Bayshore Road [City of Palo Alto]	D	AM	04/17/19	33.8	C	33.6	C	-0.3	-0.001	--	--	--	--				
			PM	04/16/19	**81.2**	**F**	**81.5**	**F**	0.6	0.000	--	--	--	--				
14	University Avenue and Donohoe Street [2]	D	AM	04/17/19	**107.9**	**F**	**116.0**	**F**	n/a	n/a	--	--	--	--	**90.1**	**F**	**90.1**	**F**
			PM	04/16/19	**74.9**	**E**	**82.2**	**F**	n/a	n/a	--	--	--	--	47.7	D	47.7	D
15	University Avenue and US101 SB Ramps [2]	D	AM	05/21/19	**99.2**	**F**	**105.7**	**F**	n/a	n/a	--	--	--	--	48.7	D	48.7	D
			PM	05/21/19	**87.4**	**F**	**100.4**	**F**	n/a	n/a	--	--	--	--	40.1	D	40.1	D

Table ES- 1 (continued)
Intersection Level of Service Summary under Existing Conditions

							Existing Plus Project								Existing Plus Project - Mitigated			
					Existing		without Loop Road				with Loop Road				without Loop Road		with Loop Road	
#	Intersection	LOS Standards	Peak Hour	Count Date	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS
16	University Avenue and Woodland Avenue [2]	D	AM	04/17/19	**66.1**	**E**	**66.0**	**E**	n/a	n/a	--	--	--	--	42.5	D	42.5	D
			PM	04/16/19	**248.0**	**F**	**280.6**	**F**	n/a	n/a	--	--	--	--	**84.9**	**F**	**84.9**	**F**
17	University Circle and Woodland Ave [2]	D	AM	05/21/19	18.7	B	18.2	B	n/a	n/a	--	--	--	--	13.5	B	13.5	B
			PM	05/21/19	**126.8**	**F**	**163.8**	**F**	n/a	n/a	--	--	--	--	18.2	B	18.2	B
18	US 101 NB Off-Ramp/University Plaza Ph I dwy and Donohoe St [2]	D	AM	05/21/19	49.3	D	**70.3**	**E**	n/a	n/a	--	--	--	--	12.5	B	12.5	B
			PM	05/21/19	**142.6**	**F**	**165.0**	**F**	n/a	n/a	--	--	--	--	38.8	D	38.8	D
19	Cooley Avenue and Donohoe Street [2]	D	AM	05/21/19	31.8	C	48.8	D	n/a	n/a	--	--	--	--	16.8	B	16.8	B
			PM	05/21/19	36.6	D	34.2	C	n/a	n/a	--	--	--	--	21.7	C	21.7	C
20	East Bayshore Road and Donohoe Street [2]	D	AM	05/21/19	32.9	C	**69.1**	**E**	n/a	n/a	--	--	--	--	10.5	B	10.5	B
			PM	05/21/19	38.2	D	27.8	C	n/a	n/a	--	--	--	--	12.9	B	12.9	B
21	Clarke Avenue and Bay Road	D	AM	05/09/19	16.0	C	18.1	C	2.1	0.033	15.7	C	-0.4	-0.061				
	(All-way Stop)		PM	05/09/19	19.9	C	21.0	C	1.1	0.010	18.7	C	-1.2	-0.013				
22	Clarke Avenue and Weeks Street	D	AM	05/09/19	14.7	B	14.8	B	n/a	n/a	--	--	--	--				
	(Two-way Stop [1])		PM	05/09/19	16.0	C	16.0	C	n/a	n/a	--	--	--	--				
23	Clarke Avenue and Runnymede Street	D	AM	05/09/19	16.1	C	16.2	C	0.1	0.003	--	--	--	--				
	(All-way Stop)		PM	05/09/19	13.3	B	13.3	B	0.0	0.001	--	--	--	--				
24	Clarke Avenue and Donohoe Street	D	AM	05/09/19	17.8	C	17.8	C	0.0	0.000	--	--	--	--				
	(All-way Stop)		PM	05/09/19	18.5	C	18.5	C	0.0	0.000	--	--	--	--				
25	Clarke Avenue and East Bayshore Road	D	AM	09/25/18	13.9	B	13.9	B	0.0	0.000	--	--	--	--				
			PM	09/25/18	10.7	B	10.7	B	0.0	0.000	--	--	--	--				

Notes:
* Indicates LOS based on "unserved demand." At this location, upstream & downstream congestion results in delay not captured by the VISTRO analysis.
For intersection 1, the increase in delay column shows the increase of average delay at the intersection.
Bold indicates a substandard level of service.
Box indicates a significant project impact.
OVFL indicates that the result is out of software calculation limits
-- indicates that the intersection level of service and delay with the loop road is the same as without the loop road.
1. For one-way and two-way stop controlled intersections, the average delay and LOS is reported for the worst approach. Changes in critical delay and v/c for the entire intersection cannot be calculated (n/a).
2. Intersections were analyzed using Synchro/SimTraffic software due to the close proximity of these intersections. Changes in critical delay and v/c cannot be calculated (n/a).
3. Delay shown is the average delay for the westbound left-turning vehicles, which have to find gaps in the eastbound traffic flow.
4. Average delay and LOS under mitigated existing plus project and mitigated cumulative plus project with loop road and other improvements reflects signalization.

Table ES- 2
Intersection Level of Service Summary under Cumulative Conditions

#	Intersection	LOS Standards	Peak Hour	Cumulative No Project without Loop Road Avg Delay (sec/veh)	Cumulative No Project without Loop Road LOS	Cumulative Plus Project without Loop Road Avg Delay (sec/veh)	Cumulative Plus Project without Loop Road LOS	Cumulative Plus Project Incr. In Crit. Delay	Cumulative Plus Project Incr. In Crit. V/C	Mitigated Cumulative Plus Project Loop Road Avg Delay (sec/veh)	Mitigated Cumulative Plus Project Loop Road LOS	Mitigated Cumulative Plus Project Loop Road + Other Improvments Avg Delay (sec/veh)	Mitigated Cumulative Plus Project Loop Road + Other Improvments LOS
1	University Avenue and Bayfront Expressway [Menlo Park] (CMP)	D	AM	**92.4**	**F**	**94.0**	**F**	1.6	n/a				
			PM	**OVFL**	**F**	**OVFL**	**F**	2.2	n/a				
2	University Avenue and Loop Road [Future Signal]	D	AM							15.5	B	14.2	B
			PM							**74.3**	**E**	38.6	D
3	University Avenue and Purdue Avenue [5]	D	AM	17.5	B	17.5	B	0.1	0.005	12.8	B		
	(One-way Stop [1])		PM	37.9	D	38.4	D	0.6	0.002	12.7	B		
4	University Avenue and Bay Road	D	AM	**64.6**	**E**	**70.5**	**E**	6.9	0.024	**65.2**	**E**	46.7	D
			PM	**92.8**	**F**	**94.0**	**F**	2.2	0.005	**74.5**	**E**	**72.8**	**E**
5	Euclid Avenue and Donohoe Street/East Bayshore Road [2,4]	D	AM	**348.7**	**F**	**349.4**	**F**					**214.9**	**F**
	(All-way Stop)		PM	**99.4**	**F**	**92.6**	**F**					12.7	B
6	US 101 NB On-Ramp/University Plaza Ph II dwy & Donohoe St [2,3,4]	D	AM	**OVFL**	**F**	**OVFL**	**F**					18.4	B
	(Uncontrolled)		PM	**OVFL**	**F**	**OVFL**	**F**					22.4	C
7	Demeter Street and Bay Road [5]	D	AM	20.8	C	20.8	C	0.4	0.034	33.0	C		
	(Two-way Stop [1])		PM	38.2	D	39.4	D	2.6	0.015	35.9	D		
8	Pulgas Avenue and Bay Road [5]	D	AM	**100.0**	**F**	**103.4**	**F**	9.5	0.024	**106.1**	**F**	**57.9**	**E**
	(Two-way Stop [1])		PM	**266.5**	**F**	**283.5**	**F**	30.7	0.068	**282.2**	**F**	45.1	D
9	Pulgas Avenue and Weeks Street [4]	D	AM	**OVFL**	**F**	**OVFL**	**F**	n/a	n/a	**OVFL**	**F**	15.2	B
	(Two-way Stop [1])		PM	**OVFL**	**F**	**OVFL**	**F**	n/a	n/a	**OVFL**	**F**	10.0	B
10	Pulgas Avenue and Runnymede Street [4]	D	AM	**291.4**	**F**	**309.2**	**F**	17.8	0.075			32.7	C
	(All-way Stop)		PM	**179.6**	**F**	**184.2**	**F**	4.7	-0.001			15.3	B
11	Pulgas Avenue and O'Connor Street	D	AM	**118.5**	**F**	**123.8**	**F**	5.4	0.000			32.5	C
	(All-way Stop)		PM	**147.1**	**F**	**150.9**	**F**	3.9	0.024			30.1	C
12	Pulgas Avenue and East Bayshore Road	D	AM	38.9	D	41.3	D	3.6	0.014				
			PM	**136.0**	**F**	**138.5**	**F**	2.7	0.006				
13	Embarcadero Road and East Bayshore Road [City of Palo Alto]	D	AM	43.1	D	42.9	D	-0.4	-0.001				
			PM	**166.2**	**F**	**168.7**	**F**	2.8	0.007				
14	University Avenue and Donohoe Street [2]	D	AM	**176.5**	**F**	**172.6**	**F**					**83.3**	**F**
			PM	**121.5**	**F**	**124.9**	**F**					**88.9**	**F**
15	University Avenue and US101 SB Ramps [2]	D	AM	**159.8**	**F**	**156.9**	**F**					116.2	**F**
			PM	**138.7**	**F**	**138.3**	**F**					**115.6**	**F**

Table ES- 2 (continued)
Intersection Level of Service Summary under Cumulative Conditions

				Cumulative No Project		Cumulative Plus Project				Mitigated Cumulative Plus Project			
				without Loop Road		without Loop Road				Loop Road		Loop Road + Other Improvments	
#	Intersection	LOS Standards	Peak Hour	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS
16	University Avenue and Woodland Avenue [2]	D	AM	**282.1**	**F**	**258.7**	**F**					86.2	**F**
			PM	**OVFL**	**F**	**OVFL**	**F**					**136.8**	**F**
17	University Circle and Woodland Ave [2]	D	AM	**128.5**	**F**	**121.3**	**F**					**57.1**	**F**
			PM	**OVFL**	**F**	**OVFL**	**F**					**OVFL**	**F**
18	US 101 NB Off-Ramp/University Plaza Ph I dwy and Donohoe St [2]	D	AM	**OVFL**	**F**	**OVFL**	**F**					38.3	D
			PM	**OVFL**	**F**	**OVFL**	**F**					**249.9**	**F**
19	Cooley Avenue and Donohoe Street [2]	D	AM	**155.5**	**F**	**158.9**	**F**					33.9	C
			PM	46.2	D	47.2	D					43.2	D
20	East Bayshore Road and Donohoe Street [2]	D	AM	**OVFL**	**F**	**OVFL**	**F**					**102.9**	**F**
			PM	**OVFL**	**F**	**OVFL**	**F**					**200.7**	**F**
21	Clarke Avenue and Bay Road [5]	D	AM	**110.1**	**F**	**121.9**	**F**	15.9	0.036	48.1	D		
	(All-way Stop)		PM	**74.8**	**E**	**78.5**	**E**	5.2	0.013	41.4	D		
22	Clarke Avenue and Weeks Street	D	AM	**107.0**	**F**	**109.3**	**F**	n/a	n/a	**89.6**	**F**		
	(Two-way Stop [1])		PM	34.1	D	34.3	D	n/a	n/a	32.9	D		
23	Clarke Avenue and Runnymede Street	D	AM	**80.2**	**F**	**81.2**	**F**	1.0	0.001				
	(All-way Stop)		PM	28.6	D	28.7	D	0.1	0.001				
24	Clarke Avenue and Donohoe Street	D	AM	**90.8**	**F**	**90.8**	**F**	0.0	0.000				
	(All-way Stop)		PM	**80.1**	**F**	**80.3**	**F**	0.2	0.000				
25	Clarke Avenue and East Bayshore Road	D	AM	14.7	B	14.7	B	0.0	0.000				
			PM	11.4	B	11.4	B	0.0	0.000				

Notes:
* Indicates LOS based on "unserved demand." At this location, upstream & downstream congestion results in delay not captured by the VISTRO analysis.
For intersection 1, the increase in delay column shows the increase of average delay at the intersection.
Bold indicates a substandard level of service.
Box indicates a significant project impact.
OVFL indicates that the result is out of software calculation limits
-- indicates that the intersection level of service and delay with the loop road is the same as without the loop road.
1. For one-way and two-way stop controlled intersections, the average delay and LOS is reported for the worst approach. Changes in critical delay and v/c for the entire intersection cannot be
2. Intersections were analyzed using Synchro/SimTraffic software due to the close proximity of these intersections. Changes in critical delay and v/c cannot be calculated (n/a).
3. Delay shown is the average delay for the westbound left-turning vehicles, which have to find gaps in the eastbound traffic flow.
4. Average delay and LOS under mitigated existing plus project and mitigated cumulative plus
5. A new traffic signal is assumed under cumulative conditions based on mitigation measures

1. Introduction

This report presents the results of the traffic study prepared for the proposed office development located at 2519 and 2535 Pulgas Avenue in East Palo Alto, California (see Figure 1). A portion of the project site is currently occupied by Toubar Equipment Company, which will be removed by the project. The remainder of the project site is currently vacant. The proposed project would construct 100,000 square feet (s.f.) of office space at 2519 Pulgas Avenue. The new office space is expected to be occupied by JobTrain (50,000 s.f.), Ravenswood Family Health Center (25,000 s.f.), and an Emerson Collective entity or another office tenant (25,000 s.f.). The project will also include underground parking spanning the entire site.

Vehicular access to and from the project site would be provided via three driveways on Pulgas Avenue (see Figure 2). The site is within the Ravenswood/4 Corners TOD Specific Plan area and is zoned as Ravenswood Employment Center.

Scope of Study

The purpose of the traffic study is to identify any impacts of the proposed project and to recommend improvements, if necessary. The impacts of the project were evaluated following the standards and methodologies set forth by the Cities of East Palo Alto, Palo Alto, and Menlo Park, and the City/County Association of Governments of San Mateo County (C/CAG). C/CAG administers the San Mateo County Congestion Management Program (CMP). The traffic study includes an analysis of AM and PM peak hour traffic conditions during weekdays at the following 25 study intersections in the vicinity of the project site.

1. University Avenue (SR 109) and Bayfront Expressway (SR 84) [CMP] (Menlo Park)
2. University Avenue (SR 109) and Loop Road (future)
3. University Avenue (SR 109) and Purdue Avenue (unsignalized)
4. University Avenue and Bay Road
5. Euclid Avenue and East Bayshore Road/Donohoe Street (unsignalized)
6. US 101 NB On-Ramp/ University Plaza Phase II driveway (future) and Donohoe Street (unsignalized)
7. Demeter Street and Bay Road (unsignalized)
8. Pulgas Avenue and Bay Road (unsignalized)
9. Pulgas Avenue and Weeks Street (unsignalized)
10. Pulgas Avenue and Runnymede Street (unsignalized)
11. Pulgas Avenue and O’Connor Street (unsignalized)
12. Pulgas Avenue and East Bayshore Road
13. Embarcadero Road and East Bayshore Road (Palo Alto)

14. University Avenue and Donohoe Street
15. University Avenue and US 101 SB Ramps
16. University Avenue and Woodland Avenue
17. University Circle and Woodland Avenue
18. US 101 NB Off Ramp/University Plaza Phase I driveway and Donohoe Street
19. Cooley Avenue and Donohoe Street
20. East Bayshore Road and Donohoe Street
21. Clarke Avenue and Bay Road (unsignalized)
22. Clarke Avenue and Weeks Street (unsignalized)
23. Clarke Avenue and Runnymede Street (unsignalized)
24. Clarke Avenue and Donohoe Street (unsignalized)
25. Clarke Avenue and East Bayshore Road

Figure 1
Site Location and Study Intersections

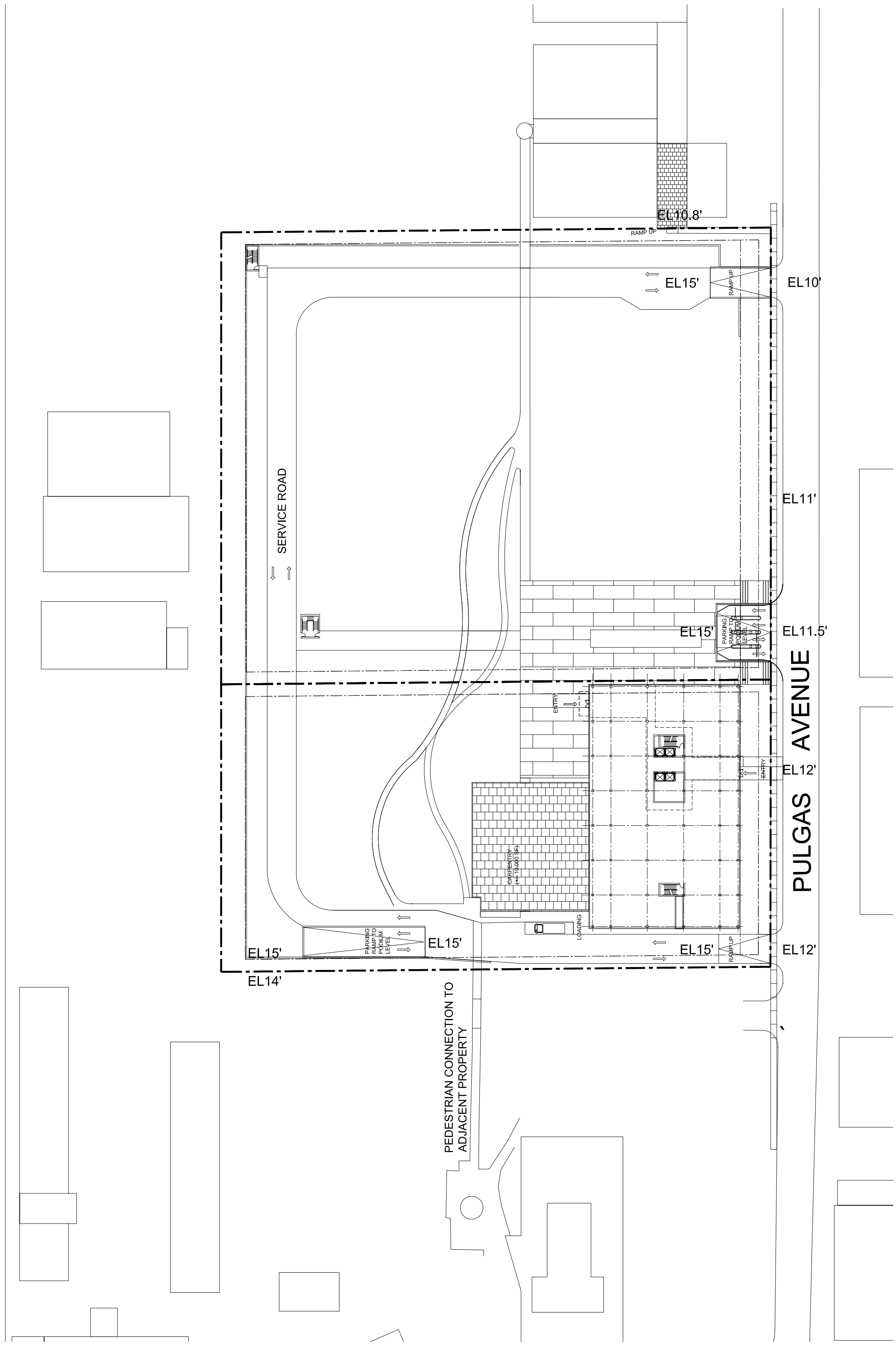


Figure 2A
Site Plan-Ground Level

HEXAGON

NORTH
Not to Scale

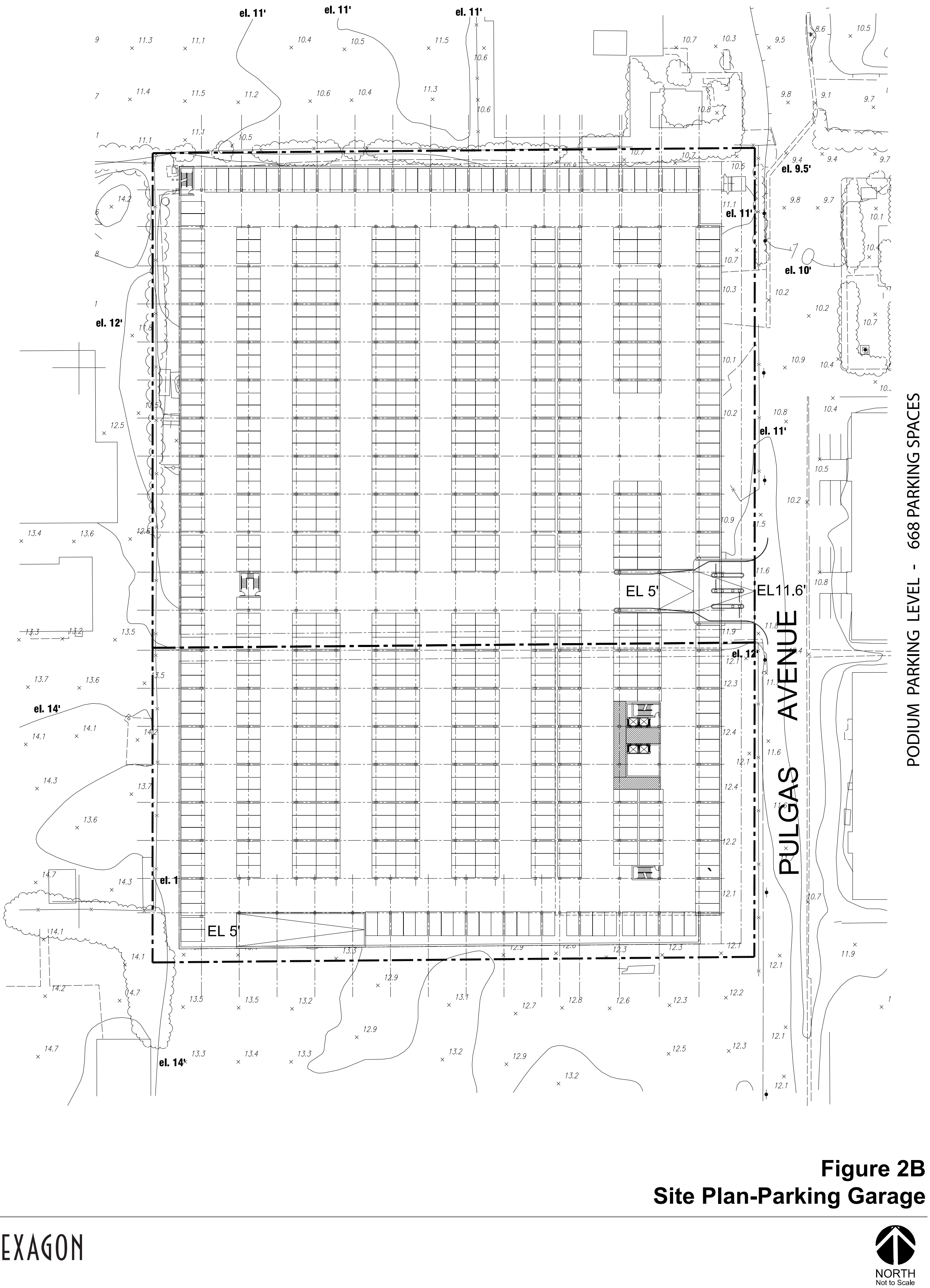


Figure 2B
Site Plan-Parking Garage

In addition, the following key freeway segments were also evaluated:

- SR 84, between University Avenue and the Alameda County Line (Dumbarton Bridge)
- US 101, between Whipple Avenue and Santa Clara County Line
- US 101, between Embarcadero Road and Oregon Expressway
- US 101, between Oregon Expressway and San Antonio Road
- US 101, between San Antonio Road and Rengstorff Avenue

The study also evaluated on ramp queues at the US 101/University Avenue interchange.

Traffic conditions at the intersections were analyzed for the weekday AM and PM peak hours of traffic. The AM peak hour of traffic is between 7:00 and 9:00 AM, and the PM peak hour is between 4:00 and 6:00 PM. It is during these periods that the most congested traffic conditions occur on an average day.

Traffic conditions were evaluated for the following scenarios:

Scenario 1: *Existing Conditions.* Existing traffic conditions are based on traffic counts conducted in 2018 to 2019.

Scenario 2: *Existing Plus Project Conditions*. Existing plus project traffic volumes were estimated by adding to existing traffic volumes the trips associated with the proposed project. Two existing plus project scenarios were evaluated to assess traffic conditions both with and without the loop road identified in the Ravenswood Four Corners TOD Specific Plan.

Scenario 3: *2040 Cumulative Conditions.* Cumulative conditions represent future traffic volumes with all foreseeable development expected to occur by the year 2040 on the future transportation network. Cumulative traffic volumes were estimated by applying a growth factor (1.2 percent per year) for 22/21 years to existing (2018/2019) traffic volumes to account for regional growth and adding trips associated with the development allowed under the Ravenswood Specific Plan and other approved and pending development projects in the City of East Palo Alto other than the proposed project.

Scenario 4: *2040 Cumulative Plus Project Conditions.* Cumulative plus project conditions reflect the projected traffic volumes with implementation of the project. Projected peak-hour traffic volumes were estimated by adding to cumulative traffic volumes the additional traffic generated by the project. Cumulative plus project conditions were evaluated relative to cumulative no project conditions in order to determine potential impacts. The planned loop road was evaluated as a possible mitigation measure along with other improvements.

Methodology

This section describes the methods used to determine the traffic conditions for each scenario described above. It includes descriptions of the data requirements, the analysis methodologies, and the applicable level of service standards.

Data Requirements

The data required for the analysis were obtained from new traffic counts, the City of East Palo Alto, the City of Menlo Park, the City of Palo Alto and field observations. The following data were collected from these sources:

- Existing traffic, bicycle, and pedestrian volumes
- Existing intersection lane configurations
- Existing signal timi+ng and phasing
- A list of approved and pending projects

Analysis Methodologies and Level of Service Standards

Traffic conditions were evaluated using level of service (LOS). *Level of Service* is a qualitative description of operating conditions ranging from LOS A, or free-flow conditions with little or no delay, to LOS F, or forced-flow conditions with extreme delays. The City of East Palo Alto level of service standard for all intersections is LOS D or better. The City of Menlo Park has established LOS D as the minimum acceptable level of service for arterial intersections including the study intersection in Menlo Park. The City of Palo Alto level of service standard for signalized intersections is LOS D or better.

Microscopic Simulation of Study Intersections

Due to the close proximity of selected study intersections, nine study intersections in the vicinity of the US 101/University Avenue interchange were analyzed using the Synchro/SimTraffic 9 software. Unlike macroscopic models of isolated intersection operations such as the *Highway Capacity Manual* methodology, SimTraffic is a microscopic model that measures the full impact of queuing and blocking. This software also provides a visual animation of the traffic operations. Simulated delay values were correlated to the level of service definitions set forth in the *2000 Highway Capacity Manual* (CHM) methodology.

Macroscopic Analysis of Signalized Intersections

The remaining three signalized study intersections in the City of East Palo Alto and one study intersection in the City of Palo Alto were evaluated using the TRAFFIX software based on the 2000 HCM methodology. Traffic operations at the University Avenue/Bayfront Expressway intersection in the City of Menlo Park were evaluated using the VISTRO software based on the level-of-service method described in the *2010 HCM*. The *2010 HCM* evaluates signalized intersection operations on the basis of average control delay time for all vehicles at the intersection. Table 1 shows the level of service definitions for signalized intersections.

Table 1
Signalized Intersection Level of Service Definitions Based on Control Delay

Level of Service	Description	Average Control Delay Per Vehicle (sec.)
A	Signal progression is extremely favorable. Most vehicles arrive during the green phase and do not stop at all. Short cycle lengths may also contribute to the very low vehicle delay.	10.0 or less
B	Operations characterized by good signal progression and/or short cycle lengths. More vehicles stop than with LOS A, causing higher levels of average vehicle delay.	10.1 to 20.0
C	Higher delays may result from fair signal progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, though may still pass through the intersection without stopping.	20.1 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable signal progression, long cycle lengths, or high volume-to-capacity (V/C) ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 to 55.0
E	This is considered to be the limit of acceptable delay. These high delay values generally indicate poor signal progression, long cycle lengths, and high volume-to-capacity (V/C) ratios. Individual cycle failures occur frequently.	55.1 to 80.0
F	This level of delay is considered unacceptable by most drivers. This condition often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. Poor progression and long cycle lengths may also be major-contributing causes of such delay levels.	greater than 80.0

Source: Transportation Research Board, *2000 Highway Capacity Manual* (Washington, D.C., 2000) p10-16.

Unsignalized Intersections

Peak-hour levels of motor vehicle delay at 11 unsignalized study intersections were estimated using the method described in Chapter 17 of the *2000 Highway Capacity Manual*. With this method, operations are defined by the average control delay per vehicle (measured in seconds) for each movement that must yield the right-of-way. At side-street controlled intersections (two-way or one-way stop control), the control delay (and LOS) is reported for the approach with the highest delay. For all-way stop-controlled intersections, the average delay (and LOS) for all movements is reported. Table 2 summarizes the relationship between average control delay per vehicle and LOS for unsignalized intersections.

Table 2
Unsignalized Intersection Level of Service Definition Based on Average Delay

Level of Service	Description	Average Delay Per Vehicle (Sec.)
A	Little or no traffic delay	10.0 or less
B	Short traffic delays	10.1 to 15.0
C	Average traffic delays	15.1 to 25.0
D	Long traffic delays	25.1 to 35.0
E	Very long traffic delays	35.1 to 50.0
F	Extreme traffic delays	greater than 50.0

Source: Transportation Research Board, *2000 Highway Capacity Manual* (Washington, D.C., 2000) p17-2.

Queuing Analysis

The queuing analysis is used to determine the appropriate storage lengths for the high demand turn lanes where the project would add substantial number of trips to these movements. Vehicle queues were estimated using a Poisson probability distribution, which estimates the probability of "n" vehicles for a vehicle movement using the following formula:

$$\text{Probability } (X=n) = \frac{\lambda^n e^{-(\lambda)}}{n!}$$

Where:

Probability (X=n) = probability of "n" vehicles in queue per lane

n = number of vehicles in the queue per lane

λ = Average number of vehicles in queue per lane (vehicles per hour per lane/signal cycles per hour)

The basis of the analysis is as follows: (1) the Poisson probability distribution is used to estimate the 95th percentile maximum number of queued vehicles per signal cycle for a particular movement; (2) the estimated maximum number of vehicles in the queue is translated into a queue length, assuming 25 feet per vehicle; and (3) the estimated maximum queue length is compared to the existing or planned available storage capacity for the movement. This analysis thus provides a basis for estimating future storage requirements at intersections.

The 95th percentile queue length value indicates that during the peak hour, a queue of this length or less would occur on 95 percent of the signal cycles. Or, a queue length longer than the 95th percentile queue would only occur on 5 percent of the signal cycles (about 3 cycles during the peak hour for a signal with a 60-second cycle length). Therefore, left-turn storage pocket designs based on the 95th percentile queue length would ensure that storage space would be exceeded only 5 percent of the time. The 95th percentile queue length is also known as the "design queue length."

Freeway Segments

The Santa Clara /San Mateo County line is located between the Embarcadero Road and University Avenue interchanges on US 101. For this reason, the segments of US 101 between Rengstorff Avenue and Embarcadero Road were analyzed based on the Santa Clara CMP guidelines, and the segments of US 101 between Embarcadero Road and Whipple Avenue were analyzed based on San Mateo County CMP guidelines. The Santa Clara County CMP and San Mateo County CMP guidelines for freeway analysis are described below.

Santa Clara County Freeway CMP Guidelines

As prescribed in the CMP technical guidelines, the level of service for freeway segments is estimated based on vehicle density. Density is calculated by the following formula:

$$D = V / (N*S)$$

where:

D= density, in vehicles per mile per lane (vpmpl)

V= peak hour volume, in vehicles per hour (vph)

N= number of travel lanes

S= average travel speed, in miles per hour (mph)

The CMP requires that mixed-flow lanes and auxiliary lanes be analyzed separately from high-occupancy vehicle (HOV) lanes (otherwise known as carpool lanes). The CMP specifies that a capacity of 2,300 vehicles per hour per lane (vphpl) be used for segments three lanes or wider in one direction and a capacity of 2,200 vphpl be used for segments two lanes wide in one direction. HOV lanes are specified as having a capacity of 1,650 vphpl. The Santa Clara County CMP defines an acceptable level of service for freeway segments as LOS E or better.

San Mateo County Freeway CMP Guidelines

The City/County Association of Governments of San Mateo County (C/CAG) established LOS E as the minimum acceptable level of service for all segments of US 101 within San Mateo County, unless the segment was operating at LOS F in 1991 (the date when the CMP was first adopted), in which case the LOS standard is LOS F (Final San Mateo County Congestion Management Program, 2011). The LOS F standard was applied to the freeway segment on US 101 between Whipple Avenue and the Santa Clara County Line as this segment was operating at LOS F in 1991.

Report Organization

This report has a total of five chapters. Chapter 2 describes existing conditions, including the existing roadway network, transit service, bicycle and pedestrian facilities, and intersection operations. Chapter 3 describes the methods used to estimate the project traffic on the roadway network and presents the intersection operations under existing plus project conditions. Chapter 4 presents the intersection operations under cumulative conditions both without and with the proposed project. Chapter 5 provides an evaluation of other transportation-related issues, such as vehicle queuing, site access, and on-site circulation.

2.
Existing Conditions

This chapter describes the existing conditions for all of the major transportation facilities in the vicinity of the site, including the roadway network, transit service, and bicycle and pedestrian facilities.

Existing Roadway Network

Regional access to the project study area is provided by US 101 and SR 84. These facilities are described below.

US 101 is a north-south freeway in the vicinity of the site. US 101 extends northward through San Francisco and southward through San Jose. Within East Palo Alto, US 101 has three general-purpose travel lanes, one high-occupancy vehicle (HOV) lane, and one auxiliary lane in each direction. Access to and from the project study area is provided via full-access interchanges at Embarcadero Road and at University Avenue.

Bayfront Expressway (SR 84) is a six-lane expressway that extends along the northern edge of East Palo Alto. SR 84 extends eastward across the Dumbarton Bridge into Alameda County and westward through San Mateo County. Bayfront Expressway provides access to the project study area via University Avenue.

Local access to the project site is provided via University Avenue, Embarcadero Road, East Bayshore Road, Bay Road, Clarke Avenue, Pulgas Avenue, Donohoe Street, and Demeter Street. These facilities are described below.

University Avenue is a north-south arterial that extends from Stanford University in Palo Alto to Bayfront Expressway just north of the City of East Palo Alto. Within East Palo Alto, University Avenue is a four-lane divided roadway with no on-street parking. South of Bay Road, University Avenue has continuous sidewalks on both sides of the street. Between Bay Road and Purdue Avenue, University Avenue has a sidewalk on only one side of the street. The posted speed limit on University Avenue is 25 mph.

Embarcadero Road is a four-lane east-west arterial street. Embarcadero Road extends from El Camino Real in the west to the Baylands Nature Reserve in the east. With the exception of the Embarcadero Road overpass at US 101, where sidewalks are present on only the north side of the street, Embarcadero Road has continuous sidewalks on both sides of the street with no on-street parking. The posted speed limit on Embarcadero Road is 25 mph.

East Bayshore Road is a two-lane north-south frontage road with two disjointed segments directly east of US 101. East Bayshore Road extends southward from Saratoga Avenue near Willow Road to Euclid Avenue, where it becomes Donohoe Street. East of University Avenue, East Bayshore Road extends southward from Donohoe Street to San Antonio Road where it becomes Bayshore Parkway in Palo Alto. East Bayshore Road has on-street parking on the east side of the street between Clarke Avenue and Pulgas Avenue. East of Donohoe Street, East Bayshore Road has continuous sidewalks on the north side of the street. The posted speed limit on East Bayshore Road is 25 mph.

Bay Road is a four-lane east-west collector street within the project vicinity beginning at East Bayshore Road continuing to Pulgas Avenue. From Pulgas Avenue, Bay Road is a two lane-road that terminates at Cooley Landing and the San Francisco Bay. Bay Road has continuous sidewalks with on-street parking on both sides of the street west of Pulgas Avenue. However, east of Pulgas Avenue, Bay Road has no sidewalks. The posted speed limit on Bay Road is 25 mph.

Clarke Avenue is a two-lane north-south local collector street within the vicinity of the site extending from East Bayshore Road in the south to Bay Road to the north, where it becomes Illinois Street. Clarke Avenue has continuous sidewalks with on-street parking on both sides of the street. The posted speed limit on Clarke Avenue is 25 mph.

Pulgas Avenue is a two-lane north-south collector street directly adjacent to the eastern boundary of the project site with on-street parking on both sides of the street. Pulgas Avenue extends from East Bayshore Road in the south to just north of Bay Road. Near the project site, a short sidewalk (about 200 feet long) is available only on the west side of Pulgas Avenue. Sidewalks are provided on both sides of Pulgas Avenue south of Bay Road. The posted speed limit on Pulgas Avenue is 25 mph. Pulgas Avenue provides direct access to the project site via three full-access driveways.

Donohoe Street is an east-west street the extends from East Bayshore Road in the west to Clarke Avenue in the east. Its classification varies from a local street to a major thoroughfare, while the cross section varies from a two-lane street with on-street parking to a divided six lane street. Donohoe Street has continuous sidewalks on both sides of the street east of University Avenue. Donohoe Street has a prima facie speed limit of 25 mph.

Demeter Street is a two-lane north-south local street within the vicinity of the site. Demeter Street has continuous sidewalks with on-street parking on both sides of the street. Demeter Street extends from Bay Road in the south to its terminus near Purdue Avenue. Demeter Street has a prima facie speed limit of 25 mph.

Existing Bicycle Facilities

Within the vicinity of the project site, Class II bicycle lanes exist on Bay Road from Newbridge Street to Clarke Avenue, and on University Avenue starting just north of Donohoe Street and extending to the location of the future loop road. Between the future loop road and Bayfront Expressway, there is a bike lane on the west (southbound) side of University Avenue and a separate bikeway on the east side of University Avenue. The Bay Trail, a bike and pedestrian path, runs along the west boundary of the Baylands Nature Preserve area, which is about one quarter mile east of the project site. The Bay Trail connects to several local neighborhood streets, including Weeks Street and Runnymede Street (see Figure 3). There is also a short paved mixed-use trail known as the Rail Spur that extends from Bay Road to Pulgas Avenue. These bicycle facilities are not well-connected. No bicycle lanes are provided on the other local and neighborhood streets in the vicinity of the project site. However, due to low traffic volumes, many of the residential streets south of the project site are conducive to bicycle traffic.

Hexagon conducted bicycle counts at the study intersections and determined that bicycle volumes at all study intersections are quite low. All bicycle counts are included in Appendix A.

Existing Pedestrian Facilities

Pedestrian facilities consist of sidewalks, crosswalks, and pedestrian signals at signalized intersections. In the vicinity of the project site, sidewalks are provided on both sides of Bay Road west of Pulgas Avenue. Between Pulgas Avenue and Tara Street, there are no sidewalks. A short sidewalk (approximately 400 feet long) is provided on the south side of Bay Road east of Tara Street. Sidewalks are provided on both sides of Pulgas Avenue south of Bay Road. North of Bay Road, a short sidewalk (about 200 feet long) is available only on the west side of the street.

Crosswalks are found on one or more approaches on most of the signalized study intersections. The intersection of University Avenue and Bay Road has crosswalks on all approaches.

The all-way stop controlled intersection of Clarke Avenue/Illinois Street and Bay Road has crosswalks on all four approaches. The intersection of Pulgas Avenue and Bay Road has a crosswalk on only the west approach while the intersection of Pulgas Avenue and Runnymede Street has crosswalks on all legs except the north approach. There are no crosswalks available at the following four unsignalized study intersections:

- Demeter Street and Bay Road
- Pulgas Avenue and Weeks Street
- Clarke Avenue and Weeks Street
- Clarke Avenue and Runnymede Street

Hexagon conducted pedestrian counts at each study intersection. The greatest pedestrian volumes were observed at the intersection of University Avenue and Bay Road, where 138 and 108 pedestrians were counted during the AM and PM peak hours, respectively. The study intersection with the next highest pedestrian volumes is Clarke Avenue and Donohoe Street, which had 88 pedestrians during the AM peak hour and 75 pedestrians during the PM peak hour. All pedestrian counts are included in Appendix A.

Existing Transit Services

Existing transit services in the study area are provided by the San Mateo County Transit District (Samtrans). The bus stops closest to the project site are at the intersection of Pulgas Avenue and Bay Road and at the intersection of Pulgas Avenue and Weeks Street. Samtrans bus services and the locations of the nearest bus stops are described below and shown on Figure 4.

The 81 line operates on Bay Road, University Avenue, and Pulgas Avenue within the study area, looping throughout East Palo Alto and providing service to Menlo-Atherton High School. The line operates twice in the morning and once in the afternoon on school days only and stops at the Pulgas Avenue and Bay Road bus stop.

The 280 line operates on Bay Road and Pulgas Avenue within the study area, providing service between the Stanford Shopping Center and East Palo Alto. The line operates with approximately 60-minute headways during the AM and PM peak periods. The bus stop closest to the project site is at the intersection of Pulgas Avenue and Bay Road.

The 296 line operates on Bay Road, Pulgas Avenue, and Clarke Avenue within the study area, providing service between the Redwood City Caltrain Station and East Palo Alto. The line operates with 20-minute headways during the AM and PM peak periods. The bus stop closest to the project site is at the intersection of Clarke Avenue and Bay Road.

Figure 3
Existing Bicycle Facilities

Hexagon

NORTH
Not to Scale

Figure 4
Existing Transit Services

Existing Lane Configurations and Traffic Volumes

The existing intersection lane configurations were obtained from field observations (see Figure 5).

Existing traffic volumes were obtained from new manual peak-hour turning-movement counts conducted in 2018 and 2019 while nearby schools were in session (see Figure 6). The traffic count data (including pedestrian and bicycle count data) are included in Appendix A.

Existing Intersection Levels of Service

The results of the intersection level-of-service analysis under existing conditions show that most of the study intersections currently operate at an acceptable level (LOS D or better) (see Table 3). As noted in the ConnectMenlo DEIR, the counted traffic volumes at the Menlo Park study intersection does not appropriately reflect demand, and isolated intersection operations limit the ability of the VISTRO program to capture these results. Therefore, instead of calculated level of service, the existing level of service results are reported based on level of service as identified by the City to reflect "unserved demand". The following study intersections currently operate at an unacceptable level of service during at least one peak hour:

- University Ave. (SR 109) and Bayfront Expressway (SR 84) [CMP] (Menlo Park) – AM and PM peak hours
- University Avenue and Purdue Avenue – PM peak hour
- Euclid Avenue and Donohoe Street/East Bayshore Road – AM peak hour
- US 101 NB On-Ramp/University Plaza Phase II driveway (future) and Donohoe Street (unsignalized) – AM peak hour
- Embarcadero Road and East Bayshore Road (Palo Alto) – PM peak hour
- University Avenue and Donohoe Street – AM and PM peak hours
- University Avenue and US 101 SB Ramps – AM and PM peak hours
- University Avenue and Woodland Avenue – AM and PM peak hours
- University Circle and Woodland Avenue – PM peak hour
- US 101 NB Off Ramp/University Plaza Phase I driveway and Donohoe Street – PM peak hour

The intersection levels of service calculation sheets are included in Appendix C.

Table 3
Existing Intersection Levels of Service

Study Number	Intersection	Peak Hour	Count Date	Avg Delay (sec/veh)	LOS
1	University Avenue and Bayfront Expressway [Menlo Park] (CMP)	AM	04/25/19	**>80***	**F**
		PM	04/25/19	**263.0**	**F**
2	University Avenue and Loop Road [Future Signal]	AM	n/a	n/a	n/a
		PM	n/a	n/a	n/a
3	University Avenue and Purdue Avenue	AM	05/21/19	18.9	C
	(One-way Stop [1])	PM	05/21/19	**47.5**	**E**
4	University Avenue and Bay Road	AM	04/17/19	41.7	D
		PM	04/16/19	48.4	D
5	Euclid Avenue and Donohoe Street/East Bayshore Road [2]	AM	05/21/19	**52.3**	**F**
	(All-way Stop)	PM	05/21/19	32.6	D
6	US 101 NB On-Ramp/University Plaza Ph II dwy & Donohoe St [2, 3]	AM	05/21/19	**64.7**	**F**
	(Uncontrolled)	PM	05/21/19	10.2	B
7	Demeter Street and Bay Road	AM	05/09/19	10.2	C
	(Two-way Stop [1])	PM	05/09/19	13.0	C
8	Pulgas Avenue and Bay Road	AM	02/28/19	13.8	B
	(Two-way Stop [1])	PM	02/28/19	32.4	D
9	Pulgas Avenue and Weeks Street	AM	05/09/19	12.5	B
	(Two-way Stop [1])	PM	05/09/19	13.7	B
10	Pulgas Avenue and Runnymede Street	AM	05/09/19	15.0	C
	(All-way Stop)	PM	05/09/19	16.4	C
11	Pulgas Avenue and O'Connor Street	AM	05/09/19	13.6	B
	(All-way Stop)	PM	05/09/19	15.7	C
12	Pulgas Avenue and East Bayshore Road	AM	09/25/18	19.9	B
		PM	09/25/18	23.9	C
13	Embarcadero Road and East Bayshore Road [City of Palo Alto]	AM	04/17/19	33.8	C
		PM	04/16/19	**81.2**	**F**
14	University Avenue and Donohoe Street [2]	AM	04/17/19	**107.9**	**F**
		PM	04/16/19	**74.9**	**E**
15	University Avenue and US101 SB Ramps [2]	AM	05/21/19	**99.2**	**F**
		PM	05/21/19	**87.4**	**F**
16	University Avenue and Woodland Avenue [2]	AM	04/17/19	**66.1**	**E**
		PM	04/16/19	**248.0**	**F**
17	University Circle and Woodland Ave [2]	AM	05/21/19	18.7	B
		PM	05/21/19	**126.8**	**F**

Table 3 (Continued)
Existing Intersection Levels of Service

Study Number	Intersection	Peak Hour	Count Date	Avg Delay (sec/veh)	LOS
18	US 101 NB Off-Ramp/University Plaza Ph I dwy and Donohoe St [2]	AM	05/21/19	49.3	D
		PM	05/21/19	**142.6**	**F**
19	Cooley Avenue and Donohoe Street [2]	AM	05/21/19	31.8	C
		PM	05/21/19	36.6	D
20	East Bayshore Road and Donohoe Street [2]	AM	05/21/19	32.9	C
		PM	05/21/19	38.2	D
21	Clarke Avenue and Bay Road	AM	05/09/19	16.0	C
	(All-way Stop)	PM	05/09/19	19.9	C
22	Clarke Avenue and Weeks Street	AM	05/09/19	14.7	B
	(Two-way Stop [1])	PM	05/09/19	16.0	C
23	Clarke Avenue and Runnymede Street	AM	05/09/19	16.1	C
	(All-way Stop)	PM	05/09/19	13.3	B
24	Clarke Avenue and Donohoe Street	AM	05/09/19	17.8	C
	(All-way Stop)	PM	05/09/19	18.5	C
25	Clarke Avenue and East Bayshore Road	AM	09/25/18	13.9	B
		PM	09/25/18	10.7	B

Notes:
* Indicates LOS based on "unserved demand." At this location, upstream & downstream congestion results in delay not captured by the VISTRO analysis.
Bold indicates a substandard level of service.
1. For one-way and two-way stop controlled intersections, the average delay and LOS is reported for the worst approach.
2. Intersections were analyzed using Synchro/SimTraffic software due to the close proximity of these intersections.
3. Delay shown is the average delay for the westbound left-turning vehicles, which have to find gaps in the eastbound traffic flow.

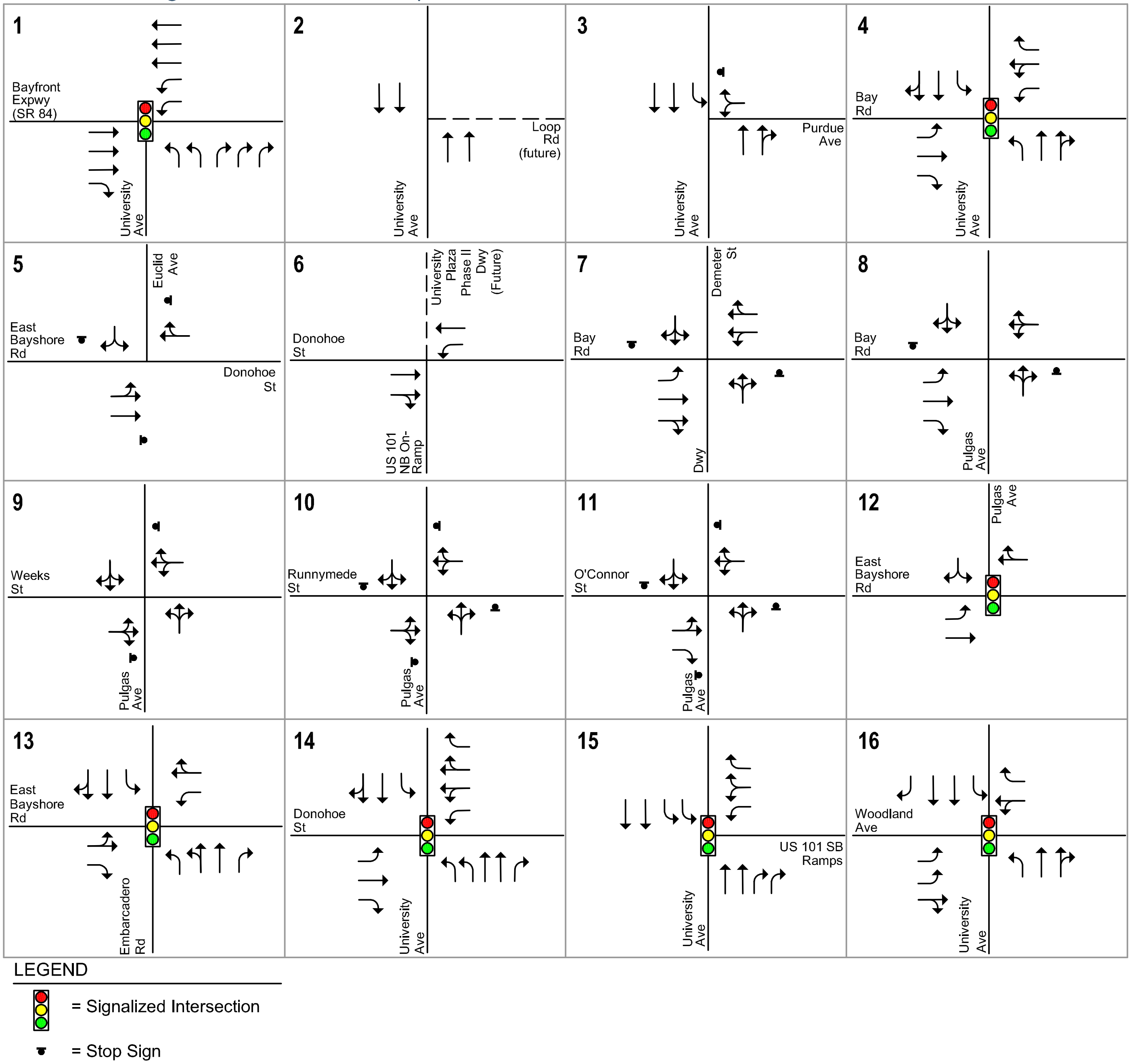


Figure 5
Existing Lane Configurations

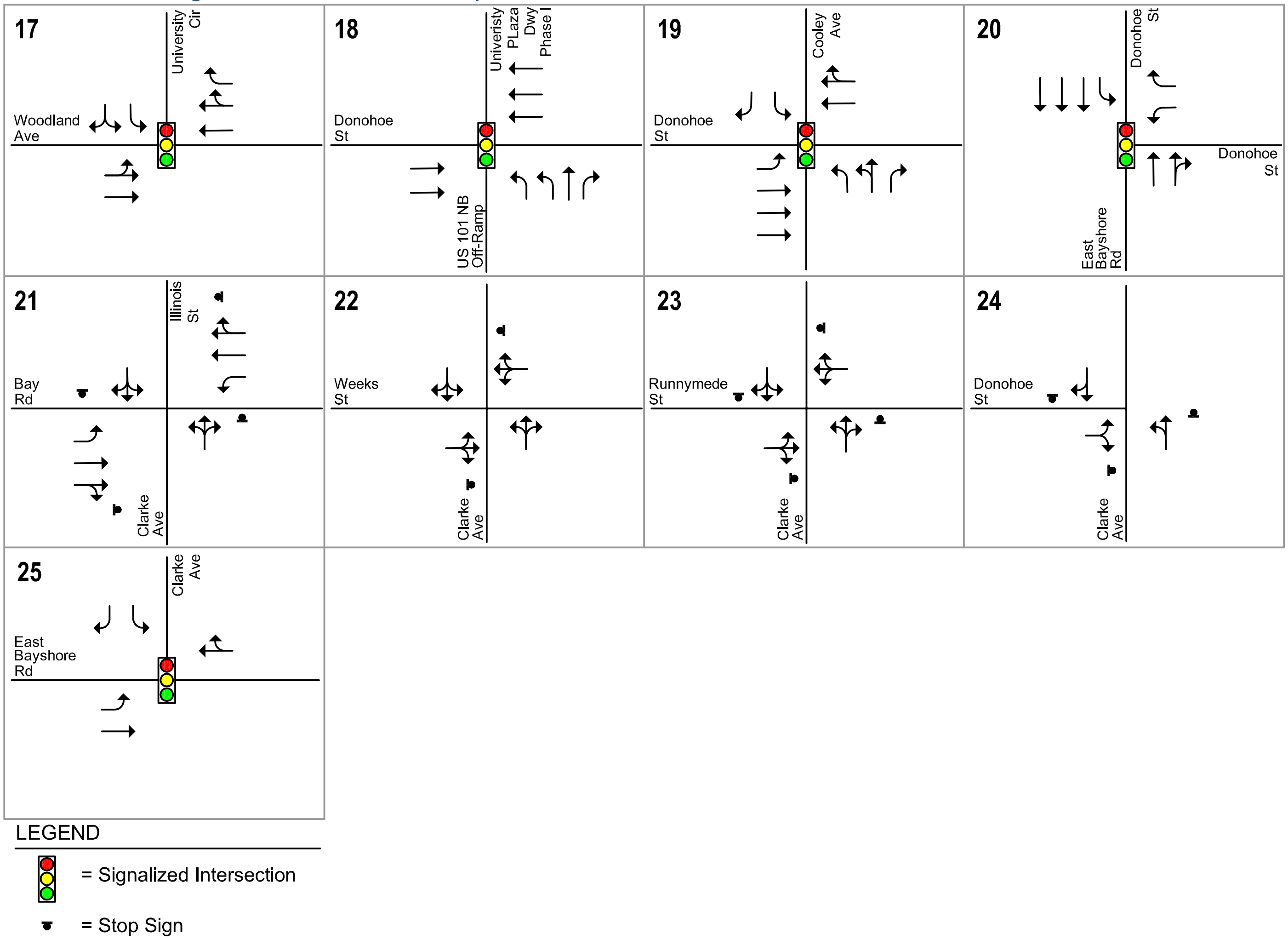
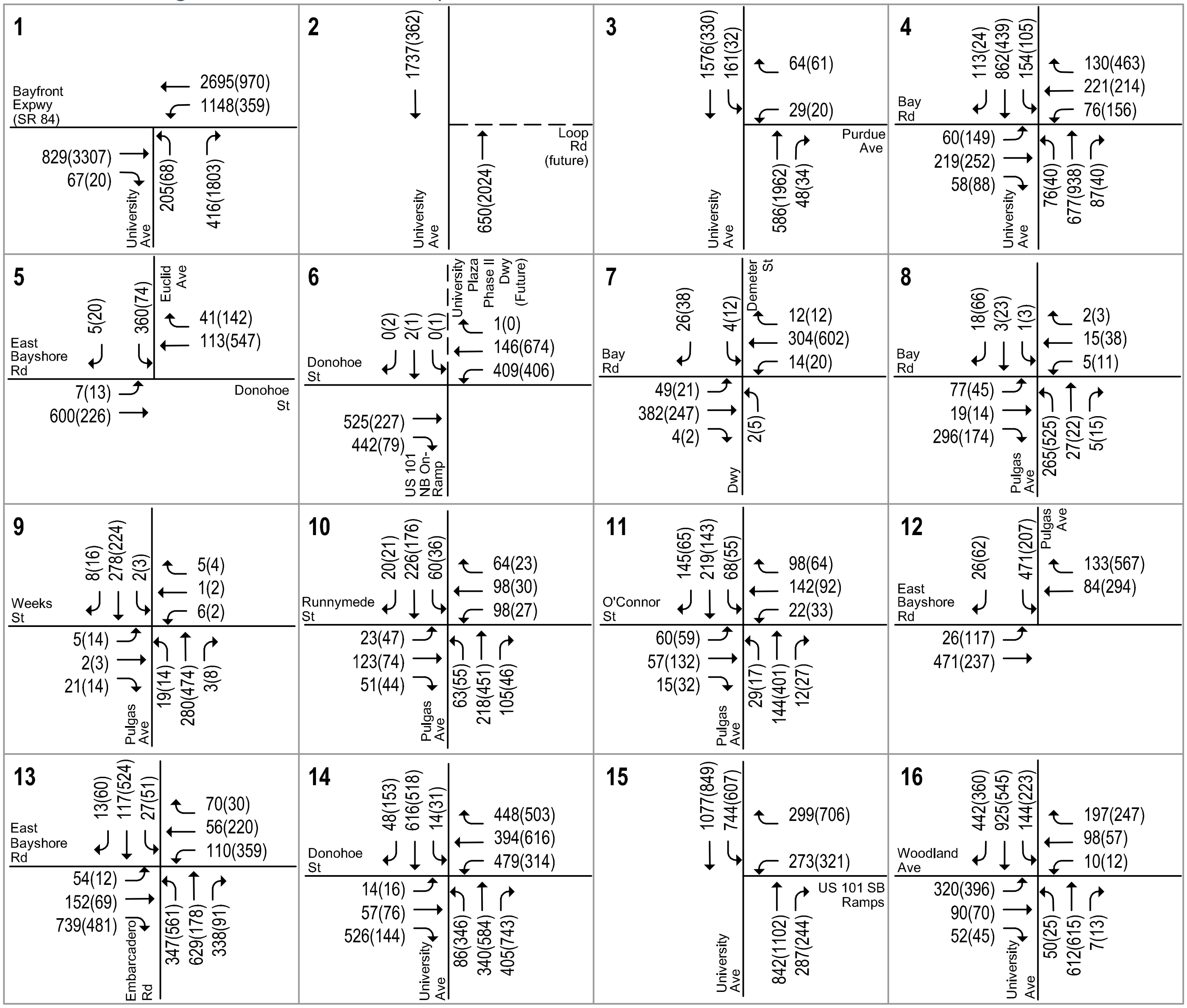


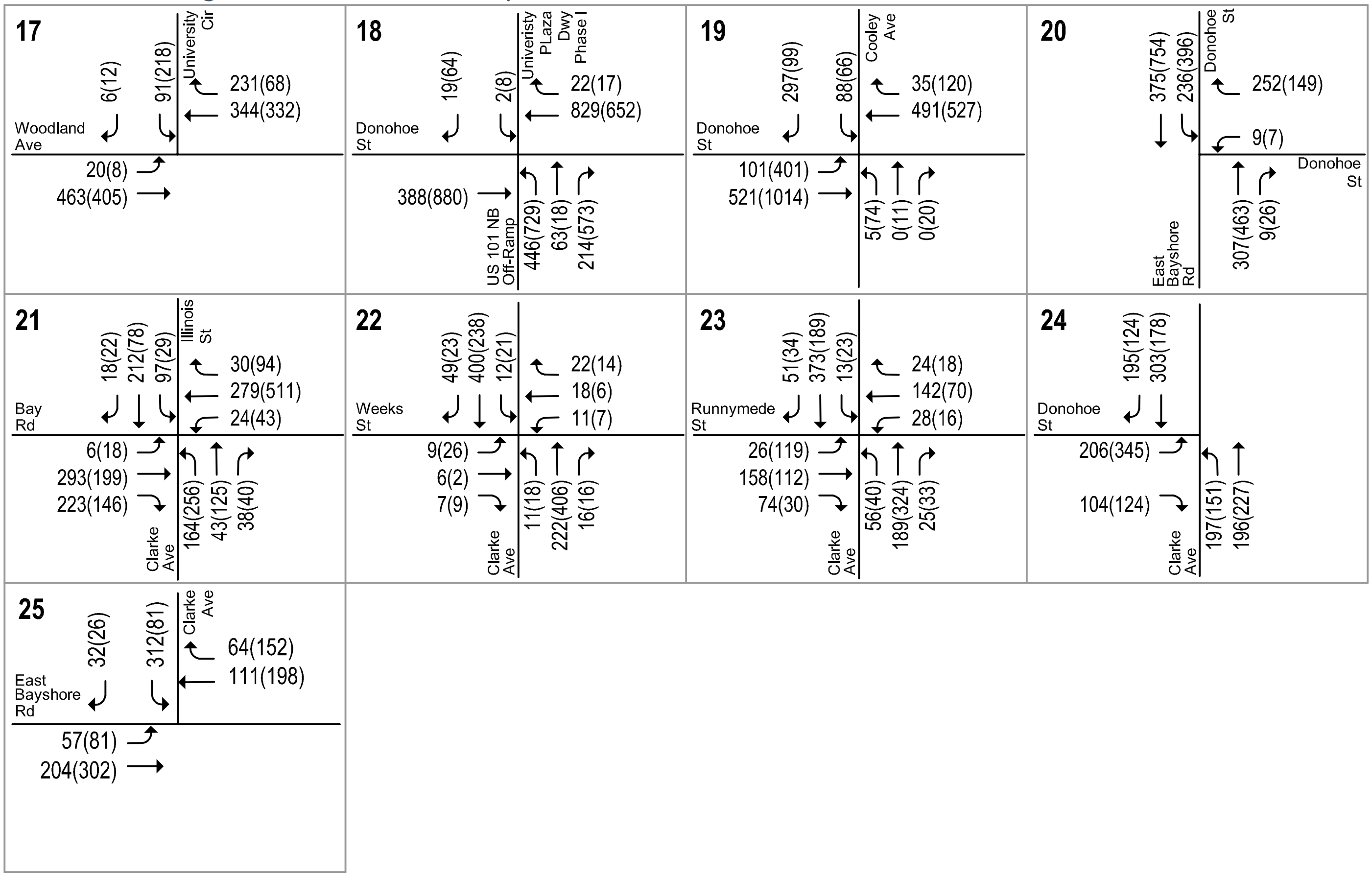
Figure 5
Existing Lane Configurations



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 6
Existing Traffic Volumes



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 6
Existing Traffic Volumes

HEXAGON

NORTH
Not to Scale

Existing Freeway Levels of Service

Existing traffic volumes and levels of service on the study freeway segments were obtained from the 2017 C/CAG CMP Monitoring Report and the 2018 Santa Clara Valley Transportation Authority (VTA) CMP Monitoring Study. The 2017 CMP data show that all four study freeway segments in San Mateo County currently operate at an unacceptable LOS F during both AM and PM peak hours (see Table 4). The levels of service reported in Table 4 reflect the lowest LOS for either direction of travel.

Table 4
Existing Freeway Segment Levels of Service – San Mateo County

Freeway	Segment	Peak Hour	Existing [1] # of Lanes		
			# of Lanes	Capacity	LOS
US 101	Santa Clara County Line to Whipple Avenue	AM	4	9,200	**F**
		PM	4	9,200	**F**
US 101	Whipple Avenue to SR 92	AM	4	9,200	**F**
		PM	4	9,200	**F**
US 101	SR 92 to Peninsula Avenue	AM	4	9,200	**F**
		PM	4	9,200	**F**
SR 84	Dumbarton Bridge	AM	3	6,900	**F**
		PM	3	6,900	**F**

Notes:
1. Existing freeway conditions are based on 2017 Congestion Management Program Monitoring Report of San Mateo County.
BOLD indicates a substandard level of service.

The following mixed-flow and HOV freeway segments in Santa Clara County currently operate at an unacceptable LOS F during at least one peak hour of traffic (see Table 5).

Mixed-Flow Freeway Segments

- US 101, northbound from Rengstorff Avenue to San Antonio Road (PM peak hour)
- US 101, northbound from San Antonio Road to Oregon Expressway (AM and PM peak hours)
- US 101, northbound from Oregon Expressway to Embarcadero Road (AM and PM peak hours)
- US 101, southbound from Embarcadero Road to Oregon Expressway (PM peak hour)
- US 101, southbound from Oregon Expressway to San Antonio Road (PM peak hour)
- US 101, southbound from San Antonio Road to Rengstorff Avenue (PM peak hour)

HOV Freeway Segments

- US 101, northbound from San Antonio Road to Oregon Expressway (PM peak hour)
- US 101, northbound from Oregon Expressway to Embarcadero Road (AM and PM peak hours)

Table 5
Existing Freeway Segment Levels of Service – Santa Clara County

					Mixed-Flow Lane						HOV Lane					
#	Freeway	Segment	Direction	Peak Hour	Avg. Speed[1]	# of Lanes[1]	Capacity (vph)	Volume[1]	Density	LOS	Avg. Speed[1]	# of Lanes[1]	Capacity (vph)	Volume[1]	Density	LOS
1	US 101	Rengstorff Ave to San Antonio Rd	NB	AM	31.80	3	6,900	5,241	55	E	47.87	2	3,300	3,432	36	D
			NB	PM	19.40	3	6,900	3,999	**69**	**F**	54.16	2	3,300	3,292	30	D
2	US 101	San Antonio Rd to Oregon Expwy	NB	AM	17.80	3	6,900	3,786	**71**	**F**	50.43	2	3,300	3,386	34	D
			NB	PM	14.20	3	6,900	3,249	**76**	**F**	13.77	2	3,300	2,964	**108**	**F**
3	US 101	Oregon Expwy to Embarcadero Rd	NB	AM	20.20	3	6,900	4,101	**68**	**F**	24.73	1	1,650	1,693	**68**	**F**
			NB	PM	18.00	3	6,900	3,813	**71**	**F**	17.84	1	1,650	1,588	**89**	**F**
4	US 101	Embarcadero Rd to Oregon Expwy	SB	AM	48.00	3	6,900	5,967	41	D	72.95	1	1,650	570	8	A
			SB	PM	15.20	3	6,900	3,405	**75**	**F**	55.31	1	1,650	1,627	29	D
5	US 101	Oregon Expwy to San Antonio Rd	SB	AM	49.00	3	6,900	5,976	41	D	70.60	2	3,300	1,838	13	B
			SB	PM	19.40	3	6,900	3,999	**69**	**F**	59.66	2	3,300	3,068	26	C
6	US 101	San Antonio Rd to Rengstorff Ave	SB	AM	38.60	3	6,900	5,670	49	E	71.66	2	3,300	1,560	11	A
			SB	PM	15.00	3	6,900	3,375	**75**	**F**	56.28	2	3,300	3,220	29	D

[1] Source: Santa Clara Valley Transportation Authority Congestion Management Program Monitoring Study, 2018.
Bold indicates unacceptable LOS.

Observed Traffic Conditions

Traffic conditions were observed in the field in order to identify existing operational deficiencies and to confirm the accuracy of calculated intersection levels of service. The purpose of this effort was (1) to identify any existing traffic problems that may not be directly related to level of service, and (2) to identify any locations where the level of service analysis does not accurately reflect existing traffic conditions.

Many of the signalized intersections on the University Avenue and Donohoe Street corridors in the study area experience congested traffic conditions during the commute AM and PM peak periods with queues that often extend through upstream intersections. Significant congestion also was observed at the Embarcadero/East Bayshore intersection and along the Bay Road and Clark Avenue corridors as commuters seek routes to avoid the congestion on University Avenue. Field visits revealed the following observations at study intersections:

University Avenue (SR 109) and Bayfront Expressway (SR 84)

During the AM peak hour, queues on westbound Bayfront Expressway extend on to the Dumbarton Bridge and need several green cycles to proceed through the intersection.

During the PM peak hour, there is congestion on the northbound University Avenue and eastbound Bayfront Expressway approaches. Northbound right-turn queues consistently extend all the way to the upstream intersections and block the left-turn lane. Eastbound queues extend to the upstream intersection at Willow Road and Bayfront Expressway. Vehicles in the northbound and eastbound directions need several green cycles to proceed through the intersection.

University Avenue and Purdue Avenue (unsignalized)

During the AM peak hour, westbound left-turn vehicles occasionally experience long delays caused by the limited availability of gaps in the southbound traffic.

During the PM peak hour, traffic flow on northbound University Avenue is slow due to spillback from the downstream intersection of University Avenue and Bayfront Expressway. The heavy northbound traffic causes some delays for vehicles on westbound Purdue Avenue. However, vehicles on Purdue Avenue often are able to complete their turn due to the courtesy of drivers on University Avenue, who let vehicles on Purdue turn in front of them when traffic is stopped.

University Avenue and Bay Road

This intersection operates without any significant operational issues during the AM peak hour.

During the PM peak hour, queues on northbound University Avenue extend from Bayfront Expressway through the University/Bay intersection to Bell Street. Spillback from the downstream intersections impedes traffic flow and causes vehicles on the northbound approach at the University/Bay intersection to wait through several signal cycles to clear the intersection.

Euclid Avenue and East Bayshore Road/Donohoe Street (unsignalized)

During the AM peak hour, the queue on eastbound Donohoe Street extends from the downstream intersection at University Avenue past the US 101 Northbound On-Ramp intersection and causes congestion for the eastbound through and southbound left-turn movements at the Euclid/East Bayshore/Donohoe intersection. Imbalanced lane utilization was observed for the eastbound through movement. Although eastbound Donohoe Street includes two through lanes, the majority of eastbound traffic uses the outside through lane since close to 90 percent of this traffic turns right onto southbound University Avenue.

During the PM peak hour, queues on the westbound approach of Donohoe Street extend past the US 101 Northbound On-Ramp to the upstream intersection at University Avenue.

US 101 Northbound On-Ramp/University Plaza Phase II driveway (future) and Donohoe Street (unsignalized)

This intersection currently is not controlled on the Donohoe Street approaches. However, westbound vehicles that want to turn left onto the on ramp must wait for an adequate gap in eastbound traffic flow before proceeding. Field observations show that the westbound left-turn queue extends into the upstream intersection of University Avenue/ Donohoe Street during the AM peak hour due to insufficient number and length of gaps in the eastbound traffic flow. Vehicle queues in the right lane on eastbound Donohoe Street constantly extend from University Avenue beyond this intersection to Euclid Avenue. The queue spillback from the University/Donohoe intersection exacerbates the delays for eastbound Donohoe traffic attempting to make right turns onto the northbound US 101 on-ramp.

During the PM peak hour, westbound left-turn traffic on Donohoe Street can easily turn onto the US 101 northbound on ramp because of the relatively low traffic volume on eastbound Donohoe Street. However, the westbound through traffic experiences significant delays due to spillback from the downstream intersection at Euclid Avenue. Queues for the westbound through traffic on Donohoe Street intermittently extend to University Avenue.

Pulgas Avenue and Bay Road

The intersection operates acceptably without any operational issues during the AM peak hour.

During the PM peak hour, queues on northbound Pulgas Avenue extend approximately 500 feet upstream but do not affect the intersection of Pulgas Avenue and Weeks Street.

Pulgas Avenue and East Bayshore Road

During the AM peak hour, the eastbound queues at the downstream intersection on East Bayshore Road spills back through the Pulgas Avenue/East Bayshore Road intersection, causing delay for eastbound through traffic on East Bayshore Road and southbound left traffic from Pulgas Avenue to East Bayshore Road. Queues on southbound Pulgas Avenue extend approximately 1,200 feet to Gaillardia Way. Long queues also were observed on the eastbound approach on East Bayshore Road, extending to Clarke Avenue. Due to this congestion, it takes multiple green cycles for these movements to clear the intersection. This congestion is short lived, however, lasting only about 15 minutes. The intersection operates at an acceptable level during the remainder of the AM peak hour.

There is a near constant stream of traffic on the westbound East Bayshore Road approach during the PM peak hour. While, queues on this approach are lengthy, they do not extend to the upstream signalized intersection at Laura Lane. Most of the vehicles on westbound East Bayshore Road turn right onto northbound Pulgas Avenue. The downstream all-way stop controlled intersection at Pulgas Avenue and Camellia Drive causes queues that occasionally extend to the Pulgas/East Bayshore intersection. However, the back-up on northbound Pulgas Avenue is usually resolved without noticeably affecting traffic flow at the Pulgas/East Bayshore intersection.

Embarcadero Road and East Bayshore Road

During the AM peak hour, northbound left and through queues on Embarcadero Road occasionally extend to the US 101 northbound off-ramp and the US 101 overpass. Generally, the queues are able clear with each cycle and the intersection operates at acceptable levels. Heavy traffic was observed on eastbound East Bayshore Road. There was a long right-turn queue on eastbound East Bayshore Road. Vehicles were observed to take more than one cycle to get through the intersection.

During the PM peak hour, there were long vehicle queues in the northbound lanes on Embarcadero Road and the westbound lanes on East Bayshore Road. The long vehicle queues result from the high northbound to westbound left-turn and the westbound through traffic. Two westbound departure lanes on East Bayshore Road are reduced to one lane immediately west of the intersection, which causes stop-and-go conditions for merging traffic that frequently extends to Embarcadero Road and delays northbound left-turn and westbound through traffic that often have no space to enter the intersection when the traffic signal indication was still green. Adding to the issues along westbound East Bayshore Road is the signalized intersection at Laura Lane, which causes queues that extend along East Bayshore Road past Embarcadero Road.

The long vehicle queue caused by the heavy northbound left-turn volume extended beyond the junction with the US101 northbound off-ramp resulting in a vehicle queue on the off-ramp because it is difficult for the off-ramp vehicles to merge into the northbound traffic on Embarcadero Road. Vehicles on northbound Embarcadero Road and the northbound off-ramp were observed to take two to three signal cycles to clear the intersection, and vehicles on westbound East Bayshore Road were observed to take three to four cycles to clear the intersection.

The southbound vehicle queue on Embarcadero Road occasionally reached Geng Road and took more than one cycle to clear the intersection during the PM peak hour.

The level of service analysis at this intersection was adjusted to reflect the maximum queue lengths observed in the field and reduced saturation flow rates due to queue spillback, which impedes traffic flow through the intersection. With the adjustments, the level of service analysis results reflect observed levels of service.

University Avenue and Donohoe Street

During the AM peak hour, the southbound through movement on University Avenue fails to clear in one signal cycle. Vehicle queues on the southbound approach constantly extend beyond the upstream intersection at Bell Street. Due to heavy congestion on southbound University Avenue, vehicle queues from the downstream intersection at the US 101 southbound ramps constantly extend to this intersection. As a result, all traffic movements bound for southbound University Avenue (i.e. the eastbound right turn, the westbound left turn, and the southbound through) experience extended delays of more than one signal cycle.

During the PM peak hour, heavy congestion and excessive delays were observed on the northbound University Avenue and westbound Donohoe Street approaches. Long queues were observed in the northbound through lanes on University Avenue that lead towards the Dumbarton Bridge. Westbound vehicle queues from the Euclid Avenue/Donohoe Street intersection extend through the University Avenue/Donohoe Street intersection and constrain the westbound through and northbound left-turn movements. Queues for these movements frequently do not clear during the respective green phase due to downstream congestion. The northbound left-turn movement experiences imbalanced lane usage. Most of the northbound left-turning traffic was observed to use the outer left-turn lane because the other turn lane becomes a trap lane to the northbound US 101 on ramp.

University Avenue and US 101 Southbound Ramps

During the AM peak hour, the southbound University Avenue through movement experiences considerable delay due to congestion extending from the downstream intersection at University Avenue and Woodland Avenue. The southbound left-turn queue on University Avenue leading to the US 101 southbound on-ramp intermittently spills over into the through lane but usually clears in one signal cycle.

During the PM peak hour, vehicular queues on northbound University Avenue extend from the downstream intersection at Donohoe Street past the upstream intersection at Woodland Avenue.

University Avenue and Woodland Avenue

This intersection operates with split phasing for the eastbound and westbound approaches on Woodland Avenue.

During the AM peak hour, long vehicle queues on the westbound approach spill back into the upstream intersection at Scofield Avenue but the queues generally clear the intersection in one signal cycle. Due to heavy traffic on southbound University Avenue, vehicle queues constantly extend beyond the upstream intersection at the US 101 southbound ramps and beyond.

During the PM peak hour, queues on northbound University Avenue extend approximately 1,700 feet to Lincoln Avenue. Long queues also were observed on the eastbound approach on Woodland Avenue, extending past the University Circle driveway to Euclid Avenue. Observations show that traffic flow on the eastbound Woodland Avenue approach is impeded by queues on northbound University Avenue that extend from the downstream US 101 southbound ramps intersection to Woodland Avenue. Between 4:00 PM and 5:00 PM, only a small number of vehicles were observed turning from eastbound Woodland Avenue onto northbound University Avenue during each signal cycle. It takes one to two cycles for eastbound traffic to clear the intersection and vehicle queues on the eastbound Woodland Avenue extend beyond Euclid Avenue in several occasions. Vehicle queuing on eastbound Woodland Avenue improves gradually after 5:00 PM and the eastbound approach is able to clear within one cycle. The westbound approach (Woodland Avenue/Scofield Avenue) was also observed to have long queues with congestion extending onto Capitol Avenue. Traffic on the westbound approach intermittently takes more than one cycle to clear the intersection.

Woodland Avenue and University Circle

Queues on eastbound Woodland Avenue spill back from the nearby downstream intersection at University Avenue during the AM peak hour. However, queues on the eastbound approach at the Woodland Avenue/University Circle intersection generally clear within one cycle. All other movements at the intersection operate adequately.

During the PM peak hour, the eastbound queues on Woodland Avenue spill back from the downstream intersection at University Avenue similar to that of the AM peak hour. The congestion on eastbound

Woodland Avenue continues through the upstream intersections of Manhattan Avenue and Euclid Avenue. However, there are generally adequate green times allocated under the current signal timing scheme that allows the eastbound queues to clear within one cycle.

US 101 Northbound Off Ramp/University Plaza Phase I driveway and Donohoe Street

During the AM peak hour, vehicle queues extend on westbound Donohoe Street from the downstream intersection at University Avenue beyond the US 101 northbound off ramp, intermittently reaching the intersection at Donohoe Street and Cooley Avenue. As a result, it occasionally takes more than one signal cycle for the westbound through traffic to clear this intersection. An imbalance in the lane utilization was observed for the three westbound through lanes. The innermost through lane is consistently more congested than the other lanes. Because of the high demand for westbound left turns and through traffic at University Avenue, most of the vehicles on westbound Donohoe Street were observed to be in the innermost through lane at the US 101 northbound off ramp intersection.

During the PM peak hour, there were significant queues on westbound Donohoe Street similar to that of the AM peak hour. Congestion for westbound traffic was primarily due to queues spilling back from the downstream intersection at University Avenue and Donohoe Street. The westbound congestion also resulted in long queues for the northbound left-turn movement on the US 101 northbound off ramp, causing vehicles to wait through multiple signal cycles to clear the intersection. Vehicles from the off-ramp making the northbound left-turn movement occasionally block the intersection, causing traffic exiting from the University Plaza Phase I site to wait for more than one cycle to clear the intersection. The queues on the US 101 northbound off ramp were also observed to spillover to the mainline US 101 freeway lanes for a considerable amount of time during the PM peak hour. Vehicles making a right turn movement and seeking to immediately turn left at the downstream intersection at Cooley Avenue also intermittently block the eastbound through lanes on Donohoe Street.

Cooley Avenue and Donohoe Street

During the AM peak hour, westbound through queues on Donohoe Street occasionally were observed to extend from the downstream intersection at University past Cooley Avenue. However, all turn movements cleared the intersection in one cycle length.

During the PM peak hour, queues on westbound Donohoe Street extend from the downstream intersection at University Avenue past the northbound US 101 off ramp and into the intersection at Cooley Avenue. Due to the close proximity of the traffic signals, queues on westbound Donohoe Street intermittently spilled back into the upstream intersection at East Bayshore Road. However, the westbound queues generally clear within one signal cycle. Also, the eastbound left-turn movement frequently overflowed the turn pocket and spilled into the adjacent eastbound through lane and through the upstream intersection at the northbound US 101 off ramp. The allocated green time for the eastbound left turn movement was generally adequate in serving the demand but the turn pocket started filling up quickly from the beginning of the red phase.

East Bayshore Road and Donohoe Street

During the AM peak hour, traffic on the northbound East Bayshore approach to Donohoe Street is delayed due to spillback from downstream intersections.

During the PM peak hour, the westbound queues at the downstream intersection of Cooley Avenue and Donohoe Street spilled back through the East Bayshore Road/Donohoe Street intersection, causing delay for northbound traffic on East Bayshore Road. However, the northbound approach cleared in one signal cycle. The left-turn queues on southbound Donohoe Street filled the turn pocket storage, but they did not spillover to the through lane and cleared in one signal cycle.

Clarke Avenue and Bay Road

The intersection operates acceptably without any operational issues during the AM peak hour.

During the PM peak hour, queues on northbound Clarke Avenue extend approximately 1,200 feet to Runnymede Street.

Clarke Avenue and Weeks Street

The intersection operates acceptably without any operational issues during the AM peak hour.

During the PM peak hour, the queue on northbound Clarke Avenue spillbacks from the intersection at Bay Road past Weeks Street to Runnymede Street blocking traffic on the stop-controlled Weeks Street approaches. However, the spillback along Clarke Avenue does not cause a backup on Weeks Street since the traffic volumes on Weeks Street are quite low and because queued vehicles on Clarke Avenue frequently allow side street vehicles to pass through or join the queue.

Clarke Avenue and Donohoe Street

During the AM peak hour, the intersection generally operates well without any operational issues.

While this intersection generally operates acceptably, the eastbound approach experiences lengthy queues (up to approximately 400 feet) that extend beyond Salas Court at times during the PM peak hour.

3.
Existing Plus Project Conditions

This chapter describes the roadway traffic operations under existing plus project conditions, the method by which project traffic is estimated, and any impacts caused by the project.

The Ravenswood Four Corners TOD Specific Plan identifies the construction of a new **"**loop road**"**, which would extend northward from the current terminus of Demeter Street and then turn westward to connect to University Avenue at the northern edge of the Ravenswood Specific Plan area. Because it is uncertain when the planned Loop Road will be constructed, the analysis of existing plus project conditions was conducted both with and without the loop road.

Significant Impact Criteria

The traffic impacts of the project are evaluated against the following criteria to determine whether the impacts are significant.

City of East Palo Alto Definition of Significant Intersection Impacts

The City of East Palo Alto assesses motor vehicle delays using a level of service standard of LOS D for intersections. Specifically, a significant automobile delay impact under this LOS D standard would be considered to occur at an intersection if for any peak hour the Project would result in any of the following:

At a <u>signalized</u> intersection, an impact is considered significant if it:

a) Causes operations to degrade from LOS D (or better) to LOS E or F; or
b) Exacerbates LOS E or F conditions by both increasing critical movement delay by four or more seconds and increasing volume-to-capacity ratio (V/C ratio) by 0.01 at an intersection evaluated using the TRAFFIX software; or
c) Exacerbates LOS E or F conditions by increasing the average intersection delay by four or more seconds at an intersection evaluated using the SimTraffic software; or
d) Increases the V/C ratio by > 0.01 at an intersection that exhibits unacceptable operations, even if the calculated LOS is acceptable; or
e) Causes planned future intersections to operate at LOS E or F.

At an <u>unsignalized</u> intersection, an impact is considered significant if it:

a) Causes operations to degrade from LOS D or better to LOS E or F; or

b) Exacerbates LOS E or F conditions by increasing control delay by five or more seconds; and
c) Causes volumes under project conditions to exceed the Caltrans Peak-Hour Volume Warrant Criteria.

City of Menlo Park Definition of Significant Intersection Impacts

The City of Menlo Park has established distinct significance criteria for signalized intersections based on the category of the intersecting streets.

The study intersection at University Avenue (SR 109) and Bayfront Expressway (SR 84) involves two state routes. For signalized intersection involving two state routes, the project is said to create a significant adverse impact if for any peak hour:

a) The level of service degrades from an acceptable LOS D or better under existing conditions to an unacceptable LOS E or F under existing plus project conditions, and the average delay per vehicle increases by four seconds or more, or

b) The level of service is an unacceptable LOS E or F under existing conditions and the addition of project trips causes an increase in the average control delay at the intersection by four seconds or more.

City of Palo Alto Definition of Significant Intersection Impacts

The intersection at Embarcadero Road and East Bayshore Road is located within the City of Palo Alto. The project is said to create a significant adverse impact on traffic conditions at a signalized intersection in the City of Palo Alto if for either peak hour:

a) The level of service at the intersection degrades from an acceptable level (LOS D or better for non-CMP intersections and LOS E or better for CMP intersections) under background conditions to an unacceptable level under background plus project conditions, or

b) The level of service at the intersection is an unacceptable level (LOS E or F at non-CMP intersections and LOS F at CMP intersections) under background conditions and the addition of project trips causes the critical-movement delay at the intersection to increase by four or more seconds and the demand-to-capacity ratio (V/C) to increase by .01 or more.

An exception to this rule applies when the addition of project traffic reduces the amount of average delay for critical movements (i.e. the change in average delay for critical movements is negative). In this case, the threshold of significance is an increase in the critical V/C value by .01 or more.

A significant impact by City of Palo Alto standards is said to be satisfactorily mitigated when measures are implemented that would restore intersection conditions to its level of service standard or to an average delay that is better than background conditions.

Santa Clara County Freeway Segments

In Santa Clara County, a development is said to create a significant adverse impact on traffic conditions on a CMP freeway segment if for either peak hour:

1. The level of service on the freeway segment degrades from an acceptable LOS E or better under existing conditions to an unacceptable LOS F under project conditions <u>or</u>,

2. The level of service on the freeway segment is an unacceptable LOS F under project conditions, and the number of project trips on that segment constitutes at least one percent (0.01) of capacity on that segment.

A significant impact by CMP standards is said to be satisfactorily mitigated when measures are implemented that would restore freeway conditions to background conditions or better.

San Mateo County Freeway Segments

Freeway segments currently in compliance with the adopted LOS standard:

> A project is considered to have a CMP impact if the project will cause the freeway segment to operate at a level of service that violates the standard adopted in the current Congestion Management Program (CMP).

Freeway segments currently not in compliance with the adopted LOS standard:

> A project is considered to have a CMP impact if the project will add traffic demand equal to one percent (0.01) or more of the segment capacity or causes the freeway segment volume-to-capacity (v/c) ratio to increase by one percent (0.01).

Transportation Network under Project Conditions

The transportation network and intersection lane configurations under existing plus project conditions are assumed to be the same as that described under existing conditions. A second scenario was analyzed to evaluate existing plus project conditions with the planned loop road, which would extend northward from the current terminus of Demeter Street to connect with University Avenue (see Figure 1).

Diversion of the Existing Traffic Due to the Planned Loop Road

The planned loop road is expected to cause some of the existing westbound right-turn and southbound left-turn traffic at the University/Bay intersection to instead use the Loop Road, thereby reducing the traffic at several study intersections on Bay Road and University Avenue. Figure 7 shows the affected study intersections, the existing traffic volumes, and the estimate of diverted traffic at each intersection.

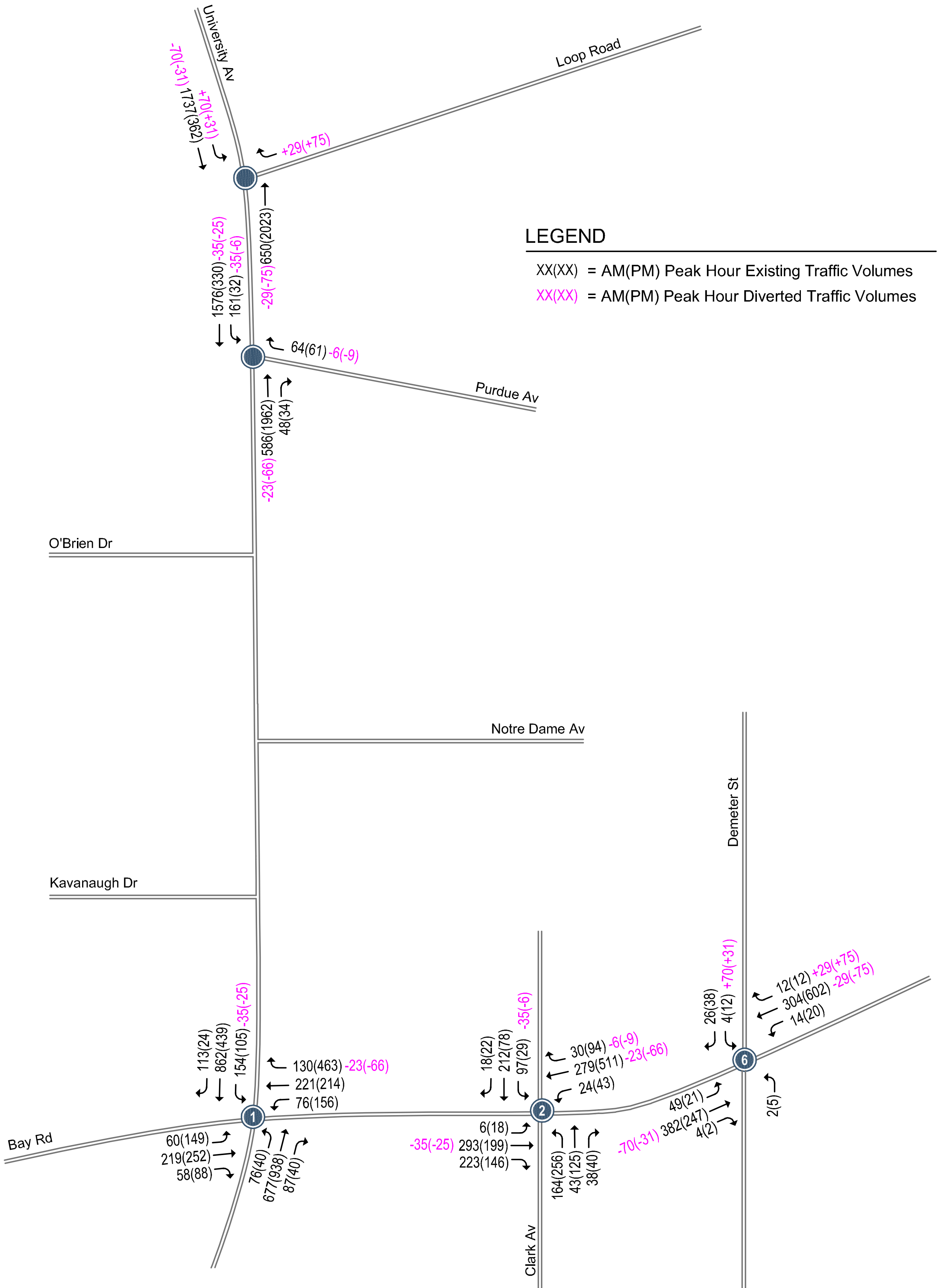


Figure 7

Diverted Existing Traffic Due to the Planned Loop Road

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Project Trip Estimates

The magnitude of traffic produced by a new development and the locations where that traffic would appear are estimated using a three-step process: 1) trip generation, 2) trip distribution, and 3) trip assignment. In determining project trip generation, the magnitude of traffic entering and exiting the site is estimated for the AM and PM peak hours. As part of the project trip distribution, an estimate is made of the directions to and from which the project trips would travel. In the project trip assignment, the project trips are assigned to specific streets and intersections. These procedures are described below.

Trip Generation

Through empirical research, data have been collected that quantify the amount of traffic produced by common land uses. Thus, for the most common land uses there are standard trip generation rates that can be applied to help predict the future traffic increases that would result from a new development. The magnitude of traffic added to the roadway system by a particular development is estimated by multiplying the applicable trip generation rates by the size of the development. For the project space proposed to be occupied by the Ravenswood Family Health Center administrative offices and by an Emerson collective entity or other office tenant, the trip generation rates published in the Institute of Transportation Engineers' (ITE) manual entitled *Trip Generation Manual, 10th Edition (*2017) for General Office Building (Land Use 710) were used. Trip generation rates for the JobTrain office facility were based on driveway counts conducted in August 2019 at the existing JobTrain location at 1200 O'Brien Drive in Menlo Park.

In addition, the proposed project will be required to develop a comprehensive Transportation Demand Management (TDM) plan to reduce vehicle trips. The City of East Palo Alto is currently considering an updated TDM Policy that could require trip reductions that exceed the current 25 percent requirement set forth in the City's code. However, to be conservative, this analysis assumes that the project site will achieve a 25 percent reduction in peak-hour trips. Based on the mode split estimate provided by the applicant, the observed trip generation rate at the existing JobTrain facility already reflects a 19% trip reduction due to the students and staff use of alternative modes of transportation. Therefore, a 25 percent reduction was applied to the proposed general office component and the proposed JobTrain trip estimates were reduced by 6 percent for a total TDM trip reduction of 25% per the City's existing ordinance.

The magnitude of traffic that is being generated by the existing business on the site was estimated based on driveway counts conducted in August 2019. After applying the TDM trip reductions and subtracting trips generated by existing uses, the proposed project is expected to generate a net total of 883 daily trips with 144 trips (132 in and 12 out) during the AM peak hour and 63 trips (11 in and 52 out) during the PM peak hour (see Table 6).

Table 6
Project Trip Generation Estimates

		Daily		AM Peak Hour				PM Peak Hour			
					Trip				Trip		
Land Use	**Size**	**Rate**	**Trip**	**Rate**	**In**	**Out**	**Total**	**Rate**	**In**	**Out**	**Total**
Proposed Uses											
General Office [1]	50,000 s.f.	9.74	487	1.16	50	8	58	1.15	9	48	57
JobTrain [2]	180 students	4.54	817	0.72	108	22	130	0.29	20	32	52
Total New Project Trips			1,304		158	30	188		29	80	109
Reductions											
25% TDM Trip Reduction for General Office			(122)		(12)	(3)	(15)		(2)	(12)	(14)
6% Additional TDM Trip Reduction for JobTrain			(49)		(7)	(1)	(8)		(1)	(2)	(3)
Existing Use											
Industrial/workshop building [3]	4,500 s.f.		(250)		(7)	(14)	(21)		(15)	(14)	(29)
Total New Project Trips			**883**		**132**	**12**	**144**		**11**	**52**	**63**

Notes:
[1] Trip generation rates for the proposed office space are based on the ITE's Trip Generation Manual, 10th Edition rates for Land Use Code 710 "General Office Building"
[2] Trip generation rates for the relocated JobTrain facility are based on driveway counts on 8/13/2019 at the existing JobTrain location .
[3] Existing AM and PM peak hour trips for the existing uses are based on 8/1/2019 driveway counts. Existing daily trips were estimated.

Trip Distribution and Assignment

The project trip distribution for the JobTrain facility was estimated based on the distribution of student residences reported by JobTrain. The project trip distribution pattern for the proposed JobTrain facility is shown on Figure 8. The project trip distribution for the proposed general office is expected to be consistent with the trip distribution pattern developed for the proposed 2020 Bay Road office development). The project trip distribution pattern for the proposed office use is shown on Figure 9. The project trips were assigned to the roadway network based on the directions of approach and departure, the roadway network connections, and the location of the project driveways.

The peak-hour trips generated by the project were assigned to the roadway network without and with the loop road in accordance with the project trip distribution patterns (see Figures 10 and 11).

Intersection Traffic Volumes

Existing plus project conditions were evaluated without and with the planned loop road. For the existing plus project without loop road scenario, the project trips shown on Figure 10 were added to the existing traffic volumes (described in Chapter 2) to derive the existing plus project without loop road traffic volumes (see Figure 12). For the existing plus project with loop road scenario, the project trips shown on Figure 11 were added to the adjusted existing traffic volumes due to the loop road to derive the existing plus project with loop road traffic volumes (see Figure 13).

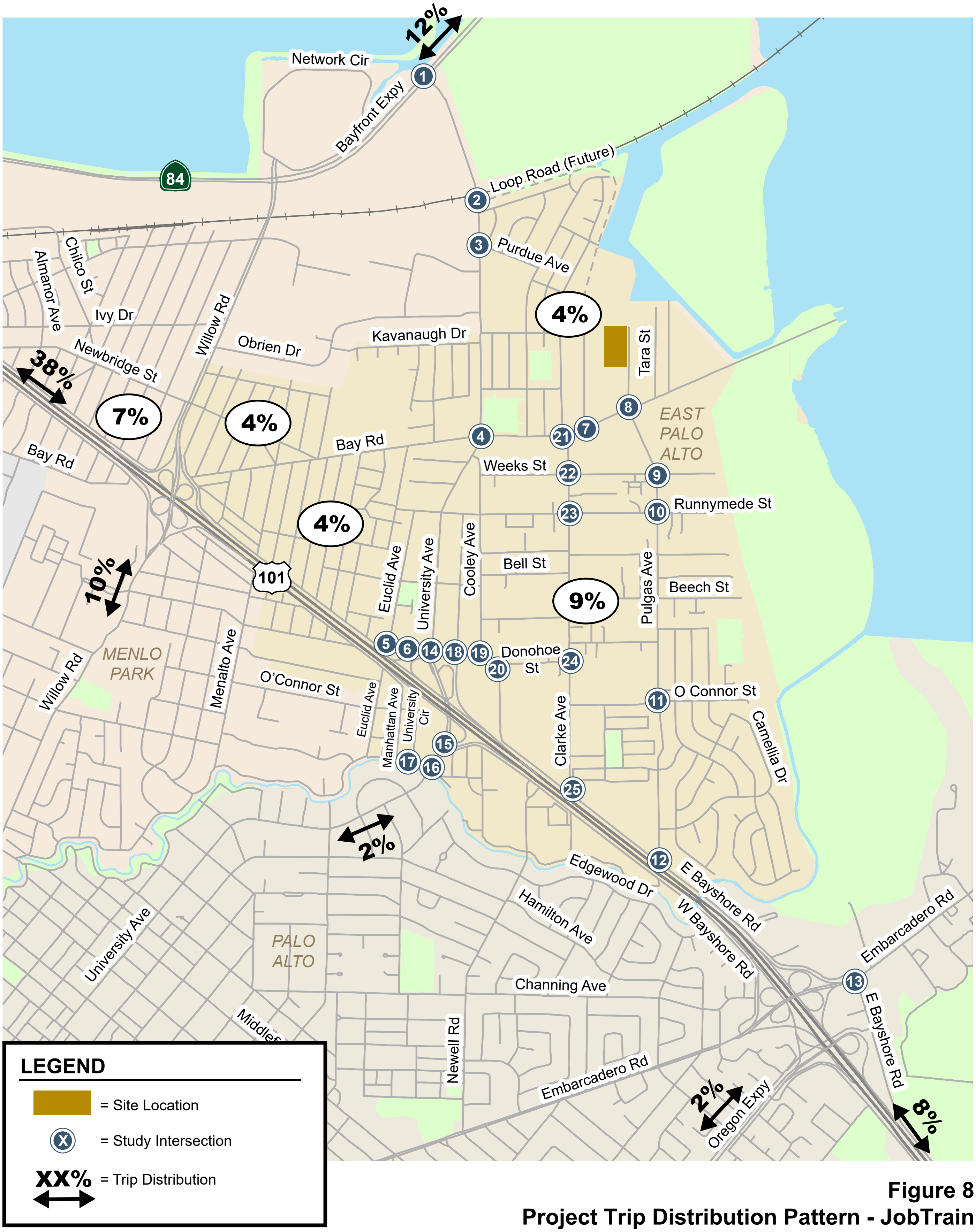


Figure 8
Project Trip Distribution Pattern - JobTrain

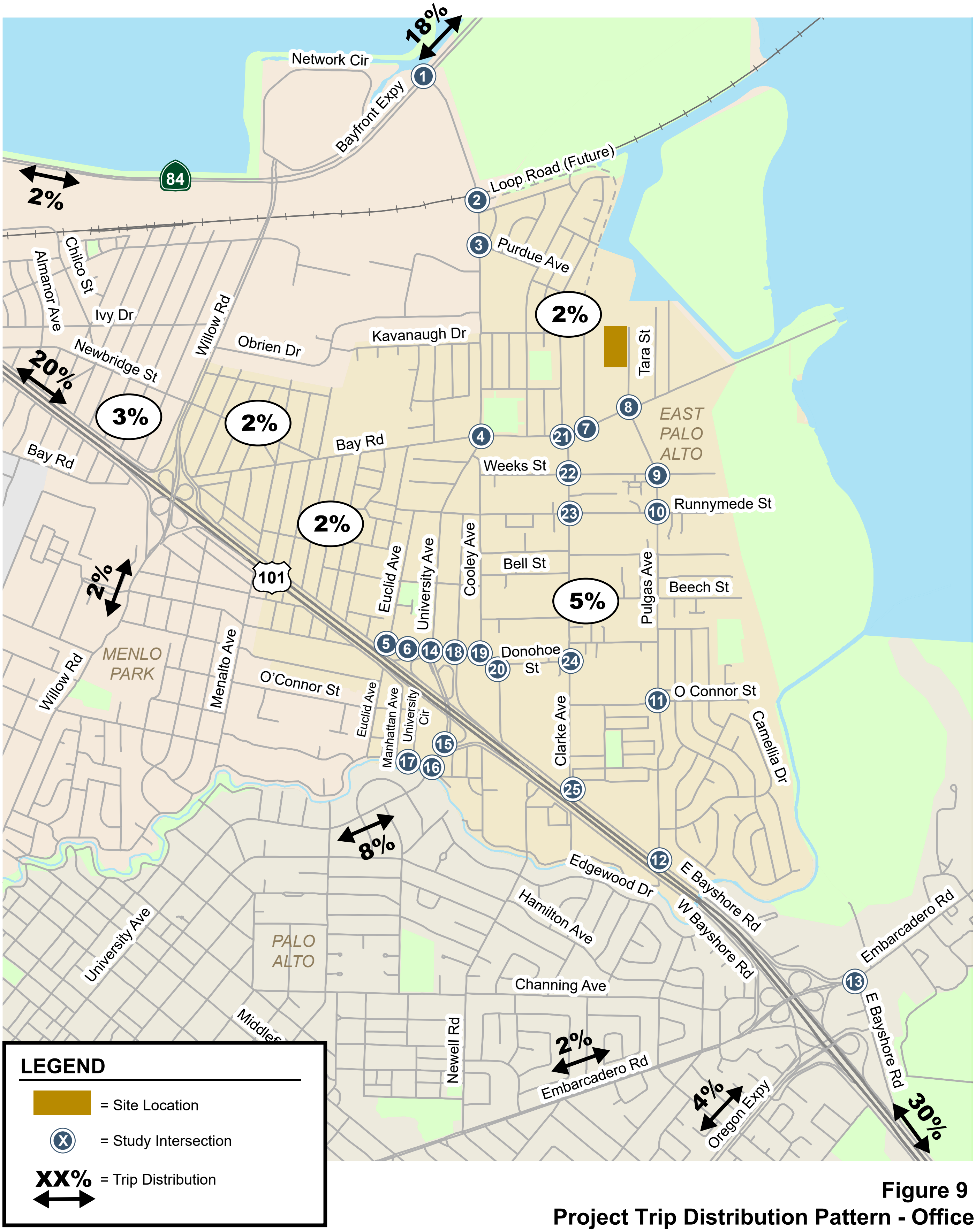
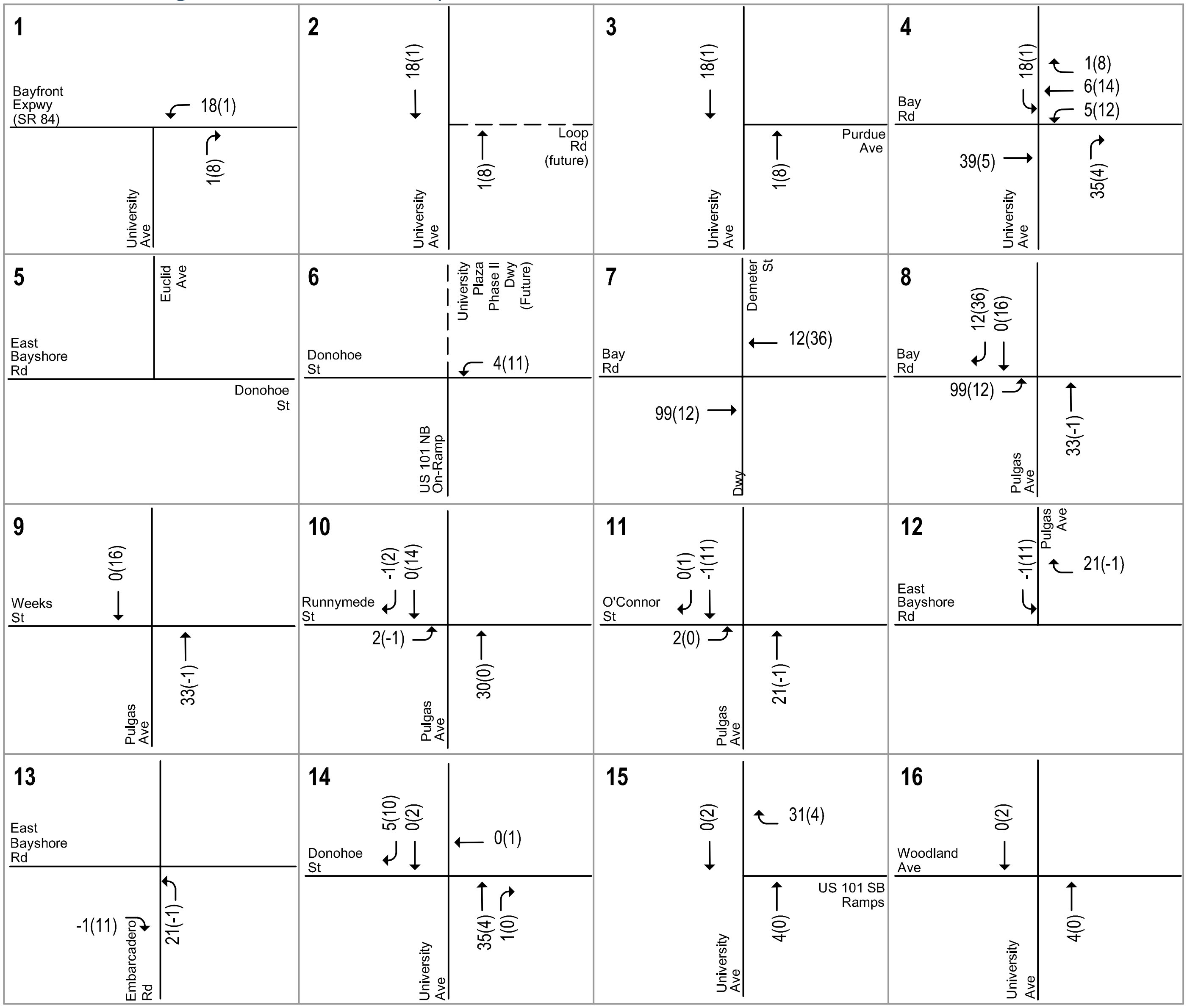


Figure 9
Project Trip Distribution Pattern - Office



LEGEND

XX(XX) = AM(PM) Peak-Hour Trips

Figure 10
Project Trip Assignment Without Loop Road

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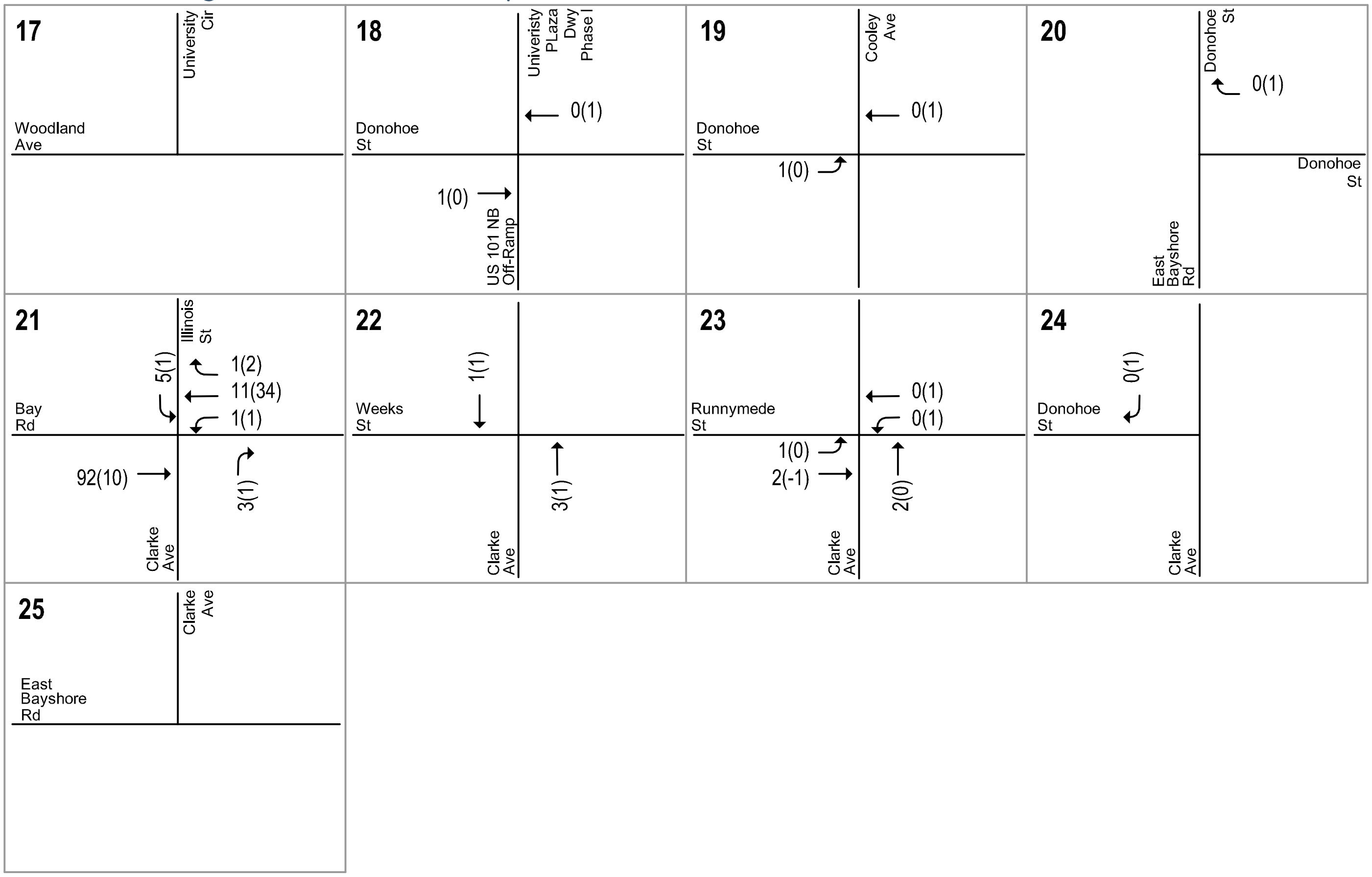
NORTH
Not to Scale



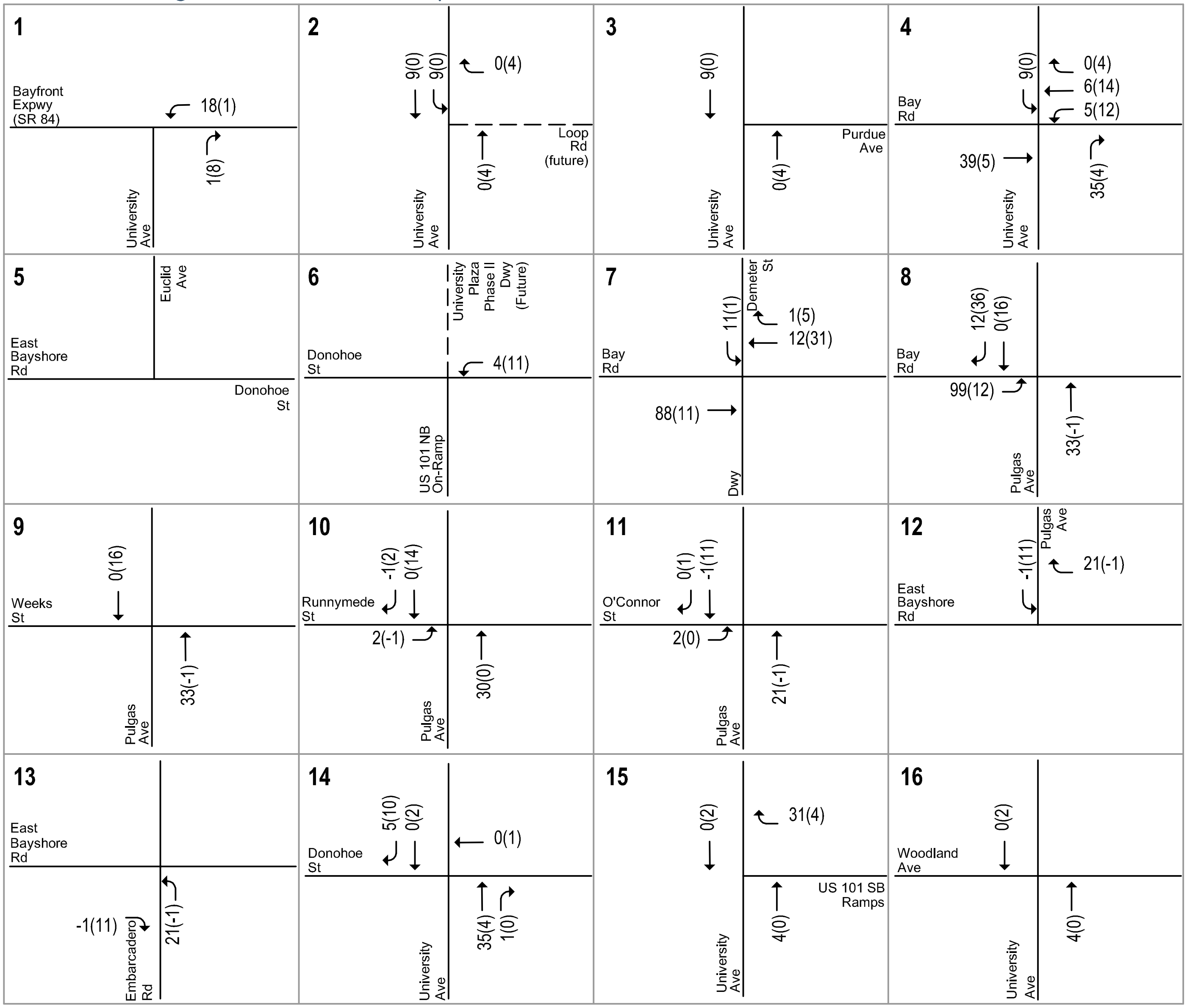
LEGEND

XX(XX) = AM(PM) Peak-Hour Trips

Figure 10
Project Trip Assignment Without Loop Road

HEXAGON

NORTH
Not to Scale



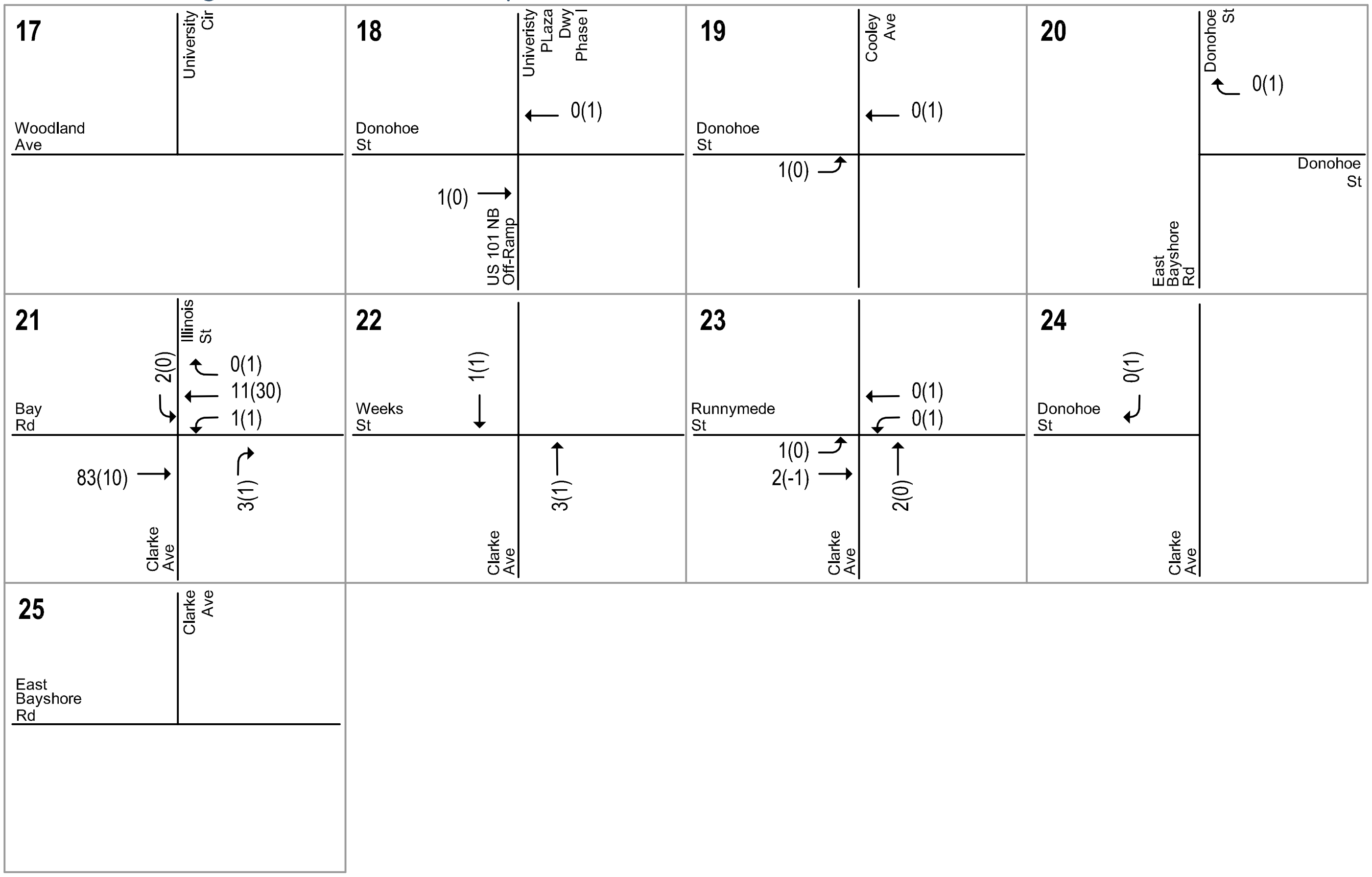
LEGEND

XX(XX) = AM(PM) Peak-Hour Trips

Figure 11
Project Trip Assignment With Loop Road

HEXAGON

NORTH
Not to Scale



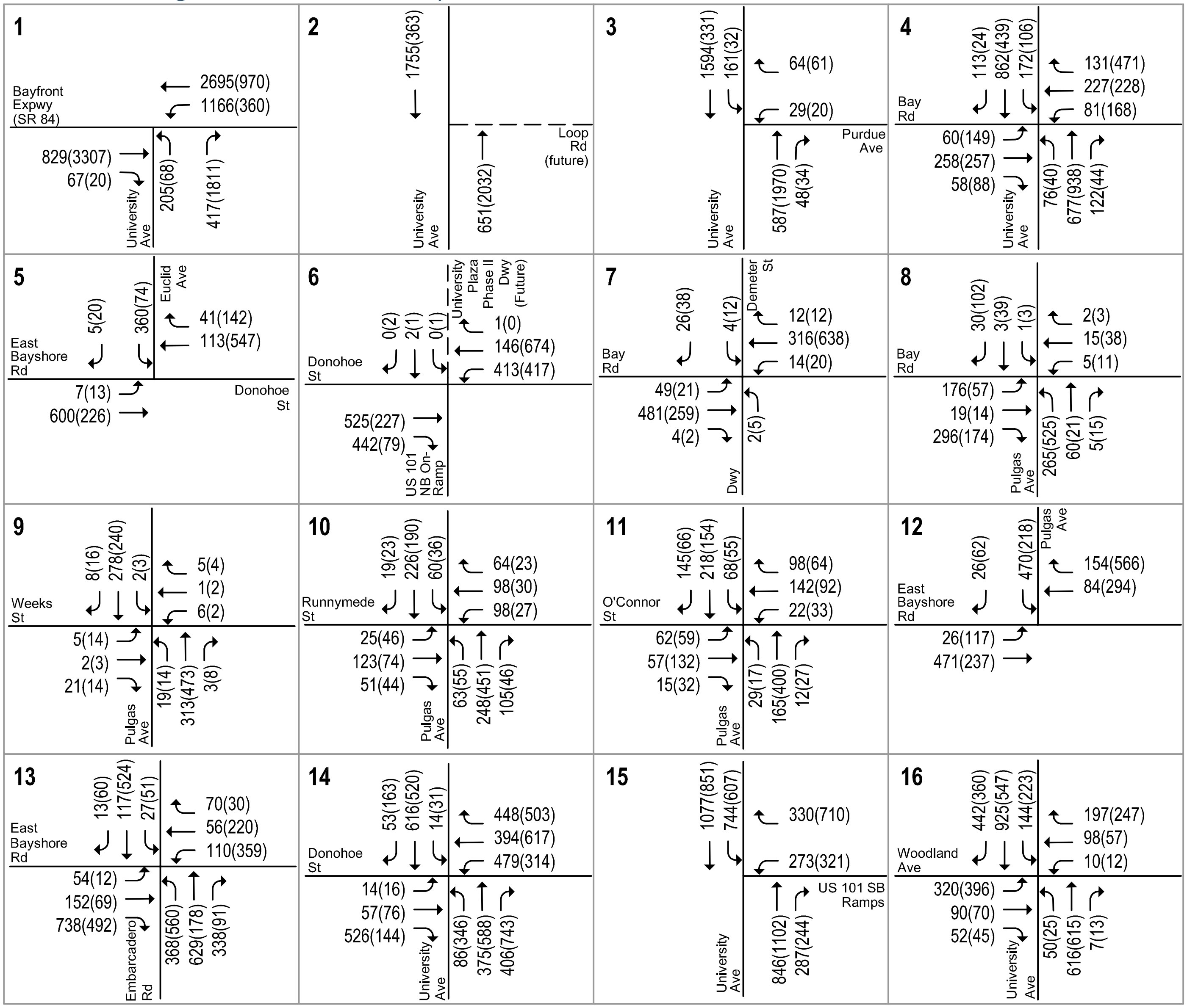
LEGEND

XX(XX) = AM(PM) Peak-Hour Trips

Figure 11
Project Trip Assignment With Loop Road

HEXAGON

NORTH
Not to Scale



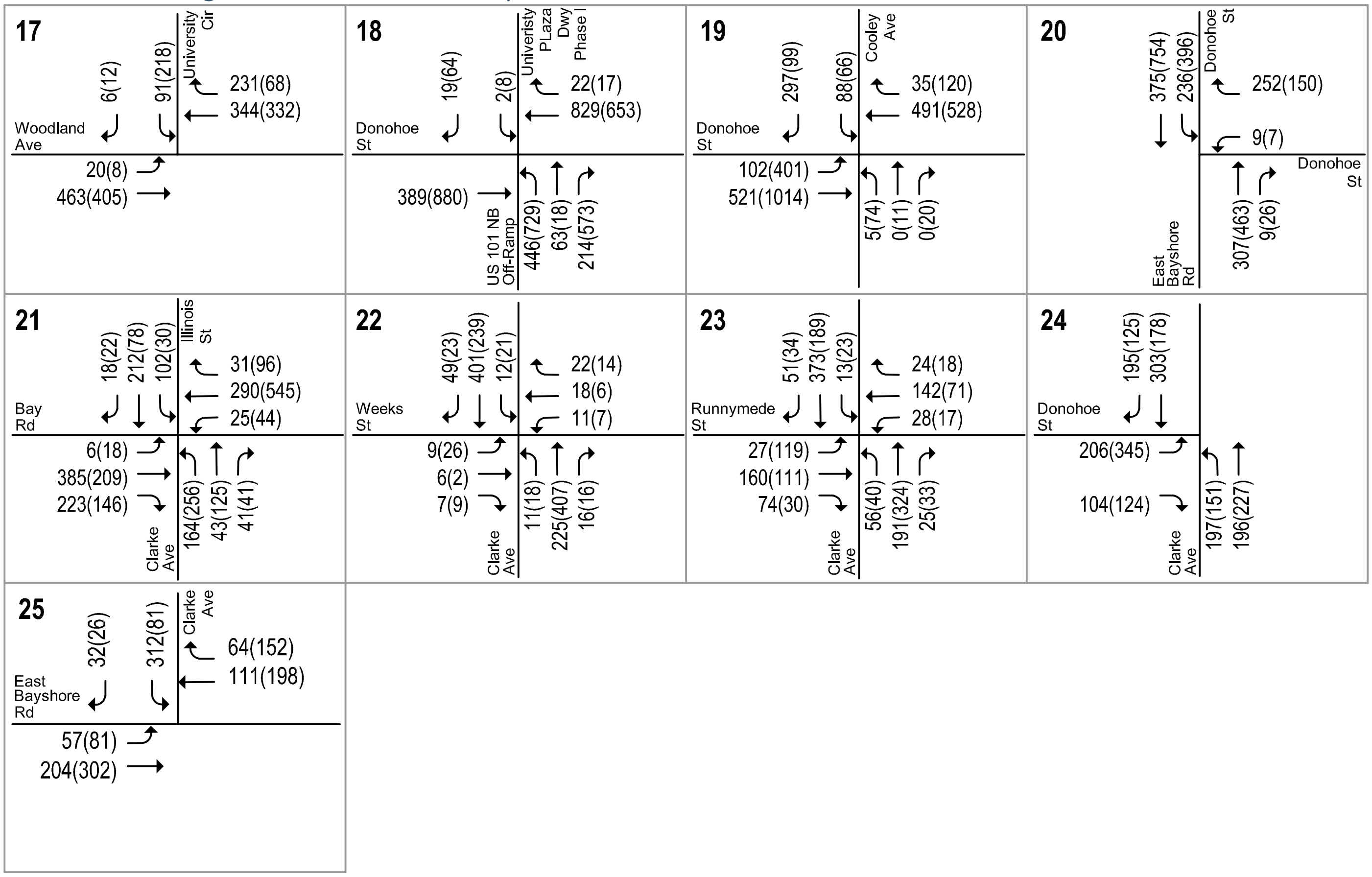
LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 12
Existing Plus Project Without Loop Road Traffic Volumes

HEXAGON

NORTH
Not to Scale



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 12
Existing Plus Project Without Loop Road Traffic Volumes

HEXAGON

NORTH
Not to Scale

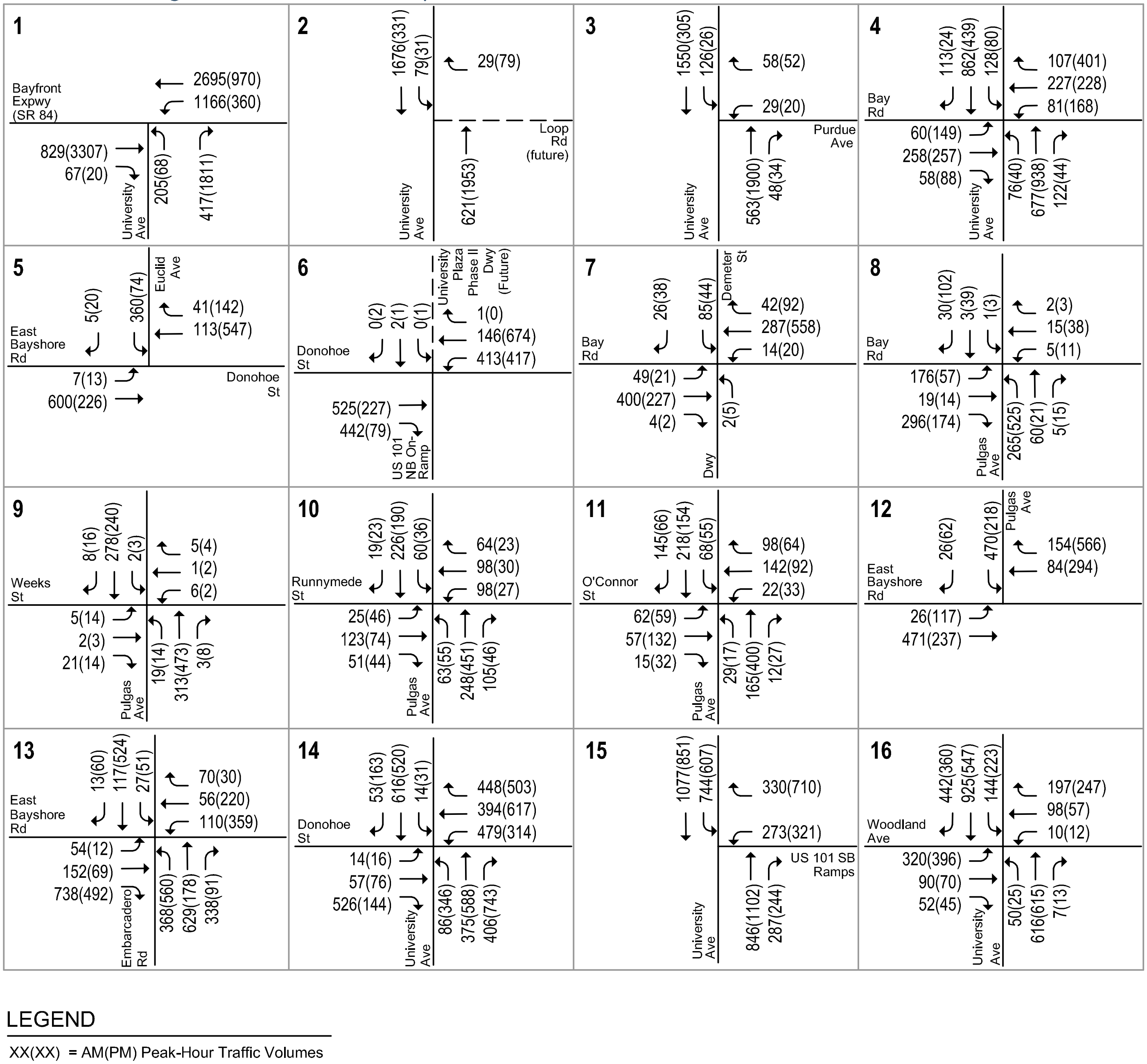
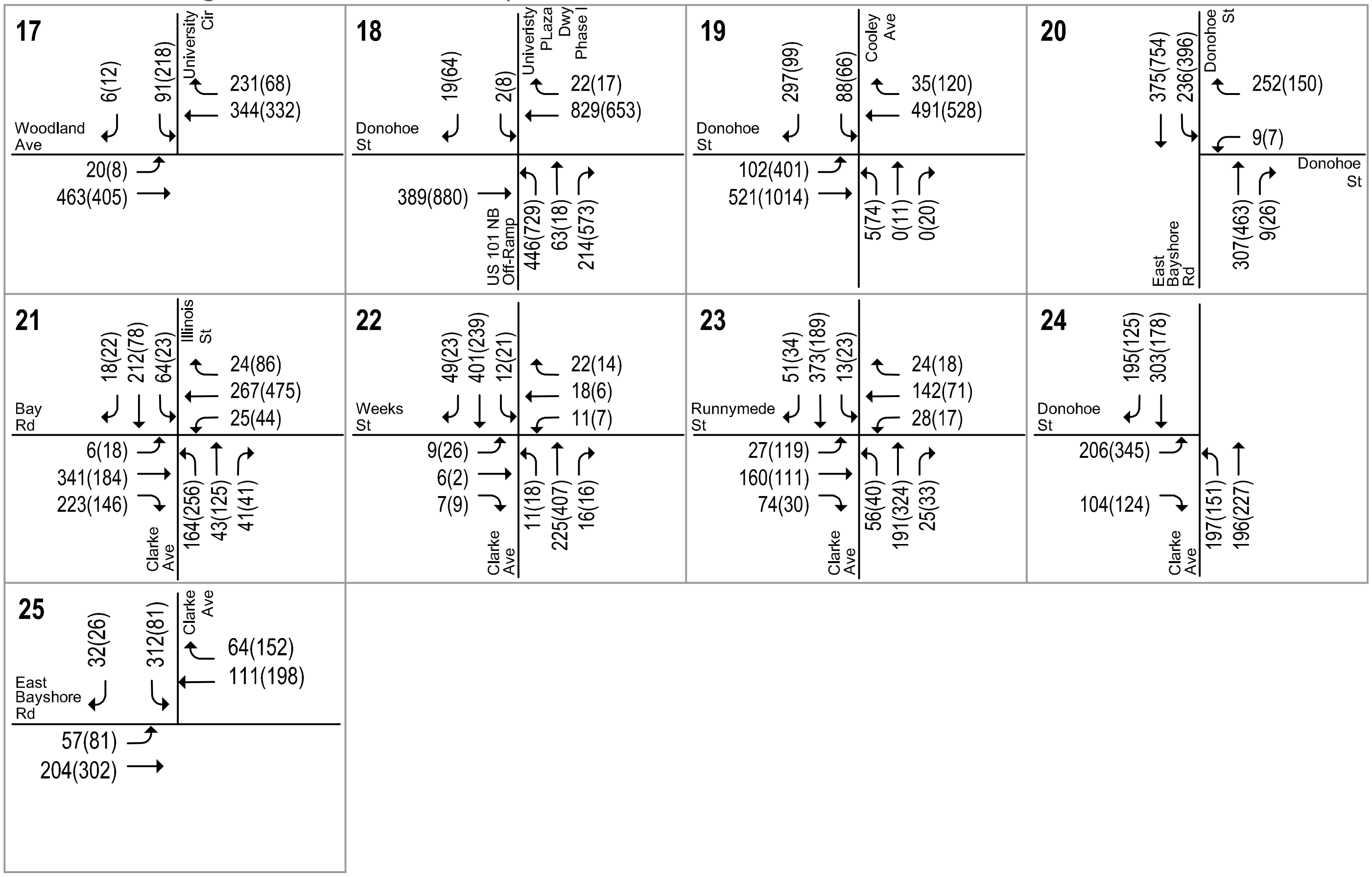


Figure 13
Existing Plus Project With Loop Road Traffic Volumes



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 13
Existing Plus Project With Loop Road Traffic Volumes

HEXAGON

NORTH
Not to Scale

Existing Plus Project Conditions Intersection Levels of Service

The results of the intersection level of service analysis under existing plus project conditions without and with the loop road are summarized in Table 7. Under the existing plus project conditions with the loop road, the summary table only shows the LOS calculation results for those intersections affected by the loop road. The traffic volume, delay, and level of service at the rest of the intersections would be unaffected by the loop road.

The results show that, measured against the significance criteria presented in previous section, the project would have a significant negative impact on all of the following intersections during one or both peak hours under existing plus project conditions without the loop road:

- Euclid Avenue and Donohoe Street/East Bayshore Road – AM peak hour
- US 101 Northbound On-Ramp and Donohoe Street – AM peak hour
- Pulgas Avenue and Bay Road – PM peak hour
- University Avenue and Donohoe Street – AM and PM peak hours
- University Avenue and US 101 SB Ramps – AM and PM peak hours
- University Avenue and Woodland Avenue –PM peak hour
- University Circle and Woodland Avenue – PM peak hour
- US 101 NB Off Ramp/University Plaza Phase I driveway and Donohoe Street – AM and PM peak hours
- East Bayshore Road and Donohoe Street – AM peak hour

The proposed project will be required to develop a comprehensive Transportation Demand Management (TDM plan) to reduce vehicle trips by at least 25 percent. Therefore, a 25 percent trip reduction was assumed in the trip generation estimates. A sensitivity analysis was conducted subsequently to explore if any significant project impacts could be mitigated through the use of enhanced TDM measures that would reduce trips by up to 50 percent.

It should be noted that at some intersections the average delay is shown to be decreased with the addition of project traffic. This occurs because the intersection delay is a weighted average of all intersection movements. When traffic is added to movements with delays lower than the average intersection delay, the average delay for the entire intersection can decrease. Furthermore, the congestion and queue spillback at an adjacent intersection can constrain the traffic volume at some intersections resulting in a small decrease in average delay.

The intersection levels of service calculation sheets are included in Appendix C.

Table 7
Existing plus Project Intersection Levels of Service

							Existing Plus Project								Existing Plus Project - Mitigated			
					Existing		without Loop Road				with Loop Road				without Loop Road		with Loop Road	
#	Intersection	LOS Standards	Peak Hour	Count Date	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS
1	University Avenue and Bayfront Expressway [Menlo Park] (CMP)	D	AM	04/25/19	**>80***	**F**	**>80***	**F**	0.2	n/a	--	--	--	--				
			PM	04/25/19	**263.0**	**F**	**265.1**	**F**	2.1	n/a	--	--	--	--				
2	University Avenue and Loop Road [Future Signal]	D	AM	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.0	A	n/a	n/a	n/a	n/a		
			PM	n/a	n/a	n/a	n/a	n/a	n/a	n/a	6.8	A	n/a	n/a	n/a	n/a		
3	University Avenue and Purdue Avenue [5]	D	AM	05/21/19	18.9	C	19.0	C	n/a	n/a	17.6	C	n/a	n/a				
	(One-way Stop [1])		PM	05/21/19	**47.5**	**E**	**48.1**	**E**	n/a	n/a	**42.2**	**E**	n/a	n/a				
4	University Avenue and Bay Road	D	AM	04/17/19	41.7	D	43.9	D	7.9	0.032	42.8	D	2.0	0.026				
			PM	04/16/19	48.4	D	48.8	D	0.7	0.010	46.8	D	-2.7	-0.038				
5	Euclid Avenue and Donohoe Street/East Bayshore Road [2, 4]	D	AM	05/21/19	**52.3**	**F**	**114.6**	**F**	n/a	n/a	--	--	--	--	45.7	D	45.7	D
	(All-way Stop)		PM	05/21/19	32.6	D	32.6	D	n/a	n/a	--	--	--	--	12.1	B	12.1	B
6	US 101 NB On-Ramp/University Plaza Ph II dwy & Donohoe St [2, 3, 4]	D	AM	05/21/19	**64.7**	**F**	**69.7**	**F**	n/a	n/a	--	--	--	--	26.5	C	26.5	C
	(Uncontrolled)		PM	05/21/19	10.2	B	9.7	B	n/a	n/a	--	--	--	--	23.3	C	23.3	C
7	Demeter Street and Bay Road	D	AM	05/09/19	10.2	C	10.4	C	n/a	n/a	17.0	C	1.6	0.202				
	(Two-way Stop [1])		PM	05/09/19	13.0	C	13.4	C	n/a	n/a	17.2	C	0.7	0.107				
8	Pulgas Avenue and Bay Road	D	AM	02/28/19	13.8	B	26.6	D	n/a	n/a	--	--	--	--	11.5	B	11.5	B
	(Two-way Stop [1])		PM	02/28/19	32.4	D	**56.0**	**F**	n/a	n/a	--	--	--	--	18.5	C	18.5	C
9	Pulgas Avenue and Weeks Street [4]	D	AM	05/09/19	12.5	B	12.9	B	n/a	n/a	--	--	--	--				
	(Two-way Stop [1])		PM	05/09/19	13.7	B	13.8	B	n/a	n/a	--	--	--	--				
10	Pulgas Avenue and Runnymede Street [4]	D	AM	05/09/19	15.0	C	16.1	C	1.0	0.051	--	--	--	--				
	(All-way Stop)		PM	05/09/19	16.4	C	16.6	C	0.2	0.004	--	--	--	--				
11	Pulgas Avenue and O'Connor Street	D	AM	05/09/19	13.6	B	13.9	B	0.2	0.006	--	--	--	--				
	(All-way Stop)		PM	05/09/19	15.7	C	15.9	C	0.2	0.003	--	--	--	--				
12	Pulgas Avenue and East Bayshore Road	D	AM	09/25/18	19.9	B	20.1	C	0.0	-0.001	--	--	--	--				
			PM	09/25/18	23.9	C	24.5	C	0.7	0.006	--	--	--	--				
13	Embarcadero Road and East Bayshore Road [City of Palo Alto]	D	AM	04/17/19	33.8	C	33.6	C	-0.3	-0.001	--	--	--	--				
			PM	04/16/19	**81.2**	**F**	**81.5**	**F**	0.6	0.000	--	--	--	--				
14	University Avenue and Donohoe Street [2]	D	AM	04/17/19	**107.9**	**F**	**116.0**	**F**	n/a	n/a	--	--	--	--	**90.1**	**F**	**90.1**	**F**
			PM	04/16/19	**74.9**	**E**	**82.2**	**F**	n/a	n/a	--	--	--	--	47.7	D	47.7	D
15	University Avenue and US101 SB Ramps [2]	D	AM	05/21/19	**99.2**	**F**	**105.7**	**F**	n/a	n/a	--	--	--	--	48.7	D	48.7	D
			PM	05/21/19	**87.4**	**F**	**100.4**	**F**	n/a	n/a	--	--	--	--	40.1	D	40.1	D

Table 7 (continued)
Existing plus Project Intersection Levels of Service

							Existing Plus Project								Existing Plus Project - Mitigated			
					Existing		without Loop Road				with Loop Road				without Loop Road		with Loop Road	
#	Intersection	LOS Standards	Peak Hour	Count Date	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS
16	University Avenue and Woodland Avenue 2	D	AM	04/17/19	**66.1**	**E**	**66.0**	**E**	n/a	n/a	--	--	--	--	42.5	D	42.5	D
			PM	04/16/19	**248.0**	**F**	**280.6**	**F**	n/a	n/a	--	--	--	--	**84.9**	**F**	**84.9**	**F**
17	University Circle and Woodland Ave 2	D	AM	05/21/19	18.7	B	18.2	B	n/a	n/a	--	--	--	--	13.5	B	13.5	B
			PM	05/21/19	**126.8**	**F**	**163.8**	**F**	n/a	n/a	--	--	--	--	18.2	B	18.2	B
18	US 101 NB Off-Ramp/University Plaza Ph I dwy and Donohoe St 2	D	AM	05/21/19	49.3	D	**70.3**	**E**	n/a	n/a	--	--	--	--	12.5	B	12.5	B
			PM	05/21/19	**142.6**	**F**	**165.0**	**F**	n/a	n/a	--	--	--	--	38.8	D	38.8	D
19	Cooley Avenue and Donohoe Street 2	D	AM	05/21/19	31.8	C	48.8	D	n/a	n/a	--	--	--	--	16.8	B	16.8	B
			PM	05/21/19	36.6	D	34.2	C	n/a	n/a	--	--	--	--	21.7	C	21.7	C
20	East Bayshore Road and Donohoe Street 2	D	AM	05/21/19	32.9	C	**69.1**	**E**	n/a	n/a	--	--	--	--	10.5	B	10.5	B
			PM	05/21/19	38.2	D	27.8	C	n/a	n/a	--	--	--	--	12.9	B	12.9	B
21	Clarke Avenue and Bay Road	D	AM	05/09/19	16.0	C	18.1	C	2.1	0.033	15.7	C	-0.4	-0.061				
	(All-way Stop)		PM	05/09/19	19.9	C	21.0	C	1.1	0.010	18.7	C	-1.2	-0.013				
22	Clarke Avenue and Weeks Street	D	AM	05/09/19	14.7	B	14.8	B	n/a	n/a	--	--	--	--				
	(Two-way Stop 1)		PM	05/09/19	16.0	C	16.0	C	n/a	n/a	--	--	--	--				
23	Clarke Avenue and Runnymede Street	D	AM	05/09/19	16.1	C	16.2	C	0.1	0.003	--	--	--	--				
	(All-way Stop)		PM	05/09/19	13.3	B	13.3	B	0.0	0.001	--	--	--	--				
24	Clarke Avenue and Donohoe Street	D	AM	05/09/19	17.8	C	17.8	C	0.0	0.000	--	--	--	--				
	(All-way Stop)		PM	05/09/19	18.5	C	18.5	C	0.0	0.000	--	--	--	--				
25	Clarke Avenue and East Bayshore Road	D	AM	09/25/18	13.9	B	13.9	B	0.0	0.000	--	--	--	--				
			PM	09/25/18	10.7	B	10.7	B	0.0	0.000	--	--	--	--				

Notes:
* Indicates LOS based on "unserved demand." At this location, upstream & downstream congestion results in delay not captured by the VISTRO analysis.
For intersection 1, the increase in delay column shows the increase of average delay at the intersection.
Bold indicates a substandard level of service.
Box indicates a significant project impact.
OVFL indicates that the result is out of software calculation limits
-- indicates that the intersection level of service and delay with the loop road is the same as without the loop road.
1. For one-way and two-way stop controlled intersections, the average delay and LOS is reported for the worst approach. Changes in critical delay and v/c for the entire intersection cannot be calculated (n/a).
2. Intersections were analyzed using Synchro/SimTraffic software due to the close proximity of these intersections. Changes in critical delay and v/c cannot be calculated (n/a).
3. Delay shown is the average delay for the westbound left-turning vehicles, which have to find gaps in the eastbound traffic flow.
4. Average delay and LOS under mitigated existing plus project and mitigated cumulative plus project with loop road and other improvements reflects signalization.

Existing Plus Project Intersection Impacts and Mitigations

The intersection impacts and recommended mitigation measures under existing plus project conditions are described below. Planning level cost estimates of the recommended mitigation measures are presented in Appendix D.

5. Euclid Avenue and Donohoe Street/East Bayshore Road

Impact: This intersection, which is currently under all-way stop control, operates at an unacceptable LOS F during the AM peak hour under existing conditions. The proposed project would cause the average delay to increase by more than five seconds per vehicle. The existing traffic volumes at this intersection without and with the proposed project meet the Peak-Hour Volume Warrant during the AM peak hour. This constitutes a significant adverse impact according to the thresholds established by the City of East Palo Alto.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the impact to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. A new traffic signal shall be installed at this intersection and coordinated with other closely spaced traffic signals along Donohoe Street. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. Furthermore, the westbound approach shall be restriped to add an exclusive right-turn lane.

With the implementation of these improvements, the Euclid/Donohoe intersection is expected to operate at an acceptable LOS D or better during both the AM and PM peak hours.

6. US 101 Northbound On-Ramp and Donohoe Street

Impact: This unsignalized intersection currently operates at an unacceptable LOS F during the AM peak hour. The proposed project would cause the average delay to increase by five seconds per vehicle. The existing traffic volumes at this intersection without and with the proposed project meet the Peak-Hour Volume Warrant during the AM peak hour. This constitutes a significant adverse impact according to the thresholds established by the City of East Palo Alto.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the impact to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. A new traffic signal shall be installed at this intersection and coordinated with other closely spaced traffic signals along Donohoe Street. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. In order to align with the proposed driveway for the University Plaza Phase II site on the north side of Donohoe Street, the US 101 on ramp shall be shifted approximately 30 feet to the east. In addition, the westbound approach on Donohoe Street shall be restriped to accommodate a short exclusive left-turn pocket (approximately 60 feet in length), a shared left/through lane, and an exclusive through lane. These improvements would require widening of the US 101 northbound on ramp to accommodate two lanes that taper down to a single lane before this ramp connects with the loop on ramp from northbound University Avenue.

With the recommended improvements, the intersection is expected to operate at an acceptable level (LOS C) during both the AM and PM peak hours.

8. Pulgas Avenue and Bay Road

Impact: The intersection is currently operating at LOS D during the PM peak hour. The addition of project traffic would cause the intersection to degrade to unacceptable LOS F both without and with the planned loop road. The existing intersection traffic volumes without and with the proposed project satisfy the Peak-Hour Volume Warrant. This constitutes a significant adverse impact according to the thresholds established by the City of East Palo Alto.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. Due to the relatively low traffic volumes on the uncontrolled approaches on Bay Road compared to the traffic volume on the stop-controlled northbound Pulgas Avenue approach, the installation of a new traffic signal is not recommended at this time. While a new traffic signal would be needed ultimately under cumulative conditions to support planned development farther east (e.g. in the Waterfront Office land use district), installation of all-way stop control is recommended to mitigate the significant project impact under near-term conditions. With all-way stop control, the intersection would operate at an acceptable LOS C during the PM peak hour under existing plus project conditions both without and with the loop road.

14. University Avenue and Donohoe Street

Impact: The intersection is currently operating at LOS F and LOS E during the AM and PM peak hours, respectively. The addition of project generated traffic is expected to cause the average delay to increase by more than four seconds during the AM and PM peak hours. This constitutes a significant adverse impact according to the thresholds established by the City of East Palo.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The westbound approach on Donohoe Street shall be widened to accommodate dual left-turn lanes, one exclusive through lane, one shared through/right lane, and one exclusive right-turn lane to allow for simultaneous left-turn movements on Donohoe Street. These improvements would require right-of-way acquisition along the south side of Donohoe Street between University Avenue and the US 101 northbound off ramp.

The recommended mitigation measure would improve the intersection operations to LOS D during the PM peak hour. During the AM peak hour, the intersection is expected to operate at LOS F, however, the average delay would be less than under existing conditions. Thus, the improvements would satisfactorily mitigate the project impacts.

15. University Avenue and US 101 Southbound Ramps

Impact: The intersection is currently operating at LOS F during the AM and PM peak hours and the addition of project trips would cause the average intersection delay to increase by more than four seconds during the AM and PM peak hours. This constitutes a significant impact according to thresholds established by City of East Palo Alto.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The recommended Donohoe Street improvements at Euclid Avenue, at the US 101 northbound on ramp, at University Avenue, at the US 101 northbound off ramp and at Cooley Avenue would improve traffic flow on University Avenue and eliminate the queue spillback that extends from Donohoe Street past the US 101 southbound ramps. The Donohoe Street improvements would reduce the delay and cause the University/US 101 southbound ramps intersection to operate at LOS D during the AM and PM peak hours. No additional improvements are required to mitigate the significant project impact at this intersection.

16. University Avenue and Woodland Avenue

Impact: The intersection is currently operating at LOS F during the PM peak hour and the addition of project trips would cause the average intersection delay to increase by more than four seconds during the same time period. This constitutes a significant impact according to thresholds established by City of East Palo Alto.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The recommended Donohoe Street improvements at Euclid Avenue, at the US 101 northbound on ramp, at University Avenue, at the US 101 northbound off ramp and at Cooley Avenue would improve traffic flow on University Avenue and eliminate the queue spillback that extends from Donohoe Street past Woodland Avenue. While the University/Woodland intersection is expected to continue to operate at LOS F during the PM peak hour, the Donohoe Street improvements would reduce the average delay at the University/Woodland intersection below that under existing conditions without the project. No additional improvements are required to mitigate the significant project impact at this intersection.

17. University Circle and Woodland Avenue

Impact: The intersection is currently operating at LOS F during the PM peak hour and the addition of project trips would cause the average intersection delay to increase by more than four seconds during the same time period. This constitutes a significant impact according to thresholds established by City of East Palo Alto.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The recommended Donohoe Street improvements at Euclid Avenue, at the US 101 northbound on ramp, at University Avenue, at the US 101 northbound off ramp and at Cooley Avenue would improve traffic flow on University Avenue, and as a result reduce the queues on Woodland Avenue. The mitigation measure would improve the intersection operations to LOS B during the PM peak hour. No additional improvements are required to mitigate the significant project impact at this intersection.

18. US 101 Northbound Off Ramp/University Plaza Phase I driveway and Donohoe Street

Impact: The intersection currently operates at an acceptable LOS D during the AM peak hour and an unacceptable LOS F during the PM peak hour. With the proposed project, the intersection would degrade to an unacceptable level (LOS E) during the AM peak hour and the average delay would increase by more than four seconds during the PM peak hour. This constitutes a significant impact based on the thresholds established by the City of East Palo Alto.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The westbound approach on Donohoe Street at the US 101 northbound off ramp shall be widened to accommodate four through lanes to improve the vehicular throughput at this intersection. This improvement would require median modifications and narrowing the eastbound Donohoe Street approach to Cooley Avenue to include two through lanes and a full length left-turn lane. In addition, the traffic signals shall be coordinated with adjacent traffic signals on Donohoe Street. With the proposed improvements, the intersection of US 101 northbound off ramp and Donohoe Street is expected to operate at an acceptable level (LOS D or better) during the AM and PM peak hours.

20. East Bayshore Road and Donohoe Street

Impact: This intersection currently operates at an acceptable LOS C during the AM peak hour. The additional trips generated by the proposed project would cause the intersection to degrade to an unacceptable LOS E during the AM peak hour. This constitutes a significant impact based on the thresholds established by the City of East Palo Alto.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The recommended Donohoe Street improvements at Euclid Avenue, at the US 101 northbound on ramp, at University Avenue, at the US 101 northbound off ramp, and at Cooley Avenue would improve traffic flow on Donohoe Street and cause the East Bayshore/Donohoe intersection to operate at LOS B during the AM peak hour under existing plus project conditions. No additional improvements are required to mitigate the significant project impact at this intersection.

Freeway Segment Evaluation under Existing Plus Project Conditions

Traffic volumes on the study freeway segments under existing plus project conditions were estimated by adding project trips to the existing volumes obtained from the 2017 CMP Monitoring Report for San Mateo County and 2018 CMP Monitoring Report for Santa Clara County.

The project's impacts at nearby freeway segments were evaluated in accordance with CMP guidelines. The results show that the project would not cause significant impact at any of the study freeway segments in San Mateo or Santa Clara County (see Tables 8 and 9).

Table 8
Existing Plus Project Freeway Level of Service Analysis – San Mateo County

				Existing [1]			Project Conditions		
Freeway	Segment	Dir	Peak Hour	# of Lanes	Capacity	LOS	Project Trips	% Capacity	Impact
US 101	Santa Clara County Line to Whipple Avenue	NB	AM	4	9,200	**F**	4	0.04%	NO
			PM	4	9,200	**F**	16	0.17%	NO
US 101	Whipple Avenue to Santa Clara County Line	SB	AM	4	9,200	**F**	45	0.49%	NO
			PM	4	9,200	**F**	6	0.07%	NO
SR 84	Dumbarton Bridge	EB	AM	3	6,900	**F**	1	0.01%	NO
			PM	3	6,900	**F**	8	0.12%	NO
SR84	Dumbarton Bridge	WB	AM	3	6,900	**F**	18	0.26%	NO
			PM	3	6,900	**F**	1	0.01%	NO

Notes:
1. Existing freeway conditions are based on 2017 Congestion Management Program Monitoring Report of San Mateo County.
BOLD indicates a substandard level of service.

Table 9
Existing Plus Project Freeway Level of Service Analysis – Santa Clara County

					Existing Plus Project												Project Trips				
					Mixed-Flow Lane						HOV Lane							Mixed-Flow Lane		HOV Lane	
#	Freeway	Segment	Direction	Peak Hour	Avg. Speed[1]	# of Lanes[1]	Capacity (vph)	Volume	Density	LOS	Avg. Speed[1]	# of Lanes[1]	Capacity (vph)	Volume	Density	LOS	Total Volume	Volume	% of Capacity	Volume	% of Capacity
1	US 101	Rengstorff Ave to San Antonio Rd	NB	AM	31.80	3	6,900	5,255	55	E	47.87	2	3,300	3,435	36	D	17	14	0.20	3	0.09
			NB	PM	19.40	3	6,900	3,998	**69**	**F**	54.16	2	3,300	3,292	30	D	-1	-1	-0.01	0	0.00
2	US 101	San Antonio Rd to Oregon Expwy	NB	AM	17.80	3	6,900	3,800	**71**	**F**	50.43	2	3,300	3,389	34	D	17	14	0.20	3	0.09
			NB	PM	14.20	3	6,900	3,248	**76**	**F**	13.77	2	3,300	2,964	**108**	**F**	-1	-1	-0.01	0	0.00
3	US 101	Oregon Expwy to Embarcadero Rd	NB	AM	20.20	3	6,900	4,115	**68**	**F**	24.73	1	1,650	1,696	**69**	**F**	17	14	0.20	3	0.18
			NB	PM	18.00	3	6,900	3,812	**71**	**F**	17.84	1	1,650	1,588	**89**	**F**	-1	-1	-0.01	0	0.00
4	US 101	Embarcadero Rd to Oregon Expwy	SB	AM	48.00	3	6,900	5,966	41	D	72.95	1	1,650	570	8	A	-1	-1	-0.01	0	0.00
			SB	PM	15.20	3	6,900	3,412	**75**	**F**	55.31	1	1,650	1,629	29	D	9	7	0.10	2	0.12
5	US 101	Oregon Expwy to San Antonio Rd	SB	AM	49.00	3	6,900	5,975	41	D	70.60	2	3,300	1,838	13	B	-1	-1	-0.01	0	0.00
			SB	PM	19.40	3	6,900	4,006	**69**	**F**	59.66	2	3,300	3,070	26	C	9	7	0.10	2	0.06
6	US 101	San Antonio Rd to Rengstorff Ave	SB	AM	38.60	3	6,900	5,669	49	E	71.66	2	3,300	1,560	11	A	-1	-1	-0.01	0	0.00
			SB	PM	15.00	3	6,900	3,382	**75**	**F**	56.28	2	3,300	3,222	29	D	9	7	0.10	2	0.06

[1] Source: Santa Clara Valley Transportation Authority Congestion Management Program Monitoring Study, 2018.
Bold indicates unacceptable LOS.
Boxed indicates significant impact.

Freeway Ramp Analysis

Field observations were conducted to measure the existing vehicular queues and metering rates at the US 101 northbound hook on ramp at Donohoe Street. The SimTraffic simulation model was calibrated to reflect the observed metering rates and ramp queues. The effects of project added traffic on queues at each freeway on ramp were evaluated based on the SimTraffic analysis results (see Table 10). This information is presented for information only as the City of East Palo Alto has not established any policies or impact criteria related to freeway ramp queues. Nevertheless, the intersection delay values reported in the previous section reflect the additional delay caused by on-ramp queues that in some cases extend beyond the length of the ramp and through the upstream intersection.

The simulation shows that the ramp queue fills or exceeds the available storage under existing conditions during both the AM and PM peak hours. The proposed project would add a relatively small number of trips (4 and 11 trips during the AM and PM peak hours, respectively) to this ramp. Because the existing queue already extends to the end of the ramp, and because upstream congestion constrains the traffic volume that is able to reach the ramp, the simulation output shows the project would not cause any change to the 95th percentile queue length on the US 101 northbound hook on ramp. Improvements proposed to mitigate project impacts at study intersections include realigning and widening the US 101 northbound hook on ramp to include two lanes that transition back to a single lane before merging with the mainline freeway. This would increase the available queue storage between the ramp meter and Donohoe Street from a single lane with 365 feet to two lanes totaling 525 feet (390 feet in one lane and 135 feet in a second lane). With the recommended mitigation measures, the on-ramp queue would continue to exceed the available storage length during the AM peak hour. However, project mitigation measures on Donohoe Street and the additional ramp storage would enable the on-ramp to serve approximately six percent more vehicles during both the AM and PM peak hours than the existing constrained on-ramp volume, which would more than offset the few additional trips added to the ramp by the proposed project.

Table 10
Freeway Ramp Analysis

			95th Percentile Queue Lengths (feet)					
	# Lanes	Storage Length (feet)	Existing		Existing+Project		Existing+Project (With Mitigations)	
			AM	PM	AM	PM	AM	PM
NB US 101 Hook On-Ramp [1]	1	365/390	380	360	380	360	380	280
	2	135	N/A	N/A	N/A	N/A	180	140

Notes:
[1] The analysis assumes a ramp metering rate of 700 vphpl. The mitigations include realigning the on-ramp (which would increase the storage length from 365 to 390 feet) and adding a second receiving lane (135 feet long) on the on-ramp.

4.
Cumulative Conditions

This chapter describes the roadway traffic operations under cumulative conditions without and with the proposed project. Cumulative conditions represent future traffic conditions (year 2040) with expected growth in the area.

Cumulative Transportation Network

The transportation network under cumulative conditions is assumed to include the following mitigation measures identified in the Ravenswood/4 Corners TOD Specific Plan Environmental Impact Report (February 22, 2013):

University Avenue and Purdue Avenue (Mitigation Measure TRA-CUM-3): A new traffic signal will be installed at this intersection. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation will be provided.

University Avenue and Bay Road (Mitigation Measure TRA-CUM-4): add an exclusive northbound right-turn lane and a second northbound left-turn lane on University Avenue, add a second westbound left-turn lane on Bay Road, add a second southbound left-turn lane on University Avenue, and modify signal phasing.

University Avenue and Donohoe Street (Mitigation Measure TRA-CUM-5): add an exclusive southbound right-turn lane on University Avenue.

Clarke Avenue and Bay Road (Mitigation Measure TRA-CUM-8): A new traffic signal will be installed at this intersection. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation will be provided.

Demeter Street and Bay Road (Mitigation Measure TRA-CUM-9): A new traffic signal will be installed at this intersection. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation will be provided.

Pulgas Avenue and Bay Road (Mitigation Measure TRA-CUM-10): A new traffic signal will be installed at this intersection. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation will be provided.

The planned loop road, which was identified in the Ravenswood/4 Corners TOD Specific Plan DEIR, was not assumed as part of the cumulative transportation network, but rather was evaluated as a possible mitigation measure along with other improvements.

The City of East Palo Alto is also working with Caltrans on a US 101/University Avenue interchange improvement project that would include a second pedestrian/bicycle overcrossing and modifications to the freeway off ramps. However, the funding for these improvements has not yet been secured so they are not assumed to be complete under cumulative conditions.

Cumulative Traffic Volumes

Cumulative (year 2040) traffic volumes were estimated by applying an annual growth factor (1.2 percent per year) for 22/21 years to existing (2018/2019) traffic volumes to account for regional growth and then adding trips associated with the development allowed under the Ravenswood Specific Plan and other approved and pending projects in the City of East Palo Alto other than the proposed project. The regional growth factor of 1.2 percent per year was developed by comparing the existing (Year 2019) traffic volumes and the cumulative with project condition (Year 2040) traffic forecasts presented in the East Palo Alto General Plan Update Traffic Impact Analysis. The following proposed and approved developments are all located within the Ravenswood/4 Corners TOD Specific Plan Area:

- 2020 Bay Road office development (proposed),
- 965 Weeks Street residential development (proposed),
- 2398 University Avenue retail project (proposed),
- 1201 Runnymede Street residential development (proposed), and
- 1950 Bay Road East Palo Alto Art Center (approved).

The development assumptions for the Ravenswood Specific Plan includes the trips generated by all of the above-listed projects. The following two projects located within the Ravenswood Specific Plan area are not covered by the development assumed under the Specific Plan:

- 1200 Weeks Street, The Primary School (approved), and
- 2398 University Avenue hotel project (proposed).

Thus, the trips generated by The Primary School and the hotel were added on top of the trips generated by the assumed Specific Plan developments.

Cumulative conditions also include the trips associated with the following notable developments anticipated outside the Ravenswood Specific Plan area:

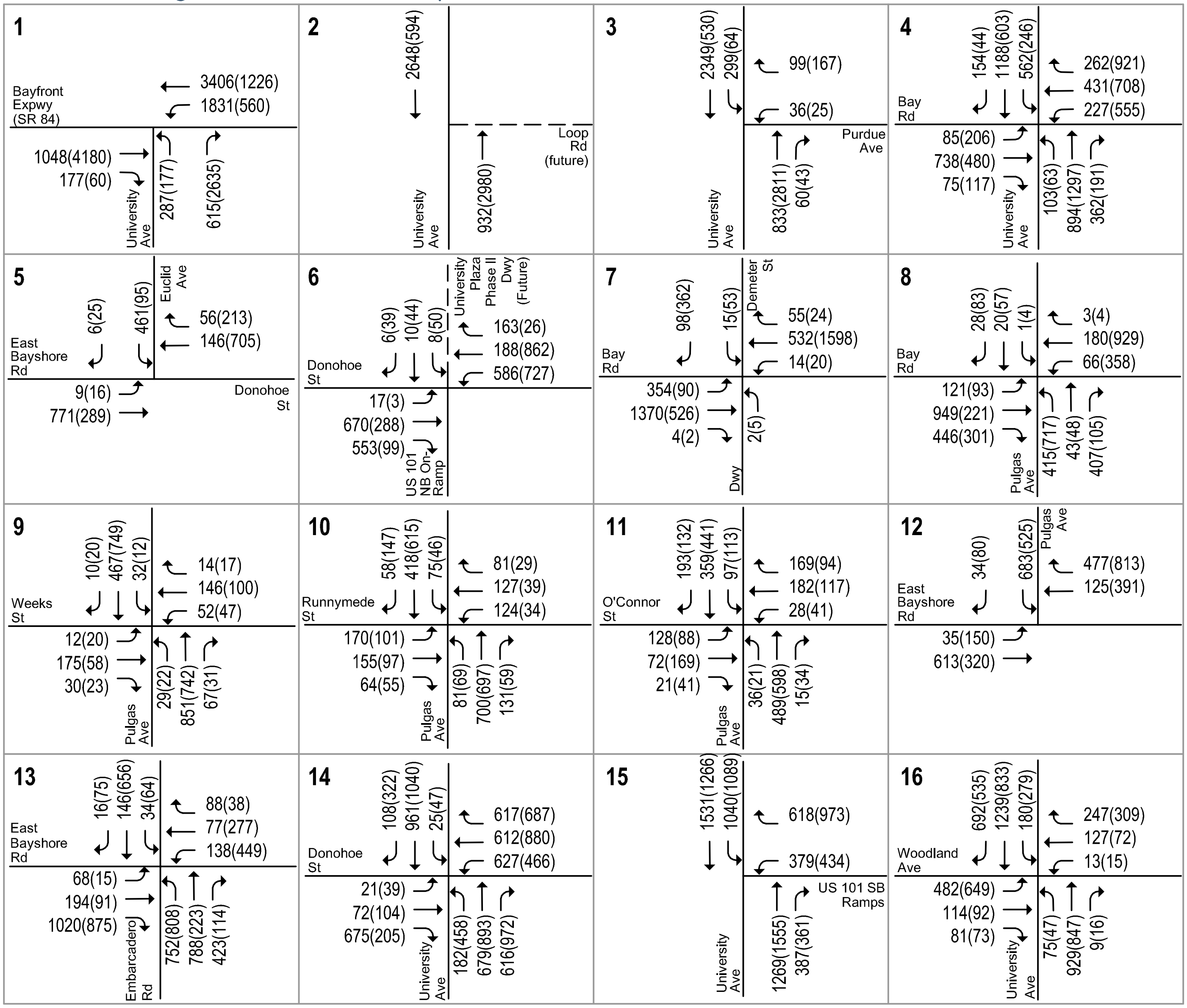
- 2111 University Avenue, University Plaza Phase 2 office development (proposed),
- 1900 University Avenue, University Circle Phase 2 office development (proposed),
- 2031 Euclid Av.– 2001 Manhattan Av., Woodland Park residential development (proposed), and
- 1805 East Bayshore Road, Light Tree Apartment Redevelopment (approved)

The regional growth factor was applied only to intersections along the following major roadways, which are expected to experience regional traffic growth not associated with developments in East Palo Alto:

- University Avenue
- East Bayshore Road
- Bayfront Expressway
- Donohoe Street
- US 101 freeway ramps
- Pulgas Avenue

Although Pulgas Avenue is considered a collector street, it experiences a high volume of cut-through traffic indicating it serves as an alternative route for University Avenue. Therefore, Pulgas Avenue is assumed to experience the same regional traffic growth as other major roadways in the study area. Similarly, Donohoe Street and East Bayshore Road serve regional trips accessing US 101 or diverted from the freeway. The growth factor accounts for the additional traffic that would be generated by approved and proposed developments in Menlo Park, Palo Alto, and other communities.

Cumulative plus project peak-hour traffic volumes were estimated by adding to cumulative traffic volumes the additional traffic generated by the project. The cumulative no project traffic volumes at study intersections are shown in Figure 14, and the cumulative plus project traffic volumes are shown in Figure 15. As previously stated, the cumulative scenarios do not assume completion of the loop road. The planned loop road was evaluated as a potential mitigation measure since it would divert traffic away from several impacted intersections. Cumulative plus project conditions with the loop road reflect the diversion of existing traffic as well as the reassignment of project trips and trips generated by other developments within the Ravenswood / 4 Corners TOD Specific Plan area. Figure 16 presents cumulative plus project traffic volumes with the loop road.



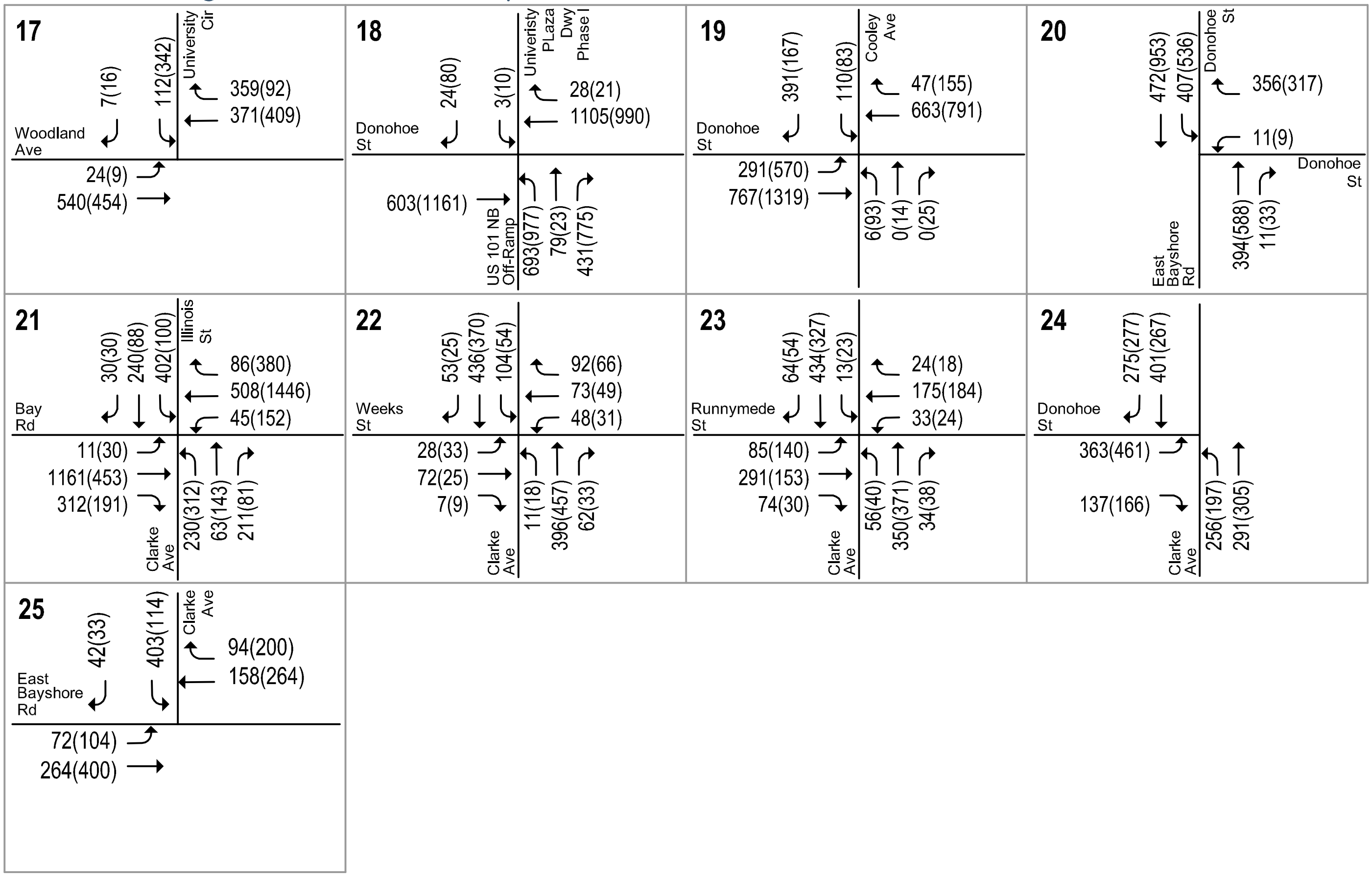
LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 14
Cumulative No Project Traffic Volumes

HEXAGON

NORTH
Not to Scale



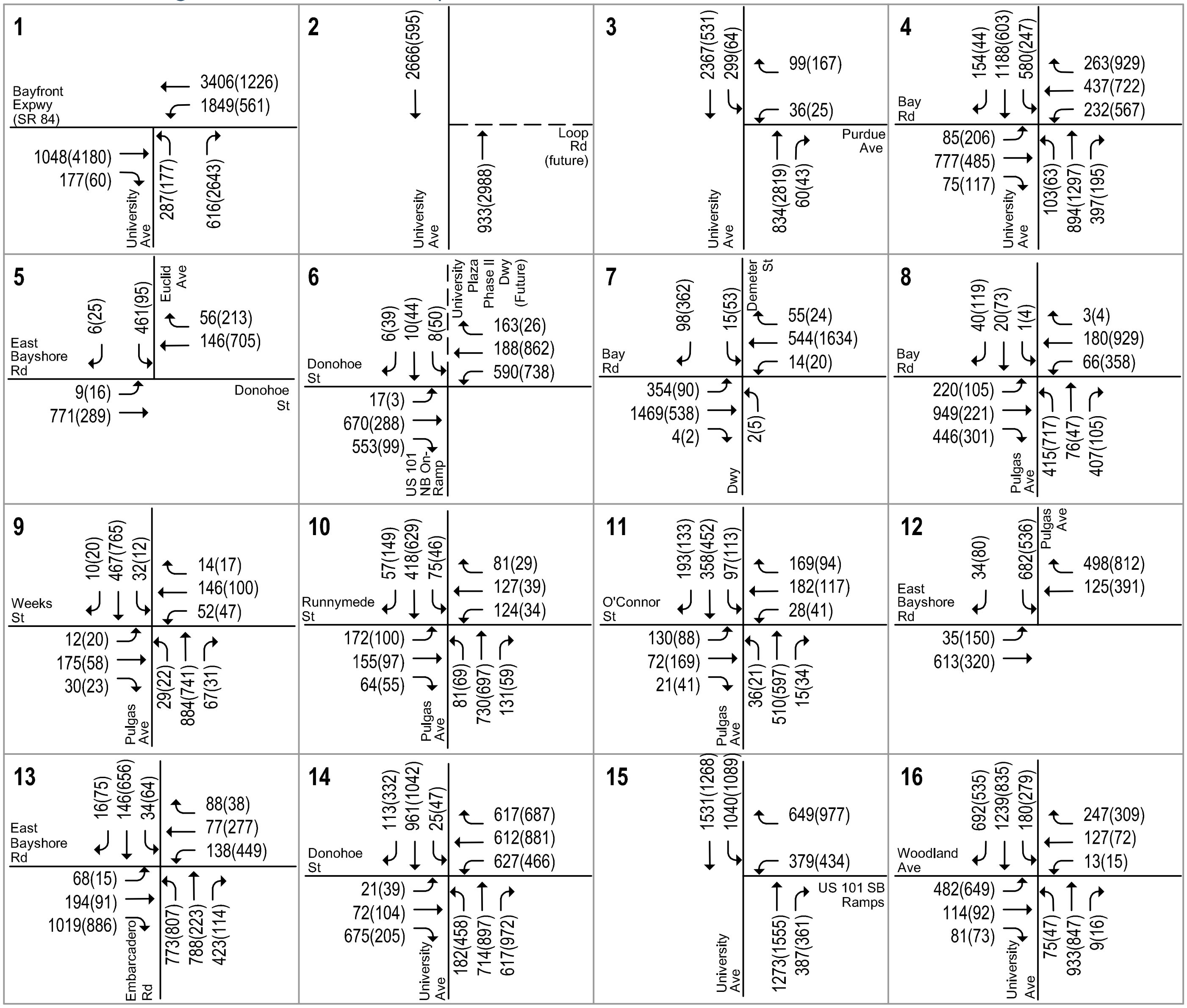
LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 14
Cumulative No Project Traffic Volumes

HEXAGON

NORTH
Not to Scale



LEGEND

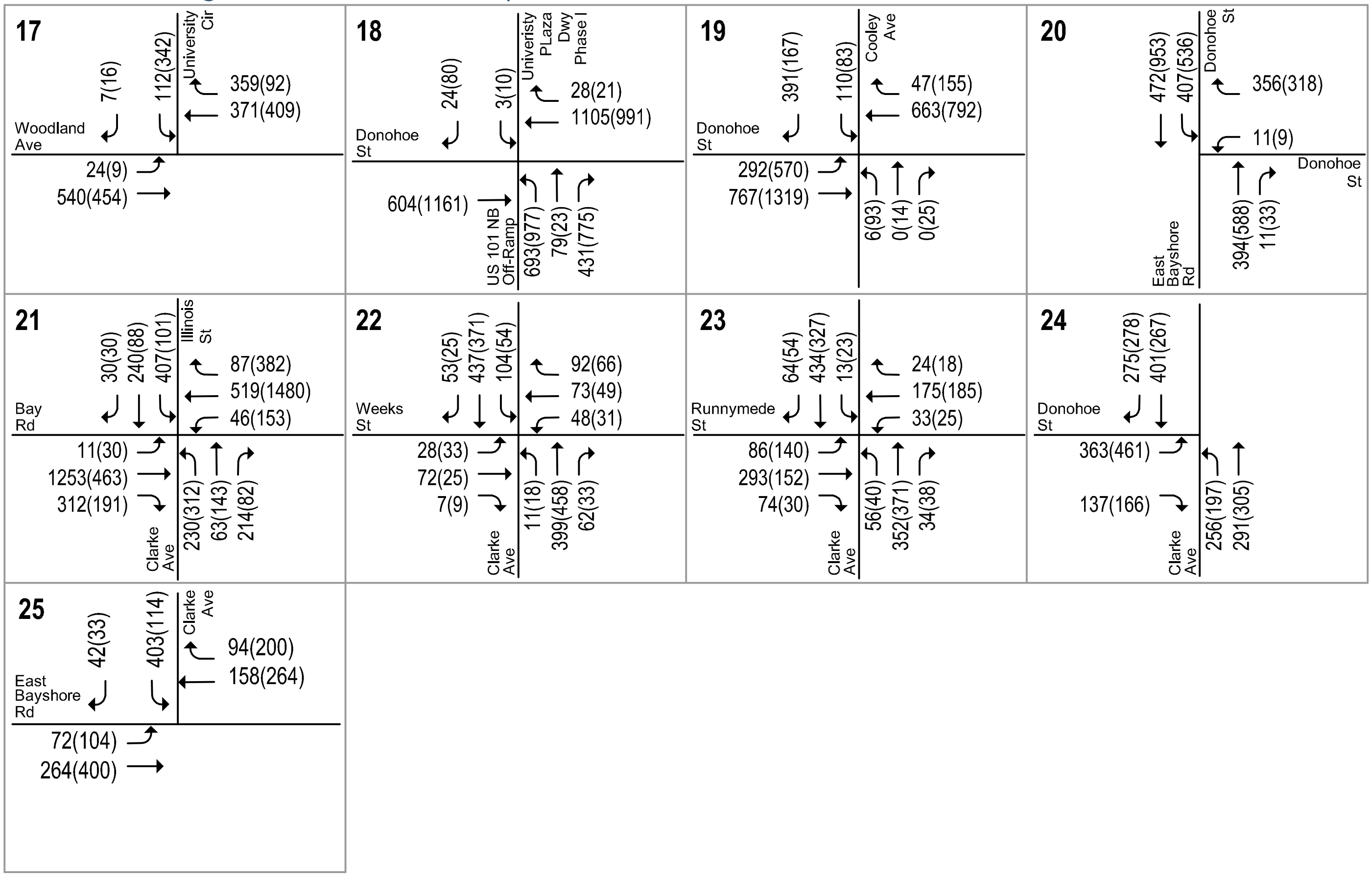
XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 15

Cumulative Plus Project Without Loop Road Traffic Volumes

HEXAGON

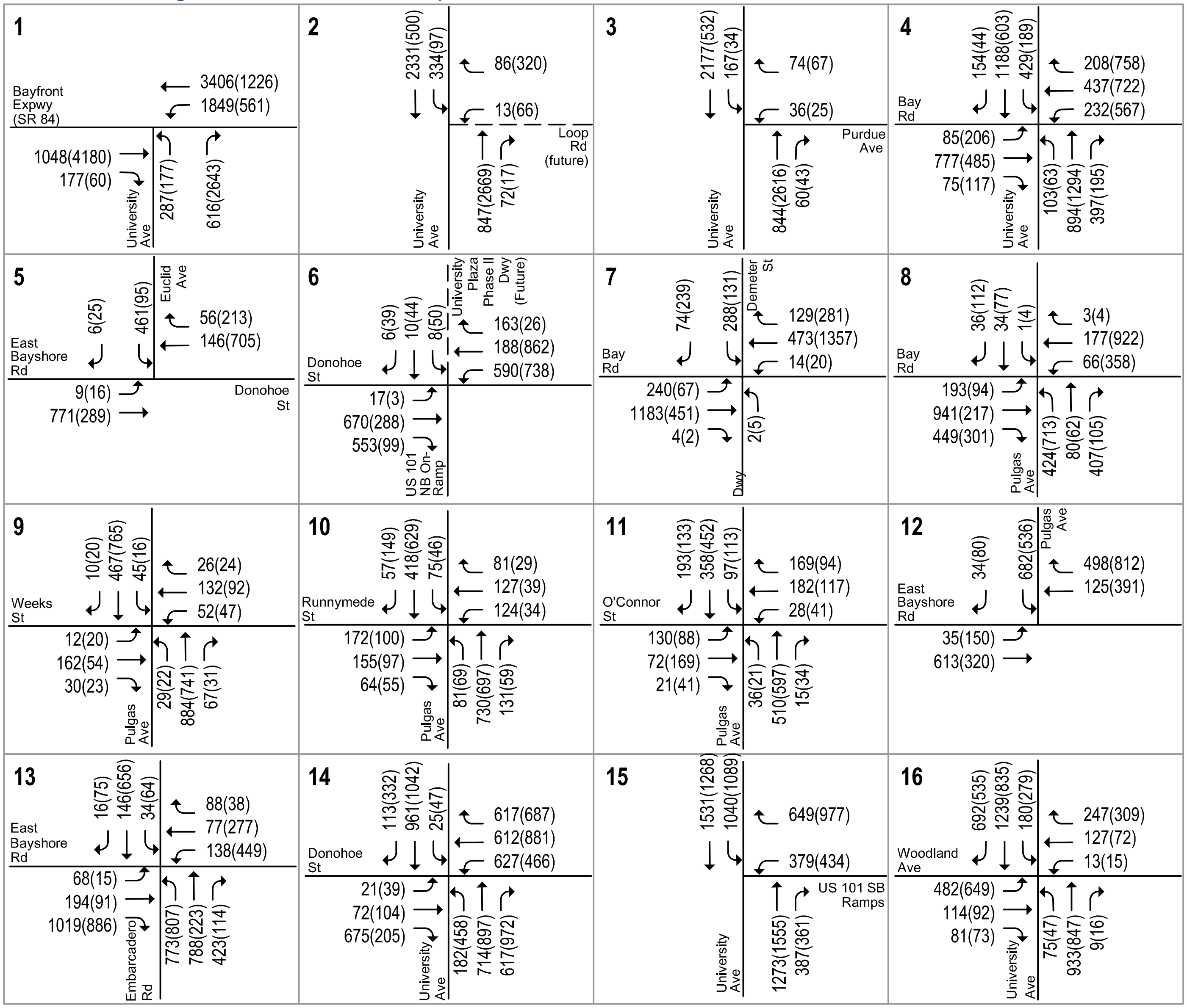
NORTH
Not to Scale



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

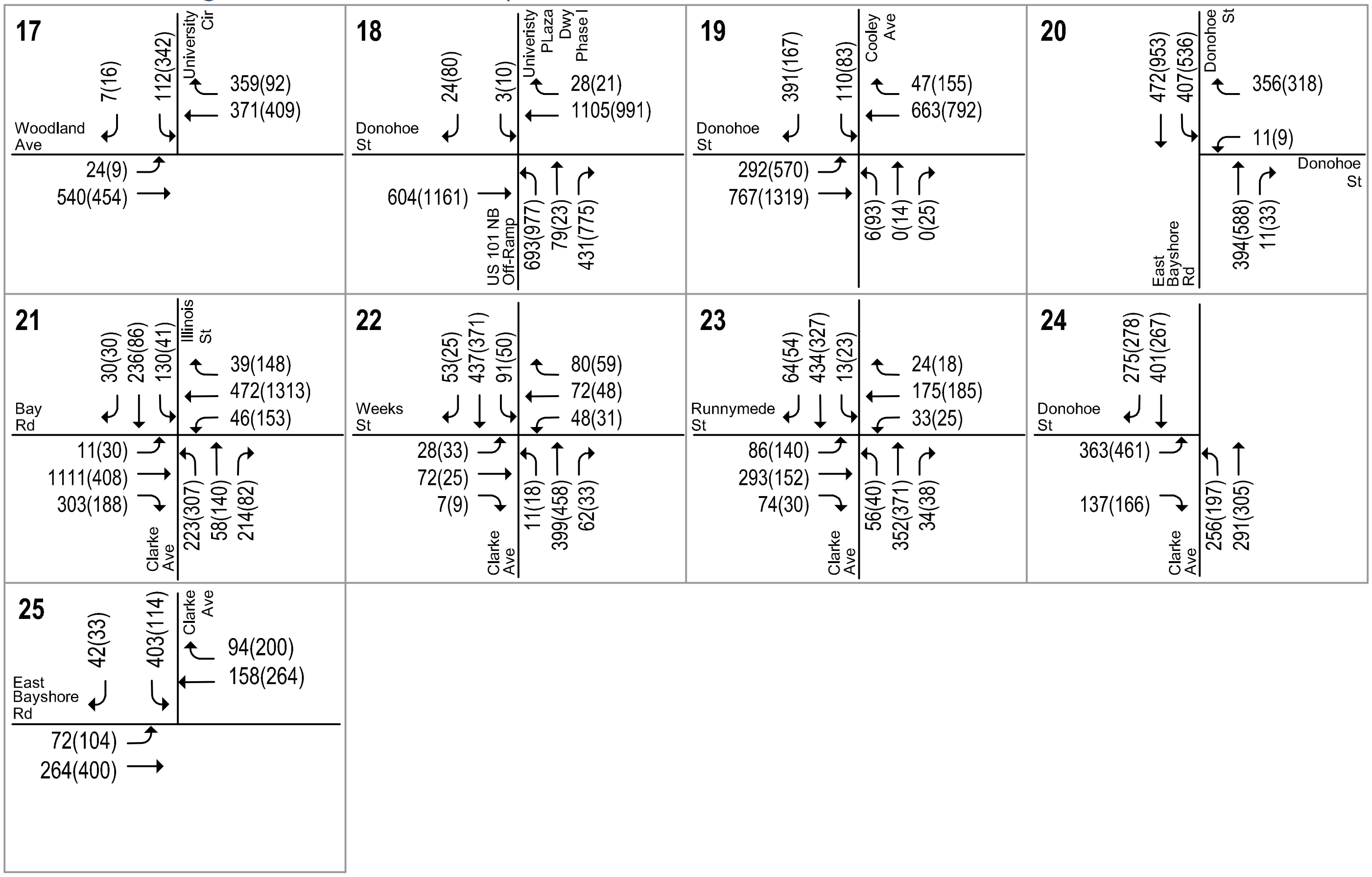
Figure 15
Cumulative Plus Project Without Loop Road Traffic Volumes



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 16
Cumulative Plus Project With Loop Road Traffic Volumes



LEGEND

XX(XX) = AM(PM) Peak-Hour Traffic Volumes

Figure 16
Cumulative Plus Project With Loop Road Traffic Volumes

HEXAGON

NORTH
Not to Scale

Intersection Levels of Service Under Cumulative Conditions

Cumulative plus project conditions were evaluated relative to cumulative no-project conditions in order to determine potential project impacts. Cumulative level of service results are shown in Table 11. Under cumulative plus project conditions without the loop road, the following 22 intersections are expected to operate at an unacceptable level, LOS E or F, during one or both peak hours:

University Avenue (SR 109) and Bayfront Expressway (SR 84)
University Avenue (SR 109) and Loop Road (Future)
University Avenue and Bay Road
Euclid Avenue and East Bayshore Road/ Donohoe Street
US 101 NB On-Ramp/University Plaza Phase II driveway (future) and Donohoe Street
Pulgas Avenue and Bay Road
Pulgas Avenue and Weeks Street
Pulgas Avenue and Runnymede Street
Pulgas Avenue and O'Connor Street
Pulgas Avenue and East Bayshore Road
Embarcadero Road and East Bayshore Road
University Avenue and Donohoe Street
University Avenue and US 101 SB Ramps
University Avenue and Woodland Avenue
University Circle and Woodland Avenue
US 101 NB Off-Ramp/University Plaza Phase I driveway and Donohoe Street
Cooley Avenue and Donohoe Street
East Bayshore Road and Donohoe Street
Clarke Avenue and Bay Road
Clarke Avenue and Weeks Street
Clarke Avenue and Runnymede Street
Clarke Avenue and Donohoe Street

Of the 22 intersections listed above, the following intersections were found to be significantly impacted as a result of the project:

University Avenue and Loop Road (Future) – PM peak hour
University Avenue and Bay Road – AM peak hour
Pulgas Avenue and Bay Road – AM and PM peak hours
Pulgas Avenue and Weeks Street – AM and PM peak hours
Pulgas Avenue and Runnymede Street – AM peak hour
Pulgas Avenue and O'Connor Street – AM peak hour
US 101 Northbound Off Ramp/University Plaza Phase I driveway and Donohoe Street – AM and PM peak hours
East Bayshore Road and Donohoe Street – AM and PM peak hours
Clarke Avenue and Bay Road – AM and PM peak hours

The proposed project will be required to develop a comprehensive Transportation Demand Management (TDM plan) to reduce vehicle trips by at least 25 percent. Therefore, a 25 percent trip reduction was assumed in the trip generation estimates. A sensitivity analysis was conducted subsequently to explore if any significant project impacts could be mitigated through the use of enhanced TDM measures that would reduce trips by up to 50 percent.

Cumulative Intersection Impacts and Mitigations

The intersection impacts and recommended mitigation measures under cumulative conditions are described below. The mitigated cumulative plus project level of service analysis shown in Table 11 presents the effect of the loop road by itself and the effect of the loop road plus other roadway improvements described below. Planning level cost estimates of the recommended mitigation measures and a calculation of the project's fair share contribution are presented in Appendix D.

Table 11
Cumulative Intersection Levels of Service

#	Intersection	LOS Standards	Peak Hour	Cumulative No Project without Loop Road Avg Delay (sec/veh)	Cumulative No Project without Loop Road LOS	Cumulative Plus Project without Loop Road Avg Delay (sec/veh)	Cumulative Plus Project without Loop Road LOS	Cumulative Plus Project Incr. In Crit. Delay	Cumulative Plus Project Incr. In Crit. V/C	Mitigated Cumulative Plus Project Loop Road Avg Delay (sec/veh)	Mitigated Cumulative Plus Project Loop Road LOS	Mitigated Cumulative Plus Project Loop Road + Other Improvments Avg Delay (sec/veh)	Mitigated Cumulative Plus Project Loop Road + Other Improvments LOS
1	University Avenue and Bayfront Expressway [Menlo Park] (CMP)	D	AM	**92.4**	**F**	**94.0**	**F**	1.6	n/a				
			PM	**OVFL**	**F**	**OVFL**	**F**	2.2	n/a				
2	University Avenue and Loop Road [Future Signal]	D	AM							15.5	B	14.2	B
			PM							**74.3**	**E**	38.6	D
3	University Avenue and Purdue Avenue [5]	D	AM	17.5	B	17.5	B	0.1	0.005	12.8	B		
	(One-way Stop [1])		PM	37.9	D	38.4	D	0.6	0.002	12.7	B		
4	University Avenue and Bay Road	D	AM	**64.6**	**E**	**70.5**	**E**	6.9	0.024	**65.2**	**E**	46.7	D
			PM	**92.8**	**F**	**94.0**	**F**	2.2	0.005	**74.5**	**E**	**72.8**	**E**
5	Euclid Avenue and Donohoe Street/East Bayshore Road [2, 4]	D	AM	**348.7**	**F**	**349.4**	**F**					**214.9**	**F**
	(All-way Stop)		PM	**99.4**	**F**	**92.6**	**F**					12.7	B
6	US 101 NB On-Ramp/University Plaza Ph II dwy & Donohoe St [2, 3, 4]	D	AM	**OVFL**	**F**	**OVFL**	**F**					18.4	B
	(Uncontrolled)		PM	**OVFL**	**F**	**OVFL**	**F**					22.4	C
7	Demeter Street and Bay Road [5]	D	AM	20.8	C	20.8	C	0.4	0.034	33.0	C		
	(Two-way Stop [1])		PM	38.2	D	39.4	D	2.6	0.015	35.9	D		
8	Pulgas Avenue and Bay Road [5]	D	AM	**100.0**	**F**	**103.4**	**F**	9.5	0.024	**106.1**	**F**	**57.9**	**E**
	(Two-way Stop [1])		PM	**266.5**	**F**	**283.5**	**F**	30.7	0.068	**282.2**	**F**	45.1	D
9	Pulgas Avenue and Weeks Street [4]	D	AM	**OVFL**	**F**	**OVFL**	**F**	n/a	n/a	**OVFL**	**F**	15.2	B
	(Two-way Stop [1])		PM	**OVFL**	**F**	**OVFL**	**F**	n/a	n/a	**OVFL**	**F**	10.0	B
10	Pulgas Avenue and Runnymede Street [4]	D	AM	**291.4**	**F**	**309.2**	**F**	17.8	0.075			32.7	C
	(All-way Stop)		PM	**179.6**	**F**	**184.2**	**F**	4.7	-0.001			15.3	B
11	Pulgas Avenue and O'Connor Street	D	AM	**118.5**	**F**	**123.8**	**F**	5.4	0.000			32.5	C
	(All-way Stop)		PM	**147.1**	**F**	**150.9**	**F**	3.9	0.024			30.1	C
12	Pulgas Avenue and East Bayshore Road	D	AM	38.9	D	41.3	D	3.6	0.014				
			PM	**136.0**	**F**	**138.5**	**F**	2.7	0.006				
13	Embarcadero Road and East Bayshore Road [City of Palo Alto]	D	AM	43.1	D	42.9	D	-0.4	-0.001				
			PM	**166.2**	**F**	**168.7**	**F**	2.8	0.007				
14	University Avenue and Donohoe Street [2]	D	AM	**176.5**	**F**	**172.6**	**F**					**83.3**	**F**
			PM	**121.5**	**F**	**124.9**	**F**					**88.9**	**F**
15	University Avenue and US101 SB Ramps [2]	D	AM	**159.8**	**F**	**156.9**	**F**					116.2	**F**
			PM	**138.7**	**F**	**138.3**	**F**					**115.6**	**F**

Table 11 (continued)
Cumulative Intersection Levels of Service

				Cumulative No Project		Cumulative Plus Project				Mitigated Cumulative Plus Project			
				without Loop Road		without Loop Road				Loop Road		Loop Road + Other Improvments	
#	Intersection	LOS Standards	Peak Hour	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS
16	University Avenue and Woodland Avenue [2]	D	AM	**282.1**	**F**	**258.7**	**F**					86.2	**F**
			PM	**OVFL**	**F**	**OVFL**	**F**					**136.8**	**F**
17	University Circle and Woodland Ave [2]	D	AM	**128.5**	**F**	**121.3**	**F**					**57.1**	**F**
			PM	**OVFL**	**F**	**OVFL**	**F**					**OVFL**	**F**
18	US 101 NB Off-Ramp/University Plaza Ph I dwy and Donohoe St [2]	D	AM	**OVFL**	**F**	**OVFL**	**F**					38.3	D
			PM	**OVFL**	**F**	**OVFL**	**F**					**249.9**	**F**
19	Cooley Avenue and Donohoe Street [2]	D	AM	**155.5**	**F**	**158.9**	**F**					33.9	C
			PM	46.2	D	47.2	D					43.2	D
20	East Bayshore Road and Donohoe Street [2]	D	AM	**OVFL**	**F**	**OVFL**	**F**					**102.9**	**F**
			PM	**OVFL**	**F**	**OVFL**	**F**					**200.7**	**F**
21	Clarke Avenue and Bay Road [5]	D	AM	**110.1**	**F**	**121.9**	**F**	15.9	0.036	48.1	D		
	(All-way Stop)		PM	**74.8**	**E**	**78.5**	**E**	5.2	0.013	41.4	D		
22	Clarke Avenue and Weeks Street	D	AM	**107.0**	**F**	**109.3**	**F**	n/a	n/a	**89.6**	**F**		
	(Two-way Stop [1])		PM	34.1	D	34.3	D	n/a	n/a	32.9	D		
23	Clarke Avenue and Runnymede Street	D	AM	**80.2**	**F**	**81.2**	**F**	1.0	0.001				
	(All-way Stop)		PM	28.6	D	28.7	D	0.1	0.001				
24	Clarke Avenue and Donohoe Street	D	AM	**90.8**	**F**	**90.8**	**F**	0.0	0.000				
	(All-way Stop)		PM	**80.1**	**F**	**80.3**	**F**	0.2	0.000				
25	Clarke Avenue and East Bayshore Road	D	AM	14.7	B	14.7	B	0.0	0.000				
			PM	11.4	B	11.4	B	0.0	0.000				

Notes:

* Indicates LOS based on "unserved demand." At this location, upstream & downstream congestion results in delay not captured by the VISTRO analysis.

For intersection 1, the increase in delay column shows the increase of average delay at the intersection.

Bold indicates a substandard level of service.

Box indicates a significant project impact.

OVFL indicates that the result is out of software calculation limits

-- indicates that the intersection level of service and delay with the loop road is the same as without the loop road.

1. For one-way and two-way stop controlled intersections, the average delay and LOS is reported for the worst approach. Changes in critical delay and v/c for the entire intersection cannot be calculated (n/a).
2. Intersections were analyzed using Synchro/SimTraffic software due to the close proximity of these intersections. Changes in critical delay and v/c cannot be calculated (n/a).
3. Delay shown is the average delay for the westbound left-turning vehicles, which have to find gaps in the eastbound traffic flow.
4. Average delay and LOS under mitigated existing plus project and mitigated cumulative plus project with loop road and other improvements reflects signalization.
5. A new traffic signal is assumed under cumulative conditions based on mitigation measures identified in the Ravenswood/Four Corners TOD Specific Plan DEIR.

2. University Avenue and Loop Road (Future)

Impact: This intersection would be constructed as part of the Ravenswood Specific Plan. The projected traffic volumes and assumed two-lane cross section of the Loop Road under cumulative plus project conditions is expected to result in LOS E with an average of 74.3 seconds of delay per vehicle during the PM peak hour. This constitutes a significant adverse impact according to the thresholds established by the City of East Palo Alto.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the intersection would still operate at LOS E with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the impact to a less than significant level.

The significant cumulative impact at this intersection could be fully mitigated by widening the planned westbound loop road approach to include an exclusive right-turn pocket and one shared left/right-turn lane. With these improvements, the intersection would operate at an acceptable LOS D during the PM peak hour under cumulative plus project conditions.

4. University Avenue and Bay Road

Impact: This intersection would operate at an unacceptable LOS E during the AM peak hour under cumulative no project conditions. The addition of project traffic would cause the critical-movement delay at the intersection to increase by four or more seconds and the volume-to-capacity ratio (V/C) to increase by .01 or more under cumulative plus project conditions. This constitutes a significant adverse impact according to the thresholds established by the City of East Palo Alto.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the impact to a less than significant level.

The construction of the planned loop road would reduce the traffic volume at the University/Bay intersection causing a decrease in the average vehicle delay during the AM peak hour. However, the intersection delay under cumulative plus project conditions with the loop road would be greater than under cumulative no project conditions. Therefore, construction of the loop road would only partially mitigate the impact at this intersection.

The significant cumulative impact at this intersection could be fully mitigated by constructing the planned loop road and converting the right-turn lane on eastbound Bay Road to a shared through-right turn lane. This improvement would not require additional right-of-way beyond that described in the Ravenswood/4 Corners TOD Specific Plan. With this improvement, the intersection would operate at an acceptable LOS D during the AM peak hour. The intersection would continue to operate at an unacceptable LOS E with the recommended improvement during the PM peak hour, however the average delay would be less than under cumulative no project conditions.

8. Pulgas Avenue and Bay Street

Impact: The intersection is expected to operate at an unacceptable LOS F during the AM and PM peak hours under cumulative no project conditions. The addition of project traffic would cause the critical-movement delay at the intersection to increase by four or more seconds and the volume-to-capacity ratio (V/C) to increase by .01 or more during the AM and PM peak hour under cumulative plus project conditions. This constitutes a significant adverse impact according to the thresholds established by the City of East Palo Alto.

Mitigation: Cumulative conditions assume the installation of a traffic signal at this intersection, which was identified as a mitigation measure in the Ravenswood/Four Corners TOD Specific Plan DEIR.

Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact during the AM peak hour even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

The construction of the planned loop road would have only a minor effect on the traffic volumes and delay at the Pulgas/Bay intersection. Therefore, construction of the loop road would not mitigate the significant adverse impact at this intersection.

The significant cumulative impact at this intersection could be mitigated by constructing the planned loop road, adding an exclusive left-turn lane on the westbound Bay Road approach, and modifying the northbound Pulgas Avenue approach to include one exclusive left-turn lane and one shared left/through/right-turn lane. Split phase signal control shall be used on the north and south approaches. These improvements will require the acquisition of additional right of way at the northeast corner to allow for curb, gutter, sidewalk, and signal equipment. However, the needed right of way would not require the demolition of the existing building on the northeast corner. With these improvements, the intersection would operate at an acceptable LOS D during the PM peak hour under cumulative plus project conditions. During the AM peak hour, the intersection would continue to operate at an unacceptable LOS E with the recommended improvement, however the average delay would be less than under cumulative no project conditions.

9. Pulgas Avenue and Weeks Street

Impact: This intersection would operate at an unacceptable level (LOS F) during the AM and PM peak hours under cumulative no project conditions. The addition of project traffic would cause the control delay at the intersection to increase by five or more seconds during the AM and PM peak hours under cumulative plus project conditions, and the intersection traffic volumes are expected to satisfy the Peak-Hour Volume Warrant. This constitutes a significant adverse impact under the City of East Palo Alto standards.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

The construction of the planned loop road would have only a minor effect on the traffic volumes and delay at the Pulgas/Weeks intersection. Therefore, construction of the loop road would not mitigate the significant adverse impact at this intersection.

The significant cumulative impact at this intersection could be mitigated by constructing the planned loop road and installing a new traffic signal at this intersection. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. With these improvements, the intersection would operate at an acceptable level (LOS B) during the AM and PM peak hours under cumulative plus project conditions.

10. Pulgas Avenue and Runnymede Street

Impact: This intersection would operate at an unacceptable level (LOS F) during the AM and PM peak hours under cumulative no project conditions. The addition of project traffic would cause the control delay at the intersection to increase by five or more seconds during the AM peak hour under cumulative plus project conditions, and the intersection traffic volumes are expected to satisfy the Peak-Hour Volume Warrant. This constitutes a significant adverse impact under the City of East Palo Alto standards.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

The construction of the planned loop road is not expected to affect the traffic volumes or delay at this intersection. A new traffic signal shall be installed at this intersection. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. With these improvements, the intersection would operate at an acceptable LOS C or better during the AM and PM peak hours under cumulative plus project conditions.

11. Pulgas Avenue and O'Connor Street

Impact: This intersection would operate at an unacceptable level (LOS F) during the AM peak hour under cumulative no project conditions. The addition of project traffic would cause the control delay at the intersection to increase by five or more seconds during the AM peak hour under cumulative plus project conditions, and the intersection traffic volumes are expected to satisfy the Peak-Hour Volume Warrant. This constitutes a significant adverse impact under the City of East Palo Alto standards.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations. In order to reduce the project impacts to a less than significant level under cumulative plus project conditions without any physical improvements to the intersection, the TDM Plan would need to reduce PM peak-hour trips by 35 percent.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. As an alternative to an enhanced TDM Plan, the significant cumulative impact at this intersection could be mitigated by installing a new traffic signal at this intersection. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. With these improvements, the intersection would operate at an acceptable level (LOS C) during the AM and PM peak hours under cumulative plus project conditions.

18. US 101 Northbound Off Ramp and Donohoe Street

Impact: The intersection is expected to operate at an unacceptable LOS F during both the AM and PM peak hours under cumulative no project conditions. With the proposed project, the intersection average delay would increase by more than four seconds per vehicle. This constitutes a significant adverse impact according to the thresholds established by the City of East Palo.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The westbound approach on Donohoe Street at the US 101 northbound off ramp shall be widened to accommodate four through lanes to improve the vehicular throughput at this intersection. This improvement would require median modifications and narrowing the eastbound Donohoe Street approach to Cooley Avenue to include two through lanes and a full length left-turn lane. In addition, the traffic signals shall be coordinated with adjacent traffic signals on Donohoe Street.

In addition, improvements also would be needed at other intersections along Donohoe Street at Euclid Avenue, at the US 101 northbound on ramp, at the US 101 northbound off ramp, and at Cooley Avenue as follows:

Euclid/Donohoe/East Bayshore

In order to prevent queues from extending through adjacent intersections, a new traffic signal shall also be installed at the Euclid/Donohoe/East Bayshore intersection and coordinated with other nearby traffic signals along Donohoe Street. Along with a new traffic signal, appropriate pedestrian and bicycle accommodation should be provided. This includes pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops. Furthermore, the westbound approach shall be restriped to add an exclusive right-turn lane.

US 101 NB On-Ramp/University Plaza Ph II Driveway & Donohoe St

A new traffic signal shall be installed at the intersection of US 101 NB On-Ramp and Donohoe Street and coordinated with other closely spaced traffic signals along Donohoe Street. In order to align with the proposed driveway for the University Plaza Phase II site on the north side of Donohoe Street, the US 101 on ramp shall be shifted approximately 30 feet to the east. In addition, the westbound approach on Donohoe Street shall be restriped to accommodate a short exclusive left-turn pocket (approximately 60 feet in length), a shared left/through lane, and an exclusive through lane. These improvements would require widening of the US 101 northbound on ramp to accommodate two lanes that taper down to a single lane before this ramp connects with the loop on ramp from northbound University Avenue. All these improvements would improve traffic flow along the Donohoe Street corridor.

University Avenue and Donohoe Street

The westbound Donohoe Street approach shall be widened to accommodate dual left-turn lanes, one exclusive through lane, one shared through/right-turn lane, and one exclusive right-turn lane to allow for simultaneous left-turn movements on Donohoe Street (as identified in the C/CAG Willow Road and University Avenue Traffic Operations Study). These improvements would require right-of-way acquisition along the south side of Donohoe Street between University Avenue and the US 101 northbound off ramp. In addition, the inner left-turn lane on the northbound University Avenue approach shall be extended by an additional 250 feet. The northbound approach on University Avenue consists of dual left-turn lanes, with the inner left-turn lane measuring 175 feet and the outer left-turn lane measuring 125 feet. With the extension of the inner left-turn lane by an additional 250 feet, the two northbound left-turn lanes would provide for a total of 550 feet of queue storage capacity, or 22 vehicles. This additional storage would prevent left-turn queues from spilling over into the adjacent through lane and impeding the through traffic on University Avenue. Extension of the northbound left-turn lane can be accommodated within the existing right-of-way, by cutting into the raised median on University Avenue. This improvement would not require any additional right-of-way acquisition or reconfiguration of the US 101 overpass.

Cooley Avenue and Donohoe Street

The eastbound Donohoe Street approach to Cooley Avenue shall be restriped to include two through lanes and a full length left-turn lane and the traffic signal shall be coordinated with adjacent traffic signals on Donohoe Street.

With all these proposed improvements, the intersection of US 101 northbound off ramp and Donohoe Street is expected to operate at acceptable levels during the AM peak hour. During the PM peak hour, the intersection would continue to operate at an unacceptable LOS F. However, the average delay would be lower than under cumulative no project conditions.

20. East Bayshore Road and Donohoe Street

Impact: This intersection is expected to operate at an unacceptable LOS F during the AM and PM peak hours. The additional trips generated by the proposed project would increase the average intersection delay by more than four seconds during both the AM and PM peak hours. This constitutes a significant adverse impact according to the thresholds established by the City of East Palo.

Mitigation: Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

Construction of the planned loop is not expected to affect the traffic volumes or delay at this intersection. The recommended Donohoe Street improvements at Euclid Avenue, at the US 101 northbound on ramp, at University Avenue, at the US 101 northbound off ramp, and at Cooley Avenue would improve traffic flow on Donohoe Street and reduce delay at the East Bayshore/Donohoe intersection. The intersection would continue to operate at an unacceptable LOS F during the AM and PM peak hours under cumulative plus project conditions with the recommended improvements. However, the average delay per vehicle would be lower than under cumulative no project conditions during the AM and PM peak hours.

21. Clarke Avenue and Bay Street

Impact: The intersection is expected to operate at an unacceptable LOS F and LOS E during the AM and PM peak hours, respectively, under cumulative no project conditions. The addition of project traffic would cause the critical-movement delay at the intersection to increase by four or more seconds and the volume-to-capacity ratio (V/C) to increase by .01 or more during the AM and PM peak hour under cumulative plus project conditions. This constitutes a significant adverse impact according to the thresholds established by the City of East Palo Alto.

Mitigation: Cumulative conditions assume the installation of a traffic signal at this intersection, which was identified as a mitigation measure in the Ravenswood/Four Corners TOD Specific Plan DEIR.

Enhanced TDM measures that would reduce project trip generation by greater than 25 percent could reduce delays and improve intersection operations somewhat. However, the project would still have a significant impact during the AM peak hour even with a 50 percent reduction in trips due to TDM measures. Therefore, it is concluded that TDM measures alone would not be sufficient to reduce the project impacts to a less than significant level.

The construction of the planned loop road would reduce the traffic volume at the Clarke/Bay intersection causing a decrease in the average vehicle delay during both peak hours. With the loop road, the intersection would operate at an acceptable LOS D during the AM and PM peak hours under cumulative plus project conditions. Therefore, construction of the loop road would fully mitigate the impact at this intersection.

Freeway Segment Evaluation under Cumulative Conditions

Traffic conditions on the study freeway segments under Year 2030 cumulative conditions were obtained from the Final Subsequent Environmental Impact Report, North Bayshore Precise Plan (Appendix D), dated November, 2017. The trips added by the proposed project are assumed to be the same under cumulative conditions as under existing plus project conditions.

The project's impacts at nearby freeway segments were evaluated in accordance with CMP guidelines. The results show that the none of study freeway segments in San Mateo or Santa Clara County would be significantly impacted by the proposed project (see Tables 12 and 13).

Table 12
Cumulative Freeway Level of Service Analysis – San Mateo County

				Year 2030 Cumulative [1]			Project Conditions		
Freeway	Segment	Dir	Peak Hour	# of Lanes	Capacity	LOS	Project Trips	% Capacity	Impact
US 101	Santa Clara County Line to Whipple Avenue	NB	AM	4	9,200	**F**	4	0.04%	NO
			PM	4	9,200	**F**	16	0.17%	NO
US 101	Whipple Avenue to Santa Clara County Line	SB	AM	4	9,200	**F**	45	0.49%	NO
			PM	4	9,200	**F**	6	0.07%	NO
SR 84	Dumbarton Bridge [2]	EB	AM	3	6,900	**F**	1	0.01%	NO
			PM	3	6,900	**F**	8	0.12%	NO
SR84	Dumbarton Bridge [2]	WB	AM	3	6,900	**F**	18	0.26%	NO
			PM	3	6,900	**F**	1	0.01%	NO

Notes:
1. Source: Final Subsequent Environmental Impact Report, North Bayshore Precise Plan (November, 2017). Appendix D: Transportation Impact Analysis (Final). July 2017
2. Cumulative traffic forecasts for the Dumbarton Bridge (SR 84) are not available. This freeway segment currently operates at LOS F during both the AM and PM peak hours. There are no planned capacity improvements for this location. Thus, it is expected to continue operating at LOS F under the Year 2030 cumulative scenario.
BOLD indicates a substandard level of service.

Table 13
Cumulative Freeway Level of Service Analysis – Santa Clara County

					Year 2030 Cumulative Conditions								Project Trips				
					Mixed-Flow Lanes			HOV Lanes					Mixed-Flow Lane			HOV Lane	
#	Freeway	Segment	Direction	Peak Hour	# of Lanes[1]	Capacity (vph)	Acceptable LOS?	# of Lanes[1]	Capacity (vph)	Ex. Volume/a/	Acceptable LOS?	Total Volume	Volume	% of Capacity	Volume	% of Capacity
1	US 101	Rengstorff Ave to San Antonio Rd	NB	AM	3	6,900	NO	2	3,300	3,300	YES	17	14	0.20	3	0.09
			NB	PM	3	6,900	NO	2	3,300	3,220	YES	-1	-1	-0.01	0	0.00
2	US 101	San Antonio Rd to Oregon Expwy	NB	AM	3	6,900	NO	2	3,300	3,520	YES	17	14	0.20	3	0.09
			NB	PM	3	6,900	NO	2	3,300	3,600	YES	-1	-1	-0.01	0	0.00
3	US 101	Oregon Expwy to Embarcadero Rd	NB	AM	3	6,900	NO	1	1,650	1,800	NO	17	14	0.20	3	0.18
			NB	PM	3	6,900	NO	1	1,650	1,980	NO	-1	-1	-0.01	0	0.00
4	US 101	Embarcadero Rd to Oregon Expwy	SB	AM	3	6,900	NO	1	1,650	2,200	NO	-1	-1	-0.01	0	0.00
			SB	PM	3	6,900	NO	1	1,650	1,720	NO	9	7	0.10	2	0.12
5	US 101	Oregon Expwy to San Antonio Rd	SB	AM	3	6,900	NO	2	3,300	2,010	YES	-1	-1	-0.01	0	0.00
			SB	PM	3	6,900	NO	2	3,300	3,810	YES	9	7	0.10	2	0.06
6	US 101	San Antonio Rd to Rengstorff Ave	SB	AM	3	6,900	YES	2	3,300	2,510	YES	-1	-1	-0.01	0	0.00
			SB	PM	3	6,900	NO	2	3,300	2,800	YES	9	7	0.10	2	0.06

Source: Final Subsequent Environmental Impact Report, North Bayshore Precise Plan (November, 2017). Appendix D: Transportation Impact Analysis (Final). July 2017
Boxed indicates significant impact.

5.
Other Transportation Issues

This chapter presents an analysis of other transportation issues associated with the project, including:

- Potential impacts on pedestrian, bicycle, and transit facilities
- Vehicle miles travelled
- Queuing analysis at selected intersections
- Site access and circulation

Unlike the level of service impact methodology, which is adopted by the City Council, the analyses in this chapter are based on professional judgment in accordance with the standards and methods employed by the traffic engineering community. Although operational issues are not considered CEQA impacts, they do describe traffic conditions that are relevant to describing the project environment.

Potential Impacts on Pedestrians, Bicycles and Transit

Pedestrian facilities consist of sidewalks, crosswalks, and pedestrian signals at signalized intersections. In the vicinity of the project site, sidewalks are provided on both sides of Bay Road west of Pulgas Avenue. Between Pulgas Avenue and Tara Street, there are no sidewalks. A short sidewalk (approximately 400 feet long) is provided on the south side of Bay Road east of Tara Street. Sidewalks are provided on both sides of Pulgas Avenue south of Bay Road. North of Bay Road, a short sidewalk (approximately 200 feet) is available only on the west side of the street. The project site plan shows that the project would provide new sidewalk along its frontage on Pulgas Avenue and would connect to the existing sidewalk. However, there is a small segment on the west side of Pulgas Avenue immediately north of Bay Road that has no sidewalk. It is recommended that a new sidewalk be constructed to connect the project site to the nearest bus stops on Bay Road.

New traffic signals are proposed at several study intersections to mitigate significant cumulative impacts on intersection levels of service. Along with a new traffic signal, appropriate pedestrian and bicycle accommodations should be provided. This includes crosswalks, pedestrian countdown timers, Americans with Disabilities Act (ADA) compliant curbs, and bicycle detection loops.

Designated bicycles facilities in the immediate vicinity of the project site include bike lanes on Bay Road west of Clarke Avenue and the Bay Trail, a bike and pedestrian path that runs along the west boundary of the Baylands Nature Preserve area about one quarter mile east of the project site. There is also a short paved mixed-use trail known as the Rail Spur that extends from Bay Road to Pulgas Avenue. These bicycle facilities are not well-connected. However, many of the residential streets south of the project site are conducive to bicycle travel due to their low traffic volumes and low speeds.

It should be noted that the East Palo Alto General Plan 2035 shows planned Class II bike lanes along the entirety of Bay Road and Pulgas Avenue. The General Plan also highlights planned Class III bike routes along Weeks Street, Cooley Avenue, East Bayshore Road, Euclid Avenue, and Runnymede Street between Cooley Avenue and Euclid Avenue. These additions to the bicycle network would improve bike access to the site.

The existing pavement width on Bay Road between Clarke and Pulgas Avenues is adequate to allow for the addition of bike lanes by restriping. Additional right of way and roadway widening would be needed in order to provide the planned bike lanes on Bay Road east of Pulgas Avenue in addition to the recommended sidewalks and westbound left-turn lane. The City should work with property owners adjacent to Bay Road east of Pulgas Avenue to ensure the construction of the planned bike lanes as properties are redeveloped.

The existing pavement width on Pulgas Avenue south of Bay Road is sufficient to accommodate the addition of bike lanes and a northbound left-turn lane. This improvement would require the elimination of on-street parking on both sides of Pulgas Avenue.

Vehicle Miles Travelled (VMT) Analysis

In December 2018, the California Natural Resources Agency certified and adopted the CEQA Guidelines update package, including the Guidelines section implementing Senate Bill 743. The guidelines state that level of service will no longer be considered to be an environmental impact under CEQA and that vehicle-miles-travelled (VMT) is the most appropriate measure of transportation impact. Cities have until July 2020 to adopt the new procedures. The City is currently in the process of preparing a VMT policy, thus the potential CEQA impacts of the proposed project were evaluated based on the City's established level of service impact criteria.

However, in order to provide decision makers the best available data for the project, a preliminary evaluation of project VMT was conducted. Given that no standard approach or guidelines have been adopted by the City of East Palo Alto, the VMT presented in this report is for information only. It is not intended to provide any indication of the transportation impacts of the project under SB 743.

Daily VMT generated by the project site was estimated using the simulated VMT per worker from the Metropolitan Transportation Commission (MTC) travel demand forecast model[1]. Within this part of East Palo Alto (Traffic Analysis Zone 332), the forecasted daily VMT is 28.72 miles per worker in the year 2020. The project employment was estimated assuming 4 employees per 1,000 square feet. Multiplying the estimated number of employees (400) by the average forecasted daily VMT of 28.72 miles per worker yields a total of 11,488 vehicle miles travelled per day.

The Governor's Office of Planning and Research (OPR) published the Technical Advisory on Evaluating Transportation Impacts in CEQA in December 2018. The technical advisory provided high-level recommendations on the VMT analysis methodology and significance thresholds. For office projects, OPR's technical advisory recommends a significance threshold that is 15% below that of existing development but does not specify the region of existing development for evaluation.

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[1] https://www.arcgis.com/home/webmap/viewer.html?url=https://services3.arcgis.com/i2dkYWmb4wHvYPda/ArcGIS/rest/services/Simulated_Vehicle_Miles_Traveled_by_Place_of_Work_2017/FeatureServer/2&source=sd, accessed on November 4, 2019.

Notwithstanding OPR's recommended threshold, lead agencies have the discretion to choose the VMT analysis methodology and to set or apply their own thresholds of significance. Several cities (e.g. San Francisco, Oakland, San Jose, and Los Angeles) have established VMT significance thresholds at 15% below average for office projects. The average is set at either the regional average, the citywide average, or the Planning Area average. The City of Pasadena set the existing citywide average VMT per service population as the significance threshold for office developments. The City of East Palo Alto could establish a VMT significance threshold at or below the existing citywide or countywide average VMT per resident for office projects.

The average VMT per worker in San Mateo County is 27.10, and the average VMT per worker in East Palo Alto is 27.89. Thus, the average forecasted daily VMT of 28.72 miles per worker for the project area is 6 percent greater than the Countywide average and 3 percent greater than the Citywide average VMT per worker.

While the MTC model provides the average VMT per capita for the project's zone, that does not mean that the project's VMT per capita would match that of the project's zone. VMT for a specific project is affected by a number of factors including location, development density, land use diversity, multimodal infrastructure, parking policies/pricing, and TDM programs. The project will implement a TDM plan that will reduce vehicle trips by at least 25 percent below a typical office development, which would reduce the project's VMT by a similar amount.

Turn Pocket Queuing Analysis

The analysis of intersection levels of service was supplemented with a vehicle queuing analysis for intersection turning movements where the project would add a substantial number of trips. This analysis provides a basis for estimating future storage requirements at the intersections. Vehicle queues were estimated using a Poisson probability distribution, described in Chapter 1. The following turn movements were selected for evaluation:

- University Avenue and Bay Road –southbound left turn
- Pulgas Avenue and Bay Road – eastbound left turn

The analysis findings are described below and presented in Table 14.

Table 14
Turn Pocket Queuing Analysis

Measurement	University Avenue & Bay Road [3] SBL AM	University Avenue & Bay Road [3] SBL PM	Pulgas Avenue & Bay Road [4] EBL AM	Pulgas Avenue & Bay Road [4] EBL PM
Existing				
Cycle/Delay [1] (sec)	150	150	13.8	32.4
Volume (vphpl)	154	105	77	45
Total 95th %. Queue (veh.)	11	8	1	2
Total 95th %. Queue (ft.) [2]	275	200	25	50
Total Storage	150	150	125	125
Adequate (Y/N)	**N**	**N**	Y	Y
Existing Plus Project				
Cycle/Delay [1] (sec)	150	150	13.8	32.4
Volume (vphpl)	172	106	176	57
Total 95th %. Queue (veh.)	12	8	2	2
Total 95th %. Queue (ft.) [2]	300	200	50	50
Total Storage	150	150	125	125
Adequate (Y/N)	**N**	**N**	Y	Y
Cumulative				
Cycle/Delay [1] (sec)	150	150	100	100
Volume (vphpl)	281	123	121	93
95th %. Queue (veh/ln.)	18	9	7	5
95th %. Queue (ft./ln) [2]	450	225	175	125
Storage (ft./ ln.)	150	150	125	125
Adequate (Y/N)	**N**	**N**	**N**	Y
Cumulative Plus Project				
Cycle/Delay [1] (sec)	150	150	100	100
Volume (vphpl)	290	124	220	105
95th %. Queue (veh/ln.)	18	9	10	6
95th %. Queue (ft./ln) [2]	450	225	250	150
Storage (ft./ ln.)	150	150	125	125
Adequate (Y/N)	**N**	**N**	**N**	**N**

Notes:
SBL = southbound left movement; EBL = eastbound left movement
[1] Vehicle queue calculations based on cycle length for signalized intersections and movement delay for unsignalized intersections.
[2] Assumes 25 feet per vehicle queued.
[3] A second southbound left-turn lane is assumed under cumulative conditions based on mitigation measures identified in the Ravenswood/Four Corners TOD Specific Plan DEIR.
[4] A new traffic signal is assumed under cumulative conditions based on mitigation measures identified in the Ravenswood/Four Corners TOD Specific Plan DEIR.

University Avenue and Bay Road

Southbound Left Turn

Currently, the left turn pocket on southbound University Avenue is only about 150 feet long, which provides enough storage for about six vehicles. The estimated 95th percentile queue exceeds the existing vehicle storage capacity by at least two vehicles during the AM and PM peak hours under existing conditions. The addition of project traffic would cause the 95th percentile queue to increase by one vehicle during the AM peak hour. The project would not cause a noticeable increase in vehicle queues during the PM peak hour. A second left-turn lane on southbound University Avenue was identified as a mitigation measure in the Ravenswood/4 Corners TOD Specific Plan EIR and is assumed under cumulative conditions. Even so, the estimated 95th percentile queue length under cumulative conditions is expected to exceed the storage in the dual left-turn lanes. The dual turn pocket cannot be extended because it is end-to-end with the northbound left-turn pocket leading to the East Palo Alto Library.

Pulgas Avenue and Bay Road

Eastbound Left Turn

Under existing and existing plus project conditions, the intersection is unsignalized. The eastbound left-turn pocket on Bay Road is expected to provide adequate storage under existing conditions and existing plus project conditions during the AM and PM peak hours.

The analysis of the cumulative and cumulative plus project conditions reflect the planned signalization, which was identified as a mitigation measure in the Ravenswood/Four Corners TOD Specific Plan. The estimated 95th percentile queue exceeds the existing vehicle storage capacity by at least two vehicles during the AM peak hour under cumulative no project conditions. The addition of project traffic would cause the 95th percentile queue to exceed the available storage by five vehicles during the AM peak hour and by one vehicle during the PM peak hour. The left-turn pocket could be extended by eliminating a segment of the existing landscaped median.

Vehicular Site Access and Circulation

A review of the project site plan was performed to determine whether adequate site access and circulation would be provided. This review was based on the site plan prepared by William McDonough + Partners dated June 10, 2019 shown on Figure 2. The site plan does not include a scale, dimensions, or sufficient other details to allow for a thorough review of all design elements. Thus, additional site plan review will be required prior to final design.

Site Access

Vehicular access to the project site would be provided via three driveways on Pulgas Avenue. The center driveway on Pulgas Avenue would provide direct access to the underground parking structure and is proposed to include two inbound lanes and two outbound lanes with gate control. The southern and northern driveways on Pulgas Avenue would provide access to a service road around the perimeter of the site. The southern driveway also leads to a secondary ramp with one lane in and one lane out that also leads to the underground parking structure.

The project is estimated to generate 139 inbound trips during the AM peak hour and 66 outbound trips during the PM peak hour. It is expected that most of the project trips would use southern or center driveways since they provide direct access to the underground parking garage. Dividing the project trips among these two driveways equates to an average of less than one vehicle per lane per minute entering or exiting each driveway. During the AM peak hour, the inbound vehicles turning left from northbound Pulgas Avenue may need to pause momentarily if there is an on-coming vehicle on southbound Pulgas Avenue. However, the delays and queues resulting from the inbound left turns are expected to be minimal given the extremely low traffic volumes on this segment of Pulgas Avenue. Likewise, on-site queues and delays for outbound project traffic would be reasonable because the traffic volume on the adjacent street is quite low. Based on the traffic expected to be generated by the proposed office building, the center driveway would operate acceptably with only a single lane in and a single lane out. The provision of additional driveway lanes may be needed if/when future development occurs that would increase the usage of the proposed garage.

The center driveway has approximately 40 feet between the garage entry control gates and the curb on Pulgas Avenue. This driveway throat length would allow two vehicles to queue per lane while waiting for the entry gate to open. This stacking space is sufficient to prevent entry queues from extending onto the street. The control gates on the driveway exit lanes are about 20 feet back from the curb. Given the minimal traffic on this segment of Pulgas Avenue, this stacking space for exiting vehicles should be sufficient.

While the site plan does not label the slope on the driveway, it appears that the ramp slope would extend all the way to the sidewalk adjacent Pulgas Avenue. The ramp slope could impair exiting drivers view of pedestrians and vehicle traffic on Pulgas Avenue. Furthermore, drivers would need to take extra care to ensure their vehicles maintain their position on a slope while stopped at the exit gate and again after proceeding through the gate while waiting to turn onto Pulgas Avenue. Likewise, vehicles entering the garage would have to stop on a slope at the entry control gates. It is recommended that the driveway ramp be modified to include flat landing pads immediately adjacent to Pulgas Avenue and at the garage gate control positions. Furthermore, the retaining walls adjacent to the center driveway must be low enough to avoid obscuring the view of drivers exiting the garage as well as pedestrians walking on the sidewalk adjacent Pulgas Avenue.

> **Recommendation:** Prior to final design, the driveway widths, ramp slope, radii and throat depth should be measured to confirm that they comply with City of East Palo Alto standards and are adequate to handle truck traffic. In order to ensure there would be sufficient sight distance at the project driveways, any landscaping, hardscape elements, parking, and signage location should be consistent with City of East Palo Alto vision triangle standards.

On-Site Circulation

The on-site circulation was reviewed in accordance with generally accepted traffic engineering standards. Generally, the underground parking garage would provide adequate connectivity for vehicles. The site plan also shows pedestrian connections between the sidewalk adjacent to Pulgas Street and the proposed office building entries. The site plan does not show any bicycle facilities. The project would provide 90-degree parking in the underground parking structure. The garage drive aisles are assumed to provide two-way circulation. However, the site plan does not show drive aisle measurements. Thus, the drive aisles should be at least 24 feet wide (the City's minimum standard for aisles with 90 degree parking) to provide sufficient room for vehicles to back out of the parking stalls.

The garage site plan shows that the center driveway ramp would intersect the eastern most parking aisle creating two dead end aisles each approximately 200 to 250 feet long. Long dead end aisles should be avoided whenever possible since it is difficult for drivers to determine if there is a parking space available before committing to driving down the dead end aisle. Vehicles that do not find an available space would have to back out of the aisle or complete a multi-point turn as there is not sufficient space to easily turn around at the end of the aisle. Furthermore, as currently shown, it would be difficult for drivers who park in a space at the end of dead-end aisle to exit the space since there is no room for them to turn while backing up.

The orientation of the secondary garage ramp along the southern edge of the site is problematic. As shown, this ramp would be directly parallel and adjacent to the service road. The perimeter service road is shown to have two-way circulation around the site except for the segment immediately adjacent to the garage ramp, which is shown with one-way (clockwise) circulation. The one-way circulation would be required at this location to avoid conflicts between vehicles coming up the ramp and vehicles traveling in the same (easterly) direction along the service road. However, the site plan does not show any logical transition from two-way to one-way flow on the service road. It is recommended that the northern and western segments of the service road be converted to one-way (clockwise) circulation or that space be added at the southwest corner of the site where the service road changes from two-way to one-way flow to allow vehicles traveling in a counterclockwise direction to turn around. In addition, the orientation of the secondary ramp would lead to vehicle conflicts at the foot of the ramp in the underground parking garage where the ramp would be immediately adjacent and parallel to an east-west drive aisle. Vehicles coming down the ramp would not be able to see vehicles approaching along the adjacent drive aisle and vice versa. Furthermore, the unusual geometry may lead to driver confusion over who has the right of way. It is recommended that the site plan be modified to improve the ramp connections to the perimeter service road and to the underground parking garage.

The site plan shows a truck loading area adjacent to the southwest corner of the proposed office building that would be accessed via the perimeter service road. The site plan also includes a passenger loading zone with space for about two vehicles along the south side of the service road near the northern edge of the site. This location is not very convenient as it is about 400 feet from the proposed building entries and there are no pedestrian pathways leading to the passenger loading zone. The dimensions of the freight and passenger loading spaces are not listed on the site plan. East Palo Alto's development code requires offices greater than 90,000 s.f. to provide three loading spaces for equipment and materials (each measuring 10 ft wide x 40 ft long x 14 ft of vertical clear space) and three passenger loading spaces (each 10 ft wide x 20 ft long x 12 ft of vertical clear space).

> **Recommendation:** The site plan should be modified to ensure adequate on-site circulation for vehicles, pedestrians, and bicycles. In particular, the site plan should avoid dead-end aisles, prevent vehicle conflicts at the top and bottom of garage ramps, and ensure that drive aisle and loading space dimensions comply with City of East Palo Alto standards.

Parking Analysis

City of East Palo Alto Parking Code Requirements

The required parking supply was determined using the parking rates specified in the East Palo Alto Municipal Code Section 18.30.050 (A). For office developments, the City Code requires 1 parking space per 300 square feet. The same parking requirement is set forth for professional office space in the Waterfront Office land use district within the Ravenswood/4 Corners TOD Specific Plan. The proposed office building would contain 100,000 square feet. Therefore, the project would require 334 parking spaces. The project proposes to provide a total of 668 parking spaces, which would meet the City's standard parking requirement. The site plan does not show the dimensions of vehicle parking spaces nor any bicycle parking.

> **Recommendation:** Prior to final design, the vehicle parking space dimensions should be measured to confirm that they comply with City of East Palo Alto standards. Furthermore, bicycle parking should be added in accordance with the bicycle parking requirements set forth in the Ravenswood/4 Corners TOD Specific Plan.

HEXAGON TRANSPORTATION CONSULTANTS, INC.

Memorandum

Date: June 2, 2021

To: Mr. Demetri Loukas, David J. Powers & Associates, Inc.

From: Michelle Hunt

Subject: Updated Transportation Impact Analysis for the Proposed New Office Building at 2535 Pulgas Avenue in East Palo Alto

Hexagon Transportation Consultants, Inc. has completed this transportation analysis update for the proposed new office building at 2535 Pulgas Avenue in East Palo Alto, California. The previous transportation analysis report for this project, dated December 6, 2019, evaluated a project comprised of 100,000 square feet (s.f.) of office space. Since the conclusion of that study, the proposed project description was changed from 100,000 to 110,000 s.f. of office space. This memorandum presents an analysis of the increased project size. Furthermore, the City of East Palo Alto has also requested that the cumulative analysis be revised to assume the completion of the Bay Road Improvements Project.

The previous report used intersection levels of service (LOS) to identify significant project impacts. In adherence with State of California Senate Bill 743 (SB 743), the City of East Palo Alto has adopted a new Transportation Analysis Policy. The policy establishes the thresholds for transportation impacts under CEQA based on vehicle miles traveled (VMT) instead of LOS. The intent of this change is to shift the focus of transportation analysis under CEQA from vehicle delay and roadway auto capacity to a reduction in vehicle emissions, and the creation of robust multimodal networks that support integrated land uses. All new projects are required to analyze transportation impacts using the VMT metric. The new Transportation Analysis Policy took effect on July 7, 2020. This memorandum contains an updated analysis of the project's impacts on VMT according to the City's new Transportation Analysis Policy.

Nevertheless, the City has retained the LOS standard set forth in the General Plan, continues to require an assessment of intersection levels of service, and may condition project approvals on improvements needed to maintain the adopted LOS standard and/or other operational issues related to transportation. Thus, the updated transportation analysis evaluates the project's effects on nearby intersections based on the LOS standards set forth in the General Plan. Due to the ongoing pandemic, traffic volumes are substantially below pre-virus conditions. To be conservative, this updated transportation analysis is based on pre-virus conditions. This memorandum also describes the existing transit services in the vicinity of the project site.

Project Trip Generation

The size of the proposed project has changed from 100,000 to 110,000 s.f. (55,000 s.f. JobTrain and 55,000 s.f. general office space). Therefore, the project trip generation was revised to reflect the change in project size. It is assumed that the number of students for JobTrain would increase in proportion to the increase in floor area. As before, a 25 percent reduction was applied to the proposed general office component, while the proposed JobTrain trip estimates were reduced by 6 percent beyond the existing 19 percent trip reduction for a total trip reduction of 25 percent as required by the City's current City Transportation System Management (TSM) ordinance.

After applying the trip reductions and subtracting trips generated by existing uses, the additional 10,000 s.f. of office space would generate an additional 113 daily trips, including 17 more AM peak hour trips, and 9 more PM peak hour trips compared to the original project trip generation estimates presented in the previous report. With the increase in size, the proposed project is expected to generate a net total of 996 daily trips with 161 trips (146 in and 15 out) during the AM peak hour and 72 trips (13 in and 59 out) during the PM peak hour (see Table 1).

Intersection Operations

The analysis of levels of service under existing plus project conditions and cumulative plus project conditions was revised at the following study intersections based on the revised project trip generation estimates:

- University Avenue and Bay Road
- Clarke Avenue and Bay Road
- Demeter Street and Bay Road
- Pulgas Avenue and Bay Road

It is assumed that the incremental increase in project trips at the other study intersections would be negligible since the increase in project size would add fewer than 10 peak-hour vehicle trips at each location.

Existing Plus Project Analysis

The results of the revised intersection level of service analysis under existing plus project conditions without and with the loop road are summarized in Table 2. Compared to the previous analysis, the results show that the additional project trips would slightly increase delay but would not cause any additional adverse effects on the study intersections. As identified in the previous report, the project would cause the intersection of Pulgas Avenue and Bay Road to degrade from an acceptable LOS D to an unacceptable LOS F during the PM peak hour. While this is no longer considered a significant impact under CEQA, this constitutes an adverse effect of the project based on the level of service standards in the City's General Plan. Likewise, project impacts on other study intersections identified in the previous report are no longer considered significant impacts under CEQA, but rather constitute an adverse effect based on the level of service standards in the City's General Plan. The improvements required to address the project's effects on intersection operations are the same as that identified in the previous report.

Cumulative Analysis

As requested by the City of East Palo Alto, the cumulative analysis was revised to assume the completion of the Bay Road Improvements Project, which will affect the lane geometry at the following three intersections:

Clarke Avenue and Bay Road: adding an exclusive left-turn lane on the northbound Clark Avenue approach.

Demeter Street and Bay Road: adding an exclusive left-turn lane on the southbound Demeter Street approach and adding an exclusive left-turn lane on the westbound Bay Road approach.

Table 1
Project Trip Generation Estimates

		Daily		AM Peak Hour				PM Peak Hour			
					Trip				Trip		
Land Use	**Size**	**Rate**	**Trip**	**Rate**	**In**	**Out**	**Total**	**Rate**	**In**	**Out**	**Total**
Proposed Uses											
General Office [1]	55,000 s.f.	9.74	536	1.16	55	9	64	1.15	10	53	63
JobTrain [2]	198 students	4.54	898	0.72	119	24	143	0.29	22	35	57
Total New Project Trips			1,434		174	33	207		32	88	120
Reductions											
25% TDM Trip Reduction for General Office			(134)		(14)	(2)	(16)		(3)	(13)	(16)
6% Additional TDM Trip Reduction for JobTrain			(54)		(7)	(2)	(9)		(1)	(2)	(3)
Existing Use											
Industrial/workshop building [3]	4,500 s.f.		(250)		(7)	(14)	(21)		(15)	(14)	(29)
Total New Project Trips			**996**		**146**	**15**	**161**		**13**	**59**	**72**

Notes:

[1] Trip generation rates for the proposed office space are based on the ITE's Trip Generation Manual, 10th Edition rates for Land Use Code 710 "General Office Building"

[2] Trip generation rates for the relocated JobTrain facility are based on driveway counts on 8/13/2019 at the existing JobTrain location .

[3] Existing AM and PM peak hour trips for the existing uses are based on 8/1/2019 driveway counts. Existing daily trips were estimated.

Table 2
Existing Plus Project Intersection Levels of Service

							Existing Plus Project								Existing Plus Project - Mitigated	
					Existing		without Loop Road				with Loop Road				without Loop Road	
#	Intersection	LOS Standards	Peak Hour	Count Date	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS
4	University Avenue and Bay Road	D	AM	04/17/19	41.7	D	44.1	D	8.2	0.036	43.0	D	2.2	0.029		
			PM	04/16/19	48.4	D	48.9	D	0.9	0.012	46.8	D	-2.6	-0.037		
7	Demeter Street and Bay Road [2]	D	AM	05/09/19	10.2	B	10.4	B	n/a	n/a	17.2	C	1.6	0.207		
	(Two-way Stop [1])		PM	05/09/19	13.0	B	13.5	B	n/a	n/a	17.3	C	0.7	0.108		
8	Pulgas Avenue and Bay Road	D	AM	02/28/19	13.8	B	29.7	D	n/a	n/a	--	--	--	--	11.6	B
	(Two-way Stop [1])		PM	02/28/19	32.4	D	**60.6**	**F**	n/a	n/a	--	--	--	--	18.7	C
21	Clarke Avenue and Bay Road	D	AM	05/09/19	16.0	C	18.4	C	2.4	0.035	15.9	C	-0.2	-0.057		
	(All-way Stop)		PM	05/09/19	19.9	C	21.1	C	1.2	0.011	18.8	C	-1.1	-0.013		

Notes:

Bold indicates a substandard level of service.

Box indicates a significant project impact.

-- indicates that the intersection level of service and delay with the loop road is the same as without the loop road.

1. For one-way and two-way stop controlled intersections, the average delay and LOS are reported for the worst approach. Changes in critical delay and v/c for the entire intersection cannot be calculated (n/a).

2. The average delay and LOS are reported for the north leg (Demeter Street).

Pulgas Avenue and Bay Road: removing the exclusive right-turn lane on the eastbound Bay Road approach and converting the through lane to a shared through/right-turn lane.

As described in our previous report, the cumulative transportation network also assumes completion of mitigation measures identified in the Ravenswood/4 Corners TOD Specific Plan Environmental Impact Report including new traffic signals on Bay Road at Clarke Avenue, Demeter Street, and Pulgas Avenue, as well as the addition of a northbound right-turn lane, a second northbound left-turn lane, a second westbound left-turn lane, and a second southbound left-turn lane at the intersection of University Avenue and Bay Road.

The proposed project is located within the Ravenswood Specific Plan area. Because cumulative conditions assume the full buildout of the Ravenswood Specific Plan, the proposed increase in project size would not alter the traffic volumes under cumulative plus project conditions. Rather, building more office space on the project site would allow for less office space on other parcels within the Plan area. Thus, the traffic volumes under cumulative no project conditions were reduced accordingly.

The results of the revised intersection level of service analysis under cumulative no project and cumulative plus project conditions without and with the loop road are summarized in Table 3. As identified in the previous report, the following intersections would operate at an unacceptable level of service during both peak hours:

- University Avenue and Bay Road
- Pulgas Avenue and Bay Road
- Clarke Avenue and Bay Road

The addition of project trips would cause the critical-movement delay at these intersections to increase by four or more seconds and the volume-to-capacity ratio (V/C) to increase by .01 or more during one or both peak hours. While this is no longer considered a significant impact under CEQA, this constitutes an adverse effect of the project based on the level of service standards in the City's General Plan.

Likewise, project impacts on other study intersections identified in the previous report are no longer considered significant impacts under CEQA, but rather constitute an adverse effect based on the level of service standards in the City's General Plan. The improvements required to address the project's effects on intersection operations are the same as that identified in the previous report.

Turn Pocket Queuing Analysis

The vehicle queuing analysis was revised to reflect the change in project size. The following turn movements were reassessed:

- University Avenue and Bay Road –southbound left turn
- Pulgas Avenue and Bay Road – eastbound left turn

The analysis findings are presented in Table 4. The estimated 95th percentile queue under existing plus project conditions and cumulative plus project conditions would be unchanged from that reported for the original project size. As stated in the previous report, the left-turn pocket on eastbound Bay Road at Pulgas Avenue could be extended by eliminating a segment of the existing landscaped median. However, the planned dual left-turn lanes on southbound University Avenue at

Table 3
Cumulative Plus Project Intersection Levels of Service

				Cumulative No Project		Cumulative Plus Project				Mitigated Cumulative Plus Project			
				without Loop Road		without Loop Road				Loop Road		Loop Road + Other Improvments	
#	Intersection	LOS Standards	Peak Hour	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS	Incr. In Crit. Delay	Incr. In Crit. V/C	Avg Delay (sec/veh)	LOS	Avg Delay (sec/veh)	LOS
4	University Avenue and Bay Road	D	AM	**64.0**	**E**	**70.5**	**E**	6.9	0.024	**65.2**	**E**	46.7	D
			PM	**92.7**	**F**	**94.0**	**F**	2.2	0.005	**74.5**	**E**	**72.8**	**E**
7	Demeter Street and Bay Road [2]	D	AM	13.8	B	13.4	B	-0.1	0.030	22.4	C		
	(Two-way Stop [1])		PM	24.7	C	24.9	C	0.3	0.011	19.4	B		
8	Pulgas Avenue and Bay Road [2]	D	AM	**211.7**	**F**	**212.3**	**F**	8.8	0.020	**216.7**	**F**	**132.9**	**F**
	(Two-way Stop [1])		PM	**OVFL**	**F**	**OVFL**	**F**	49.8	0.110	**OVFL**	**F**	54.8	D
21	Clarke Avenue and Bay Road [2]	D	AM	**100.8**	**F**	**115.0**	**F**	17.9	0.041	29.2	C		
	(All-way Stop)		PM	27.7	C	28.5	C	1.2	0.015	23.9	C		

Notes:
Bold indicates a substandard level of service.
Box indicates a significant project impact.
OVFL indicates that the result is out of software calculation limits
-- indicates that the intersection level of service and delay with the loop road is the same as without the loop road.
1. For one-way and two-way stop controlled intersections, the average delay and LOS is reported for the worst approach. Changes in critical delay and v/c for the entire intersection cannot be calculated (n/a).
2. A new traffic signal is assumed under cumulative conditions based on mitigation measures identified in the Ravenswood/Four Corners TOD Specific Plan DEIR.

Table 4
Turn Pocket Queuing Analysis

	University Avenue & Bay Road [3]		Pulgas Avenue & Bay Road [4]	
	SBL		EBL	
Measurement	AM	PM	AM	PM
Existing				
Cycle/Delay [1] (sec)	150	150	13.8	32.4
Volume (vphpl)	154	105	77	45
Total 95th %. Queue (veh.)	11	8	1	2
Total 95th %. Queue (ft.) [2]	275	200	25	50
Total Storage	150	150	125	125
Adequate (Y/N)	**N**	**N**	Y	Y
Existing Plus Project				
Cycle/Delay [1] (sec)	150	150	13.8	32.4
Volume (vphpl)	174	106	187	58
Total 95th %. Queue (veh.)	12	8	2	2
Total 95th %. Queue (ft.) [2]	300	200	50	50
Total Storage	150	150	125	125
Adequate (Y/N)	**N**	**N**	Y	Y
Cumulative				
Cycle/Delay [1] (sec)	150	150	100	100
Volume (vphpl)	280	123	110	92
95th %. Queue (veh/ln.)	18	9	6	5
95th %. Queue (ft./ln) [2]	450	225	150	125
Storage (ft./ ln.)	150	150	125	125
Adequate (Y/N)	**N**	**N**	**N**	Y
Cumulative Plus Project				
Cycle/Delay [1] (sec)	150	150	100	100
Volume (vphpl)	290	124	220	105
95th %. Queue (veh/ln.)	18	9	10	6
95th %. Queue (ft./ln) [2]	450	225	250	150
Storage (ft./ ln.)	150	150	125	125
Adequate (Y/N)	**N**	**N**	**N**	**N**

Notes:
SBL = southbound left movement; EBL = eastbound left movement
1 Vehicle queue calculations based on cycle length for signalized intersections and movement delay for unsignalized intersections.
2 Assumes 25 feet per vehicle queued.
3 A second southbound left-turn lane is assumed under cumulative conditions based on mitigation measures identified in the Ravenswood/Four Corners TOD Specific Plan DEIR.
4 A new traffic signal is assumed under cumulative conditions based on mitigation measures identified in the Ravenswood/Four Corners TOD Specific Plan DEIR.

Bay Road cannot be extended because it is end-to-end with the northbound left-turn pocket leading to the East Palo Alto Library.

Transit Services

The project site is served by two SamTrans bus routes (280 and 296) with a total of eight buses that stop within walking distance of the project site each hour during the peak commute periods. The development of the proposed project would not impede or conflict with existing or proposed transit services. The existing public transit services provide sufficient capacity to allow the project to achieve the required trip reduction through travel demand management measures.

Vehicular Site Access and Circulation

A review of the project site plan was performed to determine whether adequate site access and circulation would be provided. This review was based on the updated site plan prepared by William McDonough + Partners dated October 19, 2020 as shown on Figure 1.

Site Access

Vehicular access to the project site would be provided via two full-access driveways on Pulgas Avenue, at the northern and southern edges of the project site. The driveways would provide access to a ground level parking lot. According to the City of East Palo Alto Code of Ordinances Section 18.30.090 (A), the width of a driveway with 90-degree parking spaces should be a minimum of 24 feet. Based on the site plan, both driveways would be 26 feet wide. Therefore, the project would meet the requirement.

Driveway Trips

The project is estimated to generate 146 inbound trips during the AM peak hour and 59 outbound trips during the PM peak hour. Dividing the project trips among the two driveways equates to an average of one to two vehicles per minute entering and less than one vehicle per minute exiting each driveway. During the AM peak hour, the inbound vehicles turning left from northbound Pulgas Avenue may need to pause momentarily if there is an on-coming vehicle on southbound Pulgas Avenue. However, the delays and queues resulting from the inbound left turns are expected to be minimal given the extremely low traffic volumes on this segment of Pulgas Avenue. Likewise, on-site queues and delays for outbound project traffic would be reasonable because the traffic volume on the adjacent street is quite low.

Emergency Vehicle and Truck Access

The driveways and drive aisles that trucks would be expected to travel on would be 26 feet wide, which would be sufficient for emergency vehicle access. The site plan proposes a trash room located along the southern edge of the northern driveway with a truck loading space adjacent to it. Therefore, garbage trucks would enter the northern driveway, park onsite to collect trash, and exit from the southern driveway.

Sight Distance

The project driveways should be free and clear of any obstructions to optimize sight distance, thereby ensuring that exiting vehicles can see pedestrians on the sidewalk and other vehicles traveling on Pulgas Avenue. Landscaping and signage should not conflict with a driver’s ability to

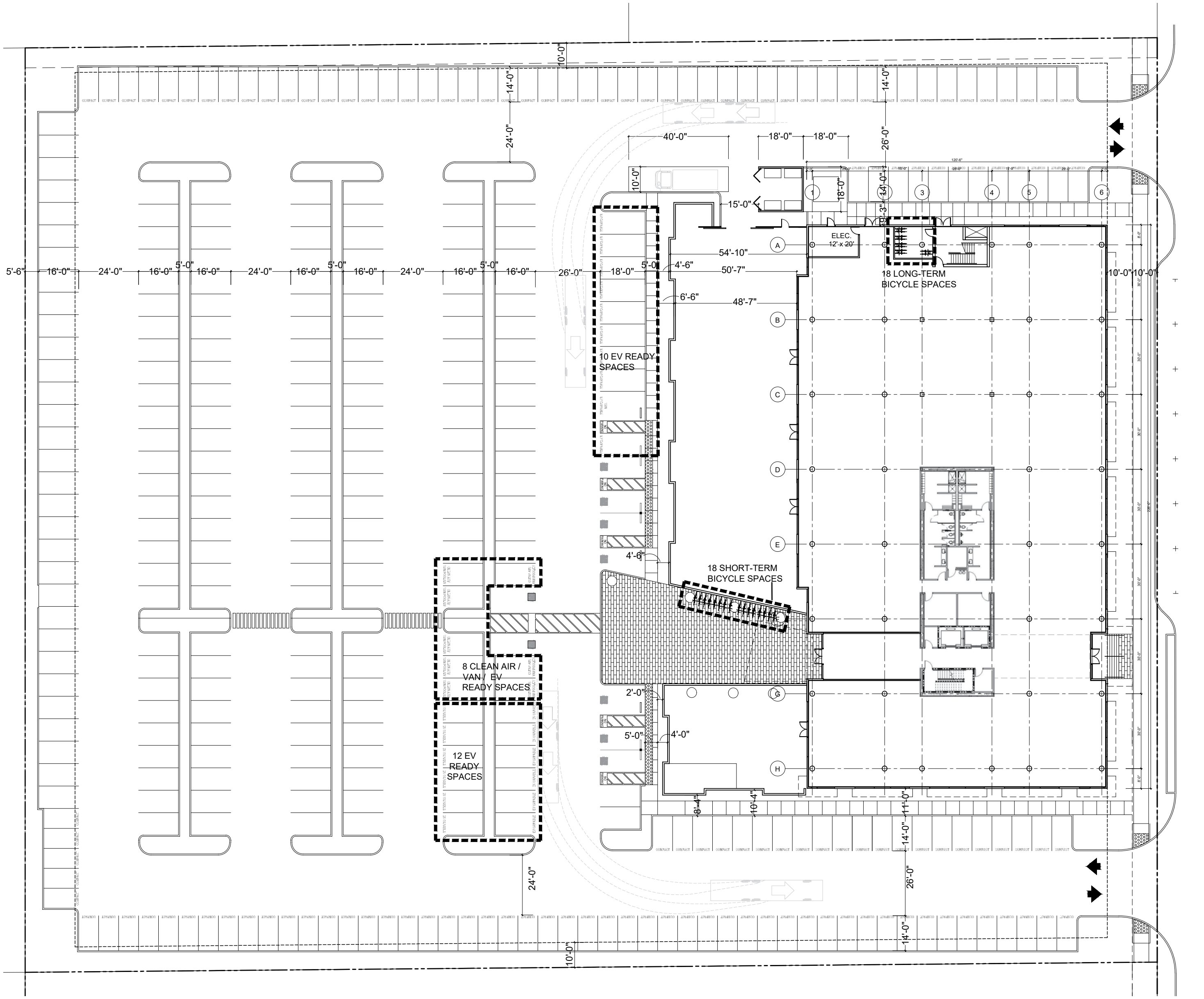

Figure 1
Site Plan

NORTH
Not to Scale

locate a gap in traffic and see oncoming pedestrians and bicyclists. Adequate sight distance (sight distance triangles) should be provided at the driveway in accordance with Caltrans standards. Sight distance triangles should be measured approximately 10 feet back from the traveled way.

According to the Caltrans *Highway Design Manual*, the minimum stopping sight distance is the distance required by the user, traveling at a given speed, to bring the vehicle or bicycle to a stop after an object ½-foot high on the road becomes visible. Stopping sight distance for motorists is measured from the driver's eyes, which are assumed to be 3 ½ feet above the pavement surface, to an object ½-foot high on the road. The required stopping sight distances are based on the Caltrans *Highway Design Manual*, Table 201.1. The project driveways are located on Pulgas Avenue, which has an assumed speed limit of 25 mph. Thus, the Caltrans stopping sight distance requirement is 200 feet (based on a design speed of 30 mph). The project would construct two driveways approximately 270 apart. There are no roadway curves, but on-street parking is permitted on Pulgas Avenue. The site plan shows a bulb-out would be constructed south of the northern site driveway that would prohibit on-street parking for a distance of approximately 45 feet. The proposed design would provide ample sight distance to the south for a design speed of 30 mph. Approximately 25 feet to the north of the northern site driveway, there is a fence next to the driveway at the adjacent property where Pulgas Avenue terminates. The fence restricts sight distance to the north to approximately 50 feet, which is the stopping sight distance standard for a design speed of 10 mph. Given that the driveway at the end of Pulgas Avenue has signs posted with a 5 mph speed limit, the driveway sight distance to the north also would be adequate. The site plan shows a bulb-out would be constructed north of the southern site driveway that would prohibit on-street parking for a distance of approximately 100 feet. The proposed design would provide ample sight distance to the north for a design speed of 30 mph. The existing on-street parking south of the southern driveway would interfere with sight distance looking south.

> **Recommendation:** Hexagon recommends including 45 feet of red curb south of the southern driveway to prevent vehicles from parking and obstructing the vision of exiting drivers.

On-Site Circulation

The on-site circulation was reviewed in accordance with generally accepted traffic engineering standards. Generally, the ground level parking lot would provide adequate connectivity for vehicles. The project would provide 90-degree parking and the drive aisles would provide two-way circulation. Based on the updated site plan, the drive aisles would be 24 – 26 feet wide, which would meet the City's minimum standard for aisles with 90-degree parking and would provide sufficient room for vehicles to back out of the parking stalls.

Bicycle and Pedestrian Circulation

The updated site plan shows pedestrian connections between the drive aisles and the proposed office building entry. Sidewalks are currently not provided along most of Pulgas Avenue. The project would add 6-foot-wide sidewalks along its frontage. The proposed building would have an entrance that directly connects to the sidewalk along Pulgas Avenue. There would also be sidewalks provided around the entire perimeter of the building except for a short segment at the northwest corner of the building where the trash enclosure and truck loading areas would be located. The project would provide indoor long-term bicycle parking near an entrance on the north side of the building and short-term bicycle parking would be provided near the west entry.

Parking Analysis

The parking analysis was conducted based on the site plan contained in the project's resubmittal application, dated October 19, 2020. For the purpose of calculating parking spaces, "floor area" for offices means the gross floor area used, or intended to be used, for service to the public as customers, patrons, clients or patients, or as tenants (East Palo Alto Municipal Code Section 18.30.050 (C)). The site plan identifies 97,094 s.f. gross floor area for parking purposes. For office developments, the City Code requires 1 parking space per 300 square feet. The same parking requirement is set forth for professional office space in the Ravenswood Employment Center land use district within the Ravenswood/4 Corners TOD Specific Plan. Therefore, the project would require 324 parking spaces. The project proposes to provide a total of 357 surface parking spaces, which would meet the City's standard parking requirement.

The East Palo Alto Municipal Code Section 18.30.090 (A) requires 90-degree parking spaces to be at least 18 feet long and 9 feet wide. Based on the updated site plan, the project proposes standard spaces to be 16 feet long with a 2-foot overhang, which would not comply with City of East Palo Alto standards. Section 18.30.090 (G) states that public parking areas should be designed so a parked vehicle does not overhang sidewalks, planters, or landscaped areas. Therefore, the parking spaces should be at least 18 feet long without any overhang. The site plan does not show the width of the proposed parking spaces.

> **Recommendation:** Prior to final design, the site plan should clearly label all parking space dimensions and should comply with City of East Palo Alto standards.

Compact Parking Spaces

Based on Section 18.30.070 (A) of the City Code, compact parking spaces at office developments may comprise up to 40 percent of the required off-street parking spaces. Thus, the project would be allowed up to 130 compact parking spaces. Based on the updated site plan, the project proposes a total of 138 compact parking spaces. Therefore, the number of compact parking spaces exceeds City of East Palo Alto standards.

Compact parking spaces are required to be at least 16 feet long, without overhang, and 8 feet wide (Section 18.30.070 (B)). Based on the updated site plan, the project proposes compact spaces to be 14 feet long with a 2-foot overhang, which would not comply with City standards. The site plan does not show the widths of the proposed parking spaces.

> **Recommendation:** Prior to final design, the number and dimensions of compact parking spaces should be clearly labeled on the site plan and should comply with City of East Palo Alto standards.

Loading Spaces

Section 18.30.130 (B) of the City Code requires that office developments with 90,001 square feet or greater have three loading spaces for equipment and materials and three passenger loading spaces. The loading spaces for equipment and materials should be at least 40 feet long and 10 feet wide, and the passenger loading spaces should be at least 20 feet long and 10 feet wide. Based on the updated site plan, the project proposes to provide one loading space along the northern driveway that would be 40 feet long and 10 feet wide, which would meet the size requirements. However, the number of loading spaces for equipment and materials would not meet the City requirement. The project site plan does not show any passenger loading spaces.

Recommendation: Prior to final design, the number of loading spaces provided should comply with City of East Palo Alto standards.

Bicycle Parking

Section 18.30.120 of the City Code requires bicycle parking facilities to comply with the *Santa Clara County Valley Transportation Authority Bicycle Technical Guidelines*. Based on Table 10-3 of the guidelines, office developments are required to provide one bicycle parking space per 6,000 square feet, with 75 percent of spaces being long-term (Class I) and 25 percent being short-term (Class II) spaces. Therefore, the project would require a total of 19 bicycle parking spaces, including 14 Class I spaces and 5 Class II spaces. The same parking requirement (one space per 6,000 square feet) is set forth for professional office space in the Ravenswood Employment Center land use district within the Ravenswood/4 Corners TOD Specific Plan. The project proposes to provide a total of 38 bicycle parking spaces, including 20 long-term spaces and 18 short-term spaces. Thus, the proposed bicycle parking would comply with City of East Palo Alto standards.

VMT Analysis

The City of East Palo Alto's Transportation Analysis Policy establishes procedures for determining project impacts on VMT based on project description and characteristics. VMT is the total miles of travel by personal motorized vehicles a project is expected to generate in a day. VMT measures the full distance of personal motorized vehicle trips with one end within the project.

Screening for VMT Analysis

A development project may be "screened out" if the use or size support a presumption that, if analyzed, the project's impact under VMT would be less than significant. Thus, a screened project would not be required to conduct a detailed VMT analysis to quantify the project's VMT and would not need to implement trip reduction measures or multimodal improvements to mitigate a significant impact on VMT. Projects that do not meet the screening criteria are "screened in" and must complete a detailed analysis of VMT produced by the project.

Based on the City's Transportation Analysis Policy, it is assumed that projects generating fewer than 110 daily trips would cause a less-than-significant impact. Based on this screening criterion, office projects that are 10,000 s. f. or less are presumed to have a less-than-significant impact on VMT. The project is proposing to construct a 110,000 s.f. office building and would generate more than 110 daily trips. The project does not meet the screening criteria and therefore would require a detailed CEQA transportation analysis.

Project VMT

The project-level impact analysis under CEQA uses the VMT metric to evaluate a project's transportation impacts by comparing against the VMT thresholds of significance as established in the Transportation Analysis Policy.

In the City of East Palo Alto, a project's VMT is compared to the applicable threshold of significance established based on the citywide average VMT. The significance threshold is equal to 15 percent below the existing citywide average home-based work trip VMT per employee for office developments. Due to the City's small size, lack of rail transit service, and relatively limited bus transit services available within the City, the baseline VMT for all office projects is assumed to be equal to the citywide average home-based work trip VMT (21.93 miles per employee) regardless of location within the City. This baseline VMT applies to all office projects with no TDM program or multimodal improvements proposed as part of the project. For office projects, a significance threshold which is 15 percent below that of existing development, calculates to a daily VMT of 18.64 miles per employee.

VMT for a specific project is affected by a number of factors including development density, land use diversity, multimodal infrastructure, parking policies/pricing, and Travel Demand Management (TDM) programs. The project's employment density (approximately 105 jobs per acre assuming 270 square feet per employee) would be substantially greater than a typical suburban office development (average 20 jobs per acre). Higher employment densities result in closer trip origins and destinations, on average, and thus in shorter trip lengths, on average. Shorter trips also may reduce VMT by making walking and bicycling more competitive alternatives to the automobile, while higher densities may increase the rate of carpool use and make it easier to support public transit. The increase in employment density is estimated to reduce the project's VMT by approximately one percent.[1] An increase in employment density associated with the planned redevelopment of the surrounding parcels within the Ravenswood Specific Plan area could further decrease the project's VMT.

Furthermore, as required by the current TSM ordinance, the project will implement a TDM plan that will reduce peak-hour vehicle trips by at least 25 percent below a typical office development. While trip reductions during off-peak periods would likely be less than that achieved during peak commute hours, it can be concluded that compliance with the existing TSM ordinance would indicate that the project has successfully achieved at least a 15 percent reduction in daily VMT below the existing Citywide average. Furthermore, the City recently approved an updated TDM Ordinance that will require developments approved after January 1, 2022 to achieve a 40 percent reduction in daily vehicle trips. Complying with the new ordinance would reduce the project's VMT even further below the significance threshold. Therefore, the project is expected to result in a less than significant impact on VMT.

A key strategy of all TDM programs is to monitor their effectiveness with an annual survey. The goal of the survey is to collect data on modes of travel used, opinions on the most effective and ineffective TDM measures, reasons for not using an alternative mode, and suggestions for improvements. As required by the City's current TSM ordinance and the new TDM ordinance, the commute survey for this project shall be prepared and administered by the employer in coordination with the City's TDM administrator annually. Based on the annual survey findings, if the trip reduction goal among the employees has not been achieved, the project would be required to outline additional measures that will be adopted in the coming year to achieve the goal along with an implementation schedule.

Conclusions

The proposed increase in project size would not result in additional adverse effects on intersection LOS or turn pocket queuing. The recommended improvements at the study intersections are unchanged from those identified in the previous report, dated December 6, 2019.

The development of the proposed project would not impede or conflict with existing or proposed transit services. The existing public transit services provide sufficient capacity to allow the project to achieve the required minimum trip reduction through travel demand management measures.

[1] Boarnet, Circella, and Hardy, Susan. 2014. "Impacts of Employment Density on Passenger Vehicle Use and Greenhouse Gas Emissions", Table 1. https://ww2.arb.ca.gov/sites/default/files/2020-06/Impacts_of_Employment_Density_on_Passenger_Vehicle_Use_and_Greenhouse_Gas_Emissions_Policy_Brief_0.pdf

While the proposed project would provide a sufficient number of parking spaces to meet the City's code requirements, the parking space dimensions, percentage of compact spaces, and number of loading spaces do not comply with the City's standards. Prior to final design, the site plan should comply with all City of East Palo Alto parking design standards. In addition, Hexagon recommends including 45 feet of red curb south of the southern driveway to prevent vehicles from parking and obstructing the vision of exiting drivers.

Compliance with the existing TSM ordinance and/or newly adopted TDM ordinance would indicate that the project has successfully achieved at least a 15 percent reduction in daily VMT below the existing Citywide average. Therefore, the project is expected to result in a less than significant impact on VMT. Prior to final design, the site plan should clearly label all parking space dimensions and should comply with City of East Palo Alto standards. The number of compact and loading spaces should also comply with City standards.

Water Supply Assessment

City of East Palo Alto

2535 Pulgas Avenue

Performed for:

City of East Palo Alto

Project location:

East Palo Alto, California

Prepared by:

Integrated Resource Management, Inc.

Contact:
Kevin Sage

May 11, 2021

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AF	Acre-Foot or -Feet (i.e., 1 acre x 1 foot deep)
AFY	Acre-Feet per Year
AWSP	Alternative Water Supply Planning Program
BAWSCA	Bay Area Water Supply and Conservation Agency
CEQA	California Environmental Quality Act
DWR	California Department of Water Resources
EPA	City of East Palo Alto
EPASD	East Palo Alto Sanitary District
ET	Evapotranspiration
°F	Degrees Fahrenheit
ft-bgs	feet below ground surface
GPCD	Gallons Per Capita Per Day
gpm	Gallons Per Minute
ISA	Interim Supply Allocation
ISG	Individual Supply Guarantee
ISL	Interim Supply Limitation
MG	Million Gallons
mgd	Million Gallons Per Day
mg/L	Milligrams Per Liter
O'Connor Tract	O'Connor Tract Co Op Water Company
PAPMWC	Palo Alto Park Mutual water Company
PEIR	Program Environmental Impact Report
psi	Pounds Per Square Inch
RWQCP	Regional Water Quality Control Plant
RWS	San Francisco Regional Water System
SB	Senate Bill
SBSA	South Bayside System Authority
SBSARTP	Regional Treatment Plant
SFPUC	San Francisco Public Utilities Commission
SFPUC Agreement	Water Supply Agreement, July 2009
SMCL	Secondary Maximum Contaminate Level
WBSD	West Bay Sanitary District
WSA	Water Supply Assessment
WSAP	Water Shortage Allocation Plan
WSIP	Water System Improvement Program

1.0 INTRODUCTION

This Water Supply Assessment (WSA) has been prepared to assist the City of East Palo Alto Planning Department in satisfying the requirements of Senate Bill 610 (SB 610) for the 2535 Pulgas Avenue Project (Proposed Project). The stated intent of SB 610 is to strengthen the process by which local agencies determine the adequacy, sufficiency, and quality of current and future water supplies in order to meet current and future demands.

Along with the Proposed Project, the City is in the process of considering approval of additional developments. Although these projects do not require a WSA, the analysis must include existing uses as well as any known future uses.

The City of East Palo Alto, Community and Economic Development Department, Planning and Housing Division is the lead agency for the Proposed Project. The City of East Palo Alto is providing this WSA pursuant to SB 610 for the purpose of ensuring there are sufficient water supplies available for the Proposed Project.

Water Code 10912 defines the “Projects” that are subject to a WSA and the Lead Agency’s responsibilities related to the WSA. A WSA is required for:

(1) A proposed residential development of more than 500 dwelling units.

(2) A proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet of floor space.

(3) A proposed commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space.

(4) A proposed hotel or motel, or both, having more than 500 rooms.

(5) A proposed industrial, manufacturing, or processing plant or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area.

(6) A mixed-use development that includes one or more of the uses described above.

(7) A development that would demand an amount of water equivalent to or greater than the amount of water required by a 500-dwelling-unit project.

(8) For Lead Agencies with under 5,000 water service connections, any new development that will increase the number of water service connections in the service area by ten percent or more.

SB 610 amended Water Code sections 10910 and 10912 to create a direct relationship between water supply and land use. In general terms, SB 610 requires the identification of an adequate 20-year water supply prior to constructing developments with more than 500 homes or the equivalent.

SB 610 was enacted in 2001 to improve the connection between water supplies and land use planning. It was intended to ensure greater communication between water providers and local planning agencies. Accordingly, SB 610 aims to ensure that land use decisions for certain large development projects are fully informed as to whether sufficient water supplies are available to serve the projects.

Further, under SB 610, water supply assessments must be furnished to local governments for inclusion in the environmental documentation for certain projects (as defined in Water Code Section 10912 [a]) that are subject to the California Environmental Quality Act (CEQA).

A WSA is, at its heart, an informational document that the CEQA lead agency relies on in deciding whether to approve projects. In this way, a WSA is similar to other informational documents used to support the analysis of impacts in an Environmental Impact Report (EIR), such as biological resource studies.

This WSA:

- Provides information on the Proposed Project's water supply consistent with Water Code section 10620 et seq. (the Urban Water Management Act) and section 10910 et seq. (Water Supply Planning to Support Existing and Planned Future Uses).

- Provides data necessary to produce the sufficiency findings required by CEQA.

1.1 Project Description

The City of East Palo Alto has received a proposal to redevelop 2535 Pulgas Avenue in to an approximately 110,000 square foot office building, surface parking lot with landscaping.

The Proposed Project encompasses 3.86-acre site (APN 063121370), on the west side of Pulgas Avenue, within the Ravenswood Specific Plan area of the City of East Palo Alto. The project site is currently developed with two single-story wood frame buildings and storage areas used for equipment and vehicle storage by the current occupant, Touchatt Trucking. The existing one-story buildings onsite total approximately 5,741 square feet.

The project site is bounded by industrial uses and vacant parcels to the north, industrial uses to the east and west and a vacant parcel and the Ravenswood Health Center to the south. Vehicle access to the site is currently provided via one driveway on Pulgas Avenue. The Ravenswood Open Space Preserve is located 0.20-mile northeast of the project site.

The Proposed Project would demolish the existing buildings, improvements and parking associated with the existing industrial use onsite and redevelop the site with a new four story, approximately 110,000 square foot office building, surface parking lot, and landscaping. The new office building would have a maximum height of 78 feet (including mechanical screening) with approximately 55,000 square feet being used for JobTrain and approximately 55,000 square feet being used by Emerson Collective as general office space. The first floor of the proposed building would feature approximately 10,500 square feet of ground floor open space for a carpentry yard and a children's play area.

The Proposed Project would be built to the California Green Building Standards Code (CALGreen), which includes design provisions intended to minimize wasteful energy consumption. The proposed project would be designed to achieve the equivalent of LEED Silver certification and would include water efficient landscaping with irrigation design and low flow indoor water fixtures among other green building features.

The Proposed Project is considering constructing an on-site sanitary sewer treatment facility to serve the proposed office building. The on-site treatment facility would have a capacity of 6,000 gallons per day (gpd) and would be located in the southwest corner of the project site. The facility would have four main components: 1) 30,000-gallon buffer/emergency storage tank, 2) wastewater treatment plant, 3) sludge collector, and 4) 20,000-gallon recycled water storage tank. Two pipes would connect the on-site sanitary sewer treatment plant to the office building transporting sewage from the office building to the treatment facility and returning processed, reclaimed water from the treatment facility back to the office building. In total, the on-site sanitary sewer facility would occupy approximately 2,490 square feet.

Existing water demand is estimated to be approximately 316 gpd. Proposed Project water demand of 0.055 gpd/sf for office space is based on experience and previously approved BKF (project engineer) projects within East Palo Alto. Landscaping consists of primarily California Native low and very low water usage plants. Landscaping water demand is estimated to be 930 gpd. The required water demand for the office building is 6,005 gpd. The Proposed Project would increase the water demand for the site by 6,619 gpd or 7.4 AF annually.

1.2 General Plan Update

An update of the City of East Palo Alto General Plan was adopted in 2016. The General Plan Update provides the foundation for establishing goals, purposes, zoning, and activities allowed on each land parcel. A WSA was completed for the General Plan update which analyzed the expected growth within the City and its water demand on the City water systems through 2035.

1.3 2020 Urban Water Management Plan

The UWMP uses a service area-wide method in developing its water demand projections. This methodology does not rely on individual development demands to determine area-wide growth. Rather, the growth in water use for the entire service area was considered in developing long-term water projections for the City of East Palo Alto.

The UWMP is updated every five years as required by California law. This process entails, among other requirements, an update of water supply and water demand projections for water agencies. In the 2020 update (due July 1, 2021), the City is in the process of developing a revised demand forecast that will factor in the water demand and any new additional supplies to meet future demands.

1.4 Weather Data

The City of East Palo Alto is located within the San Francisco Bay region and is characterized by a Mediterranean climate with dry, warm summers and wet, cool winters. Table 1-1 gives data on the climate of the region. The area receives most of its rainfall between late October and early May and its warmest temperatures in May through September. The average annual rainfall for the City of East Palo Alto is approximately 15 inches with an average reference evapotranspiration (ETo) of 44.88.

Table 1-1 Climate Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Rainfall (inches)	3.15	2.89	2.29	1.02	0.37	0.09	0.02	0.05	0.17	0.73	1.73	2.70	**15.21**
Ave Min Temperature (°F)	38.5	41.3	43.1	44.7	48.5	52.5	54.9	54.8	52.6	48.0	42.6	38.2	**46.6**
Ave Max Temperature (°F)	57.4	61.1	64.2	68.4	72.9	77.4	78.4	78.4	78.3	73.0	64.3	57.8	**69.3**
Average ETo (inches per month)	1.42	2.00	3.37	4.45	5.46	6.03	6.21	5.54	4.37	3.04	1.69	1.30	**44.88**

Sources: Monthly Average ETo Report (No. 171, Union City, San Francisco Bay Region), CIMIS, Department of Water Resources, Office of Water Use Efficiency; Western Regional Climate Center. Palo Alto, California (Station 046646) http://www.wrcc.dri.edu, Accessed November 10, 2020.

1.5 City of East Palo Alto Population

The City of East Palo Alto's water service area does not mirror the City boundaries. Therefore the population estimates must be adjusted accordingly for the areas served by Palo Alto Park Mutual and O'Connor Tract Cooperative Water Companies within the City limits.

The total projected population within the service area is expected to be 32,230 by 2045. The following population projections were developed in the City's 2015 UWMP and consistent with the General Plan Update and associated WSA.

Table 1-2 Population - Current and Projected

	2015	2020	2025	2030	2035	2040	2045
Service Area Population*	24,424	25,935	27,215	25,589	30,062	31,646	33,230

**Projected population growth based on City's General Plan (City of East Palo Alto, 2016)*

1.6 City of East Palo Alto Water Purveyors

The City's water system is operated as a public-private partnership between the City and Veolia North America (Veolia). The City serves the majority of the City of East Palo Alto. Other purveyors within City limits include the Palo Alto Park Mutual Water Company, which serves customers within the western portion of the City, and the O'Connor Tract Co-operative Water Company, which serves the southwestern portion of the City. The Proposed Project will be served by the City's water system.

1.6.1 City of East Palo Alto Water Purveyors

The City of East Palo Alto's public water system is run through the City's Department of Public Works under contract by Veolia. A major portion of the city's water system was formerly operated by the County of San Mateo under the name East Palo Alto County Waterworks District. The City of East Palo Alto assumed operation of the water distribution system from San Mateo County in 2001. Currently, Veolia manages the distribution, operation, and maintenance of the municipal water system on behalf of, and under contract with, the City of East Palo Alto. The City managed water system operates under Public Water System ID 4110024.

The City managed water system draws all of its current domestic water supply through three turnouts off the San Francisco Public Utilities Commission's (SFPUC) Bay Division Pipelines (BDPLs) 1 and 2 (see Figure 1-2). In addition, there are two one-way interties that serve Palo Alto Park Mutual and O'Connor Tract Co-operative Water Company and one intertie with City of Menlo Park. Treated water is supplied from the Hetch Hetchy Aqueduct at pressures ranging from 105 to 140 pounds per square inch (psi). The turnouts are located on the aqueduct near Willow Road, O'Brien Drive, and University Avenue. Pressure-regulating valves at each turnout reduce the pressure in the distribution system. The pressure-regulating valves are set at the following pressures: 70 psi at Willow Road, 75 psi at O'Brien Drive, and 75 psi at University Avenue. From the turnouts the water flows by gravity through the city's pressurized distribution network. The existing distribution system is a network of 1½-inch to 12-inch diameter pipes.

The City of East Palo Alto owns and operates one groundwater well located at the intersection of Gloria Way and Bay Road. The well has been redeveloped and is available for potable use.

There is currently no storage within the City of East Palo Alto's managed water system. The City managed water system relies solely on water from the SFPUC system for the storage necessary for equalization, fire flows, and emergency use.

The City has an adopted Capital Improvement Program intended to improve the City's water supply, storage, and delivery system

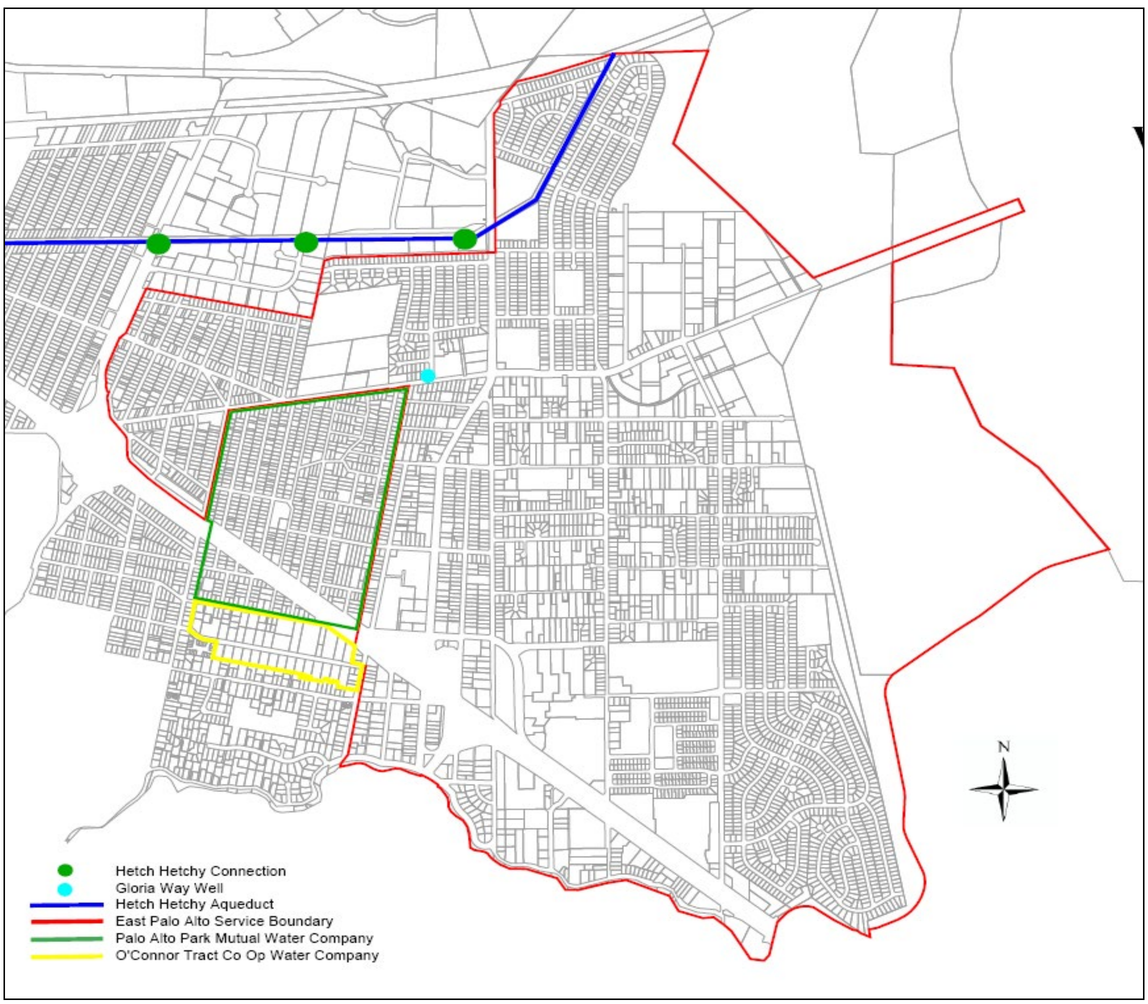
1.6.2 Palo Alto Park Mutual Water Company

Palo Alto Park Mutual Water Company is a non-profit mutual benefit corporation; a mutual water company incorporated in the state of California and owned by approximately 650 property owners in the Palo Alto Park area, a subdivision in East Palo Alto, and Menlo Park. Its area of service covers homes between Bay Road, Glen Way, Menalto (across the Bayshore Freeway), and Donohue. The company is not a public utility and can only sell water to the shareholders within the service area. Palo Alto Park Mutual Water Company is a groundwater system. The water is served by five (5) wells ranging from one hundred twenty-five to eight hundred gallons per minute and stored in two storage tanks with the capacities of 11,500 and 350,000 gallons.

1.6.3 O'Connor Tract Co-operative Water Company

O'Connor Tract Co-operative Water Company is a non-profit organization founded on January 31, 1921 to supply water to a small portion of East Palo Alto and Menlo Park. The Company serves approximately 343 connections. Its service area is bounded by Donohoe Street on the north, Woodland Avenue on the south, Menalto Avenue on the west, and Euclid Avenue on the east. The water is supplied from two deep wells and then pumped into a 100,000-gallon tank before being distributed to the system

Figure 2-1 City of East Palo Alto Water System Map



2.0 WATER SOURCES

The City of East Palo Alto managed water system receives all of its domestic water from the SFPUC with limited groundwater produced from the Gloria Way Well. The City has emergency interties with Palo Alto Park Mutual Water Company and O'Connor Tract Co-Op Water Company. The Proposed Project will be served by the City's water system.

Table 2-1 East Palo Alto Supply Sources

Supply	AFY	Right	Contract	Ever used
SFPUC	3,879		X	Yes
Groundwater	No Limit	X		Yes

2.1 San Francisco Public Utilities Company

The City of East Palo Alto receives water from the City and County of San Francisco's Regional Water System (RWS), operated by the SFPUC. This supply is predominantly from the Sierra Nevada, delivered through the Hetch Hetchy aqueducts, but also includes treated water produced by the SFPUC from its local watersheds and facilities in Alameda and San Mateo Counties.

Through the RWS, SFPUC supplies to both retail and wholesale customers. Its retail customers include the residents, businesses and industries located within the City and County of San Francisco. SFPUC also provides retail water service to other customers located outside of San Francisco, including Treasure Island, the Town of Sunol, San Francisco International Airport, and Lawrence Livermore Laboratory. The SFPUC also sells water on a wholesale basis to 26 water agencies in San Mateo, Santa Clara, and Alameda Counties of which East Palo Alto is one.

The amount of imported water available to the SFPUC's retail and wholesale customers is constrained by hydrology, physical facilities, and the institutional parameters that allocate the water supply of the Tuolumne River. Due to these constraints, the SFPUC is very dependent on reservoir storage to firm-up its water supplies.

The SFPUC serves its retail and wholesale water demands with an integrated operation of local Bay Area water production and imported water from Hetch Hetchy. In practice, the local watershed facilities are operated to capture local runoff.

2.1.1 2009 Water Supply Agreement (Amended November 2018)

The business relationship between San Francisco and its wholesale customers is largely defined by the "Water Supply Agreement between the City and County of San Francisco and Wholesale Customers in Alameda County, San Mateo County and Santa Clara County" entered into in July 2009 and amended in November 2018 (SFPUC Agreement). The SFPUC Agreement addresses the rate-making methodology used by the City in setting wholesale water rates for its wholesale customers in addition to addressing water supply and water shortages for the RWS. The SFPUC Agreement has a 25 year term, with provisions for two five-year extensions.

San Francisco has a perpetual commitment (Supply Assurance) to deliver 184 million gallons per day (mgd) to the 24 permanent wholesale customers collectively. San Jose and Santa Clara are not included in the Supply Assurance commitment and each has temporary and interruptible water supply contracts with San Francisco. The Supply Assurance is allocated among the 24 permanent wholesale customers through Individual Supply Guarantees (ISG), which represent each wholesale customer's allocation of the 184 mgd Supply Assurance. To accommodate the demands of the City of Hayward the ISGs of the 24 wholesale customers (other than San José and Santa Clara) are subject to reduction on a pro-rata basis if total delivery to City of Hayward and to the wholesale customers exceeds 184 mgd.

The SFPUC Agreement provides for an Interim Supply Limitation (ISL) of 265 mgd, expressed on an annual average basis, through the year 2018. The Wholesale customer's collective allocation under the ISL is 184 mgd and San Francisco's is 81 mgd. As an incentive to keep deliveries below the ISL of 265 mgd, the SFPUC adopted an Environmental Enhancement Surcharge for collective deliveries in excess of the ISL effective at the beginning of FY 2011-12.

In the 2009 WSA, there are three decisions the SFPUC committed to making that will affect water supply development:

- Whether or not to make the cities of San Jose and Santa Clara permanent customers; Whether or not to supply the additional unmet supply needs of the wholesale customers beyond 2018.
- Whether or not to increase the wholesale customer Supply Assurance above 184 mgd.
- The SFPUC Agreement does not guarantee that San Francisco will meet peak daily or hourly customer demands when their annual usage exceeds the Supply Assurance

Events since 2009 made it difficult for the SFPUC to conduct the necessary water supply planning and CEQA analysis required to make these three decisions before 2018. Therefore, in the 2018 Amended and Restated WSA, the decisions were deferred for 10 years to 2028.

2.1.2 City of East Palo Alto Individual Supply Guarantees

In 2009, the City of East Palo Alto, along with 25 other Bay Area water suppliers signed the SFPUC Agreement with San Francisco, supplemented by an individual Water Supply Contract. These contracts, which expire in 25 years, provide for a 184 mgd (expressed on an annual average basis) Supply Assurance to the SFPUC's wholesale customers collectively. Prior to 2018, East Palo Alto's ISG was 1.963 mgd. In 2018 and 2019, a portion of ISG's from the City of Mountain View and the City of Palo Alto were permanently transferred to East Palo Alto, resulting in the City's current ISG of 3.463 (or approximately 3,879 acre feet per year). Although the SFPUC Agreement and accompanying Water Supply Contract expire in 2034, the Supply Assurance (which quantifies San Francisco's obligation to supply water to its individual wholesale customers) survives their expiration and continues indefinitely.

2.2 Local Groundwater

2.2.1 Background

East Palo Alto is located over the Santa Clara Valley Groundwater Basin, San Mateo Subbasin, and the San Francisquito Watershed. This San Mateo Subbasin is not adjudicated and has not been identified or projected to be in overdraft by the California Department of Water Resources. Several groundwater management plans have been developed for the San Mateo Subbasin.

2.2.2 Santa Clara Valley Groundwater Basin

The Santa Clara Groundwater Basin is located in the San Francisco Hydrological Unit as defined by the Department of Water Resources. The basin is further divided into four subbasins: Niles Cone, Santa Clara, San Mateo Plain, and East Bay Plain. The basin is defined as encompassing 345,300 square miles of the San Francisco Hydrological Unit. The basin straddles the southern portion of the San Francisco Bay and is bounded on the east side of the bay by the northwest trending Coast Range, on the west side of the bay to the north by San Pablo Bay, and to the south by the groundwater divide near the town of Morgan Hill. The Diablo Range bounds it on the west and the Santa Cruz Mountains form the basin boundary on the east.

2.2.3 Santa Clara Valley Groundwater Basin, San Mateo Subbasin

The City overlies the southern end of the San Mateo Plain Groundwater Subbasin of the Santa Clara Valley Groundwater Basin (DWR Basin 2-9.03). The San Mateo Plain Subbasin covers approximately 75 square miles on the west side of the San Francisco Bay Hydrologic Region. The San Mateo Subbasin occupies a geological trough running underground and parallel to the northwest-trending Coast Ranges at the southwest end of San Francisco Bay. The subbasin is bound by the Santa Cruz Mountains in the west, the San Francisco Bay on the east, the Westside Basin to the north and San Francisquito Creek to the south. The basin is composed of alluvial fan deposits formed by tributaries to San Francisco Bay that drain the basin.

The principal groundwater aquifers of the basin and subbasins are composed of interbedded coarse- and fine-grained alluvial fan deposits of San Francisquito Creek, extending from the Santa Cruz Mountains north and under San Francisco Bay, and distal alluvial fan deposits of the Niles Cone, extending from the Diablo Range. Most of the permeable alluvial sediments occurring in the groundwater subbasin and beneath the City originated from the Santa Cruz Mountains to the south-southwest; however, some alluvial sediments from the Niles Cone may interfinger under San Francisco Bay with sediments of the San Francisquito Cone.

The alluvial fan deposits vary in composition with distance from the head of the San Francisquito Cone. Deposits near the head of the fan are characterized as poorly sorted clays and gravels, and deposits near the central portion of the fan and the active stream course are generally cleaner sands and gravels. Deposits near the terminal or distal portion of the fan consist of finer-grained silts, clays and fine sands. Relatively finer-grained materials were deposited laterally away from the stream channel course. Overlying most of the alluvial sediments beneath the City are thick, laterally-extensive fine-grained materials, deposited when the area was below sea level. These Bay Mud sediments form a continuous aquitard or confining layer, thereby producing a multiple aquifer zone system.

The USGS (Metzger, 2002) characterized the groundwater aquifers and aquitards as a generalized three-layer system: an upper unconfined to confined shallow aquifer zone, a fine-grained Bay Mud unit near the Bay, and a deep principal aquifer beneath the confining layer. Most large production wells derive their water from the deep aquifer zone, at depths ranging from 200 to over 800 feet below ground surface (ft-bgs).

Shallow Aquifer Zone

The shallow aquifer zone underlying East Palo Alto is comprised of localized gravel-filled stream channels etched into a prevailing clayey surface in past geologic time and subsequently buried by younger sedimentary deposits. The shallow aquifer coarse-grained deposits are generally thin (10's of feet thick) localized groundwater bearing zones and form sinuous paths with limited lateral continuity. Some local domestic wells produce groundwater from this shallow aquifer zone, however most municipal groundwater production is from the deeper principal aquifer zone.

Bay Mud Aquitard

The Bay Mud aquitard occurs beneath San Francisco Bay and extends south-southwest under the entire City. There is a clear increase in aquitard thickness (up to 300 ft-bgs) in the northeast closer to the Bay. The unit does not extend to the foothills in the southwest. The southwestern extent of the Bay Mud aquitard has been mapped by USGS and others, and demarcates the unconfined and confined aquifer zones. The confined zone occurs in the subbasin's northern portion. The subbasin's southern portion, south of the aquitard, is an unconfined zone, and is generally characterized by permeable alluvial fan deposits. This portion of the groundwater subbasin is also a groundwater recharge area, where mountain-front recharge, rainfall infiltration, urban landscaping return flows and percolation of San Francisquito Creek water can directly recharge the principal aquifer.

Deep Aquifer Zone

The principal groundwater-bearing aquifer zone comprises unconsolidated to semi-consolidated gravel, sand, silt and non-marine clay that generally has high permeability and thickness compared with the overlying shallow aquifer zone and Bay Mud aquitard. Where the Bay Mud aquitard is present, the principal aquifer zone is confined. The thickness of the principal aquifer zone ranges from less than 100 feet near the Santa Cruz Mountains to almost 1,000 feet near San Francisco Bay. The principal aquifer zone underlying the City does not end at the shoreline of San Francisco Bay; rather it extends offshore beneath the Bay and may be hydraulically connected to aquifer zones in the southeast side of the Bay including the Niles Cone aquifer.

Natural recharge occurs by infiltration of water from streams that enter the valley from the upland areas within the drainage basin and by percolation of precipitation that falls directly onto the valley floor. It is estimated that the San Francisquito Creek adds about 1,000 acre-feet of recharge to the groundwater subbasin immediately underneath East Palo Alto annually. Infiltration of runoff from the foothills, over-irrigation, urban watering, and leakage from water distribution and storm water systems also contribute to groundwater recharge.

Historically, groundwater resources in the area were developed to meet irrigation needs. Heavy groundwater pumping from the early 1920s to the mid-1960s caused movement of saline water from San Francisco Bay inland and land subsidence in parts of Palo Alto and East Palo Alto. Since 1965, increased surface water deliveries from the Hetch Hetchy system has reduced groundwater demand and allowed the restoration of the groundwater subbasin to pre-1960 levels.

Surprisingly, the subbasin also benefits from the Alameda County Water District recharge program on the eastern side of the Bay. According to the Santa Clara Basin Watershed Management Initiative (2000), surface water spread by the District flows several hundred feet beneath the Bay and sustains groundwater pumping along the bayfront in Palo Alto, Menlo Park, East Palo Alto, and Mountain View.

The groundwater in the San Mateo Subbasin tends to be quite hard and have high concentrations of iron and manganese.

DWR Bulletin 118 states that there is no data regarding groundwater storage and groundwater storage capacity in this area. Additionally, there is no centralized database of groundwater elevation measurements by the County of San Mateo or local municipalities. The East Palo Alto Groundwater Management Plan estimates that the recharge of the basin is between 5,000 to 10,000 AFY and the discharge is 2,900 Acre Foot (AF). Due to the limited data, the groundwater level is considered relatively stable and the change in storage is about zero

2.2.4 Groundwater Quality

The groundwater in East Palo Alto has high levels of total dissolved solids (TDS), nitrate, iron and manganese. The United States Environmental Protection Agency standards for drinking water fall into two categories—Primary Standards and Secondary Standards. Elevated levels of these constituents make groundwater undesirable for potable use for aesthetic reasons.

TDS, chloride, Iron and manganese are classified under the Secondary Maximum Contaminant Level (SMCL) standards. The SMCL for iron in drinking water is 0.3 milligrams per liter (mg/L) and 0.05 mg/L for manganese. The SMCL for TDS is 500 mg/L with an upper limit of 1,000 mg/L and the SMCL for chloride is 250 mg/L.

Several of the wells in the area exceed the TDS SMCL of 500 mg/L, including the City's Gloria Way Well which had concentrations as high as 840 and the nearby wells of PAPMWC which have slightly lower concentrations. Additionally, chloride levels exceeding the SMCL have been found in the City's Gloria Way Well as high as 350 mg/L. Several wells have manganese concentrations exceeding the SMCL. The City's Gloria Way Well has had manganese concentrations as high as 0.19 mg/L. Some of the nearby PAPMWC and O'Connor Tract wells also have had manganese concentrations above the SMCL.

Although the wells in the area exceed these SMCL's the groundwater in the area is acceptable for potable and irrigation uses.

2.3 Groundwater Management Plan

In September 2014, the State enacted three legislative bills (AB 1739, SB 1168, and SB 1319), more commonly known as the Sustainable Groundwater Management Act. This legislation mandates sustainable management of groundwater resources and provides expanded powers to local public water agencies that organize as groundwater sustainability agencies. Sustainability is defined in terms of a basin's yield as the maximum long-term quantity of water that can be withdrawn annually without causing an undesirable result.

Compliance with the Sustainable Groundwater Management Act is required for groundwater basins or subbasins that have been designated by CDWR as medium- or high priority. Although the San Mateo Subbasin is considered to be of very low priority, the City, being proactive, developed a Groundwater Management Plan for the portion of the subbasin underlying the City.

In August 2015, the City adopted the first groundwater management plan within the Subbasin. The City's Groundwater Management Plan (GWMP) was prepared in accordance with Assembly Bill 3030, Senate Bill 1938, and Assembly Billy 359. The objectives of the GWMP were to:

- Provide the City with a long-term, reliable and affordable high quality supply;
- Maintain or improve groundwater quality and quantity for the benefit of all groundwater users; and
- Provide integrated water resource management for resilience during droughts, with service interruptions and emergencies, and with long-term climate change effects.

The GWMP identified six basin management objectives (BMOs) that express the desired achievements for the GWMP. The BMOs are intended to be measurable and achievable, and each BMO is associated with specific management actions. The BMOs are also intended to be adaptive and subject to regular re-examination and update as more information becomes available and as conditions change. The BMOs identified in the GWMP are as follows:

1. Maintain acceptable ground water levels.
2. Avoid subsidence
3. Protect groundwater quality
4. Integrate management of groundwater and surface water
5. Improve understanding of the groundwater system
6. Promote regional groundwater management

Additionally, San Mateo County has begun to participate in the CASGEM program. CASGEM is a groundwater elevation monitoring program that was developed by DWR per the requirements of SBx7 6. The objective of CASGEM is to establish a groundwater monitoring to track seasonal and long-term trends in groundwater elevations. In, 2019, The County of San Mateo Office of Sustainability provided initial notification to DWR of its intent to become the CASGEM Monitoring Entity for the subbasin. A CASGEM Monitoring Plan, including a monitoring network of approximately ten wells throughout the subbasin, was submitted to and approved by DWR in 2020 and monitoring pursuant to the CASGEM Plan has been initiated.

2.4 San Francisquito Watershed

The San Francisquito Creek Watershed covers approximately 45 square miles of the South Bay area, draining the east-facing slopes of the Santa Cruz Mountains through to the San Francisco Bay. The upper part of the watershed is rural and hilly, while the lower part of the watershed is urban and flat. The highest elevation in the watershed is approximately 2,200 feet.

The watershed is “probably the most inter-jurisdictionally complicated watershed in the Bay Area” (USGS 2003), enveloping the Cities of East Palo Alto, Menlo Park, Palo Alto, Portola Valley, Woodside, unincorporated areas in both San Mateo and Santa Clara Counties, and Stanford University. What’s more, San Francisquito Creek forms the county line between San Mateo and Santa Clara Counties. The watershed is approximately 80 percent in San Mateo County and 20 percent in Santa Clara County.

The San Francisquito Creek fan encompasses approximately 22 square miles. The subbasin boundaries roughly correspond to the extent of the San Francisquito Creek alluvial fan. The City of East Palo Alto lies entirely on the alluvial fan of San Francisquito Creek sharing this floodplain with the Cities of Menlo Park and Palo Alto. Historically, during floods the swollen creek would deposit sand, silt, and gravel carried from the hills across the Baylands area. For thousands of years this process, coupled with the constantly changing course of the lower streambed, built up thick, fan-shaped sedimentary deposits of sand and gravel on which East Palo Alto and its neighbors now sit.

The San Francisquito Creek subbasin is composed of coarse- and fine-grained alluvial deposits of San Francisquito Creek. The groundwater system includes a shallow aquifer and a deep aquifer beneath a laterally extensive confining clay layer. The deep aquifer consists of an upper and lower zone. The groundwater subbasin is as much as 1,000 feet thick in places. The groundwater system includes a shallow aquifer that extends from the ground surface to about 15 to 100 ft-bgs and a deep aquifer beneath the confining layer that has two water-bearing zones. The upper zone is between 200 and 300 ft-bgs and the lower zone extends to depths greater than 300 ft-bgs.

San Francisquito Creek has an inadequate carrying capacity due to development, vegetation sedimentation, land subsidence, levee settlement and erosion. Flooding on the creek affects the cities of Menlo Park and East Palo Alto in San Mateo County, and Palo Alto in Santa Clara County. As a result of record rainfall in February 1998, San Francisquito Creek overtopped its banks, affecting approximately 1,700 residential and commercial structures. Due to the flooding, the cities of Palo Alto, Menlo Park, and East Palo Alto, the County of San Mateo, and the Santa Clara Valley Water District joined together to create a regional government agency, the San Francisquito Creek Joint Powers Authority (SFCJPA). The SFCJPA plans, designs, and implements projects along the creek.

The Cities of Menlo Park and East Palo Alto commissioned a study on the San Francisquito Creek Groundwater Subbasin (Watershed). The report developed by Todd Engineers provides a preliminary feasibility level evaluation of the potential supply and quality of groundwater resources in Menlo Park and East Palo Alto.

The report determined that supplemental wells could be installed by the City of East Palo Alto and Menlo Park for irrigation and/or potable use to augment existing water supplies in case of emergency or drought. Yields from a properly designed and sited large diameter well installed in the Cities can be expected to range from approximately 300 to 1,800 gallons per minute (gpm). The preliminary estimate of annual groundwater recharge in the San Francisquito Groundwater Subbasin ranges from approximately 4,000 to 8,000 AFY. The Cities could install supplemental wells to capture some portion of this annual recharge without depleting the groundwater resource.

2.4.1 Regional Groundwater Management

In September 2014, the City passed Resolution No. 4542 in support of sustainable groundwater management in the San Francisquito Creek area. This resolution was also passed by six other local agencies: Santa Clara Valley Water District, San Mateo County and the cities of Palo Alto, Menlo Park, Atherton, and Portola Valley. It represents a regional commitment to groundwater management.

Accordingly, per the resolution, the agencies resolved to collaborate with other agencies and organizations to better understand the hydrology and geology of the San Francisquito Creek area. They also stated their respective commitment to the sustainable management of local groundwater to protect its quality and ensure its availability during droughts and emergencies.

2.5 East Palo Alto Groundwater Supply

The City currently relies on the SFPUC for all of its domestic water supply. The City is in the process of expanding groundwater production to meet future water demands, as well as provide sufficient fire flow, and to provide the City with a supplemental potable water supply in the event of a water-quality breach, supply interruption, or other potential water supply emergency.

The City completed the redevelopment of the Gloria Way Well in 2017. The Gloria Way Well project included the installation of a new well pump, an iron and manganese treatment system and blending facility. The Gloria Way Well is blended with SFPUC water prior to being distributed to customers. The Gloria Way Well is capable of producing up to 300 gpm, or between 200 and 450 AFY of supplemental water supplies for the City, depending on produced water quality, storage infrastructure, timing of demands, and other operational constraints. However, the City is limited on how much the well is run due to permit restriction from the State of 150gpm or approximately 15AFY.

The City plans to develop additional local groundwater supplies by constructing a new water standby well and treatment system (the Pad D Well). The new well is planned to be located at the corner of Clarke Road and East Bayshore Drive, and its associated treatment system. In 2014, the City drilled, constructed, and tested a six-inch diameter test well at the Pad D site for the purposes of assessing local aquifer characteristics, water quality, and the potential yield of a municipal supply well at the Pad D site. The current work being completed includes the preparation of the required CEQA documents, permitting, and design of the well, pump, treatment/blending system, disinfection system, and associated controls and piping. It is anticipated that groundwater production from the Pad D Well will be limited to 33 AFY, assuming a 500-gpm pumping rate at up to 24 hours per day for 15-days per year (pumping would not occur for more than 5 consecutive days).

The combined production capacity of the wells is anticipated to be 48 AFY.

3.0 WATER SUPPLY RELIABILITY

Water supply reliability is a measure of the water provider's ability to provide an adequate water supply during times of shortage. The City has no storage and very limited groundwater production capacity. Therefore the City relies solely on SFPUC for its water supply. This section discusses the reliability of the City's water supplies during single and multiple dry years.

This following describes the constraints on the City's water supplies and the management strategies that affected agencies have employed or will employ to address these constraints.

3.1 Reliability of the Regional Water System

The SFPUC adopted Level of Service (LOS) Goals and Objectives in conjunction with the adoption of WSIP. The SFPUC updated the LOS Goals and Objectives in February 2020. The goals and objectives of the WSIP related to water supply are:

Program Goal	System Performance Objective
Water Supply – *meet customer water needs in non-drought and drought periods*	• Meet all state and federal regulations to support the proper operation of the water system and related power facilities. • Meet average annual water demand of 265 mgd from the SFPUC watersheds for retail and Wholesale Customers during non–drought years for system demands consistent with the 2009 Water Supply Agreement. • Meet dry-year delivery needs while limiting rationing to a maximum 20 percent system-wide reduction in water service during extended droughts. • Diversify water supply options during non-drought and drought periods. • Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers.

3.2 Bay-Delta Plan Impacts

In December 2018, the State Water Resources Control Board (SWRCB) adopted amendments to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan Amendment) to establish water quality objectives to maintain the health of the Bay-Delta ecosystem. The Bay-Delta Plan Amendment requires the release of 30-50% of the "unimpaired flow" on the three tributaries from February through June in every year type.

If the Bay-Delta Plan Amendment is implemented, the SFPUC will be able to meet the projected water demands presented in normal years but would experience supply shortages in single dry years or multiple dry years. Implementation of the Bay-Delta Plan Amendment will require rationing in all single dry years and multiple dry years. The SFPUC has initiated an Alternative Water Supply Planning Program (AWSP) to ensure that San Francisco can meet its Retail and Wholesale Customer water needs, address projected dry years shortages, and limit rationing to a maximum 20 percent system-wide in accordance with adopted SFPUC policies. This program is in early planning stages and is intended to meet future water supply challenges and vulnerabilities such as environmental flow needs and other regulatory changes; earthquakes, disasters, and emergencies; increases in population and employment; and climate change. As the region faces future challenges – both known and unknown – the SFPUC is considering this suite of diverse non-traditional supplies and leveraging regional partnerships to meet Retail and Wholesale Customer needs through 2045.

The SWRCB has stated that it intends to implement the Bay-Delta Plan Amendment on the Tuolumne River by the year 2022, assuming all required approvals are obtained by that time. But implementation of the Plan Amendment is uncertain at this time.

3.3 Tier One and Tier Two Allocations

3.3.1 Tier One Drought Allocations

In July 2009, San Francisco and its Wholesale Customers in Alameda County, Santa Clara County, and San Mateo County (Wholesale Customers) adopted the Water Supply Agreement (WSA), which includes a Water Shortage Allocation Plan (WSAP) that describes the method for allocating water from the RWS between Retail and Wholesale Customers during system-wide shortages of 20 percent or less. The WSAP, also known as the Tier One Plan, was amended in the 2018 Amended and Restated WSA.

The SFPUC allocates water under the Tier One Plan when it determines that the projected available water supply is up to 20 percent less than projected system-wide water purchases. The following table shows the SFPUC (i.e, Retail Customers) share and the Wholesale Customers' share of the annual water supply available during shortages depending on the level of system-wide reduction in water use that is required. The Wholesale Customers' share will be apportioned among the individual Wholesale Customers based on a separate methodology adopted by the Wholesale Customers, known as the Tier Two Plan, discussed further below.

The Tier One Plan allocates water between San Francisco and the wholesale customers collectively based on the level of shortage:

Table 3-1 Interim Water Shortage Allocation Plan Tier One Reduction Rates

Level of System Wide Reduction in Water Use Required	Share of Available Water	
	SFPUC Share	Wholesale Customers Share
5% or less	35.5%	64.5%
6% through 10%	36.0%	64.0%
11% through 15%	37.0%	63.0%
16% through 20%	37.5%	62.5%

The Tier One Plan allows for voluntary transfers of shortage allocations between the SFPUC and any wholesale customer and between wholesale customers themselves. In addition, water "banked" by a wholesale customer, through reduction in usage greater than required, may also be transferred.

As amended in 2018, the Tier One Plan requires Retail Customers to conserve a minimum of 5 percent during droughts. If Retail Customer demands are lower than the Retail Customer allocation (resulting in a "positive allocation" to Retail) then the excess percentage would be re-allocated to the Wholesale Customers' share. The additional water conserved by Retail Customers up to the minimum 5 percent level is deemed to remain in storage for allocation in future successive dry years.

The Tier One Plan will expire at the end of the term of the WSA in 2034, unless mutually extended by San Francisco and the Wholesale Customers.

The Tier One Plan applies only when the SFPUC determines that a system-wide water shortage exists and issues a declaration of a water shortage emergency under California Water Code Section 350. Separate from a declaration of a water shortage emergency, the SFPUC may opt to request voluntary cutbacks from its Retail and Wholesale Customers to achieve necessary water use reductions during drought periods.

3.3.2 Tier Two Drought Allocations

The wholesale customers have negotiated and adopted the Tier Two Plan, the second component of the WSAP, which allocates the collective wholesale customer share among each of the 26 wholesale customers. This Tier Two allocation is based on a formula that takes into account multiple factors for each wholesale customer including:

- Individual Supply Guarantee;
- Seasonal use of all available water supplies; and
- Residential per capita use.

The water made available to the Wholesale Customers collectively will be allocated among them in proportion to each Wholesale Customer's Allocation Basis, expressed in millions of gallons per day, which in turn is the weighted average of two components. The first component is the Wholesale Customer's Individual Supply Guarantee, as stated in the WSA, and is fixed. The second component, the Base/Seasonal Component, is variable and is calculated using the monthly water use for three consecutive years prior to the onset of the drought for each of the Wholesale Customers for all available water supplies. The second component is accorded twice the weight of the first, fixed component in calculating the Allocation Basis. Minor adjustments to the Allocation Basis are then made to ensure a minimum cutback level, a maximum cutback level, and a sufficient supply for certain Wholesale Customers.

The Allocation Basis is used in a fraction, as numerator, over the sum of all Wholesale Customers' Allocation Bases to determine each wholesale customer's Allocation Factor. The final shortage allocation for each Wholesale Customer is determined by multiplying the amount of water available to the Wholesale Customers' collectively under the Tier One Plan, by the Wholesale Customer's Allocation Factor.

The Tier Two Plan requires that the Allocation Factors be calculated by BAWSCA each year in preparation for a potential water shortage emergency. As the Wholesale Customers change their water use characteristics (e.g., increases or decreases in SFPUC purchases and use of other water sources, changes in monthly water use patterns, or changes in residential per capita water use), the Allocation Factor for each Wholesale Customer will also change. However, for long-term planning purposes, each Wholesale Customer shall use as its Allocation Factor, the value identified in the Tier Two Plan when adopted.

Per WSA Section 3.11, the Tier One and Tier Two Plans will be used to allocate water from the Regional Water System between Retail and Wholesale Customers during system-wide shortages of 20% or less. For Regional Water System shortages in excess of 20%, San Francisco shall (a) follow the Tier 1 Shortage Plan allocations up to the 20% reduction, (b) meet and discuss how to implement incremental reductions above 20% with the Wholesale Customers, and (c) make a final determination of allocations above the 20% reduction. After the SFPUC has made the final allocation decision, the Wholesale Customers shall be free to challenge the allocation on any applicable legal or equitable basis. For purposes of the 2020 UWMPs, for San Francisco Regional Water System (RWS) shortages in excess of 20%, the allocations among the Wholesale Customers is assumed to be equivalent among them and to equal the drought cutback to Wholesale Customer by the SFPUC.

The Tier Two Plan, which initially expired in 2018, has been extended by the BAWSCA Board of Directors every year since for one additional calendar year. In November 2020, the BAWSCA Board voted to extend the Tier Two Plan through the end of 2021.

3.4 SFPUC and Other Regional Strategies and Actions

3.4.1 Dry Year Supply Projects

The WSIP authorized the SFPUC to undertake a number of water supply projects to meet dry-year demands with no greater than 20% system-wide rationing in any one year. Implementation of these projects is also expected to mitigate impacts of the implementation of the Bay-Delta Plan Amendment. Those projects include the following:

- Calaveras Dam Replacement Project.
- Alameda Creek Recapture Project.
- Lower Crystal Springs Dam Improvements.
- Regional Groundwater Storage and Recovery Project.
- MGD Dry-year Water Transfer.

In order to achieve its target of meeting at least 80 percent of its customer demand during droughts and to mitigate the impacts of the Bay-Delta Plan, SFPUC must successfully implement the dry-year water supply projects included in the WSIP.

3.4.2 Alternative Water Supply Program

With the adoption of the Bay-Delta Plan Phase 1 (Bay-Delta Plan) by the State Water Resources Control Board in December of 2018, coupled with the uncertainties associated with litigation and the development of Voluntary Agreements that, if successful, would provide an alternative to the 40% unimpaired flow requirement that is required by the Bay-Delta Plan, BAWSCA redoubled its efforts to ensure that the SFPUC took necessary action to develop alternative water supplies such that they would be in place to fill any potential gap in supply by implementation of the Bay-Delta Plan and that the SFPUC would be able to meet its legal and contractual obligations to its Wholesale Customers.

In early 2020, the SFPUC began implementation of the Alternative Water Supply Planning Program (AWSP), a program designed to investigate and plan for new water supplies to address future long-term water supply reliability challenges and vulnerabilities on the RWS.

Included in the AWSP is a suite of diverse, non-traditional supply projects that, to a great degree, leverage regional partnerships and are designed to meet the water supply needs of the SFPUC Retail and Wholesale Customers through 2045. As of the most recent Alternative Water Supply Planning Quarterly Update, SFPUC has budgeted $264 million over the next ten years to fund water supply projects. BAWSCA is heavily engaged with the SFPUC on its AWSP efforts.

3.5 BAWSCA Long Term Reliable Water Supply Strategy

BAWSCA's Long-Term Reliable Water Supply Strategy (Strategy), completed in February 2015, quantified the water supply reliability needs of the BAWSCA member agencies through 2040, identified the water supply management projects and/or programs (projects) that could be developed to meet those needs, and prepared an implementation plan for the Strategy's recommendations.

When the 2015 Demand Study concluded it was determined that while there is no longer a regional normal year supply shortfall, there was a regional drought year supply shortfall of up to 43 mgd. In addition, key findings from the Strategy's project evaluation analysis included:

- Water transfers represent a high priority element of the Strategy.
- Desalination potentially provides substantial yield, but its high effective costs and intensive permitting requirements make it a less attractive drought year supply alternative.
- Other potential regional projects provide tangible, though limited, benefit in reducing dry-year shortfalls given the small average yields in drought years.

Since 2015, BAWSCA has completed a comprehensive update of demand projections and engaged in significant efforts to improve regional reliability and reduce the dry-year water supply shortfall.

BAWSCA continues to implement the Strategy recommendations in coordination with BAWSCA member agencies. Strategy implementation will be adaptively managed to account for changing conditions and to ensure that the goals of the Strategy are met in an efficient and cost-effective manner. On an annual basis, BAWSCA will reevaluate Strategy recommendations and results in conjunction with development of the BAWSCA's FY 2021-22 Work Plan. In this way, actions can be modified to accommodate changing conditions and new developments.

3.6 East Palo Alto Supply Reliability

In accordance with the SFPUC's perpetual obligation to East Palo Alto's Supply Assurance, East Palo Alto has an ISG of 3.463 mgd, or approximately 3,879 AF per year. SFPUC is obligated to provide East Palo Alto with up to 100% of East Palo Alto's ISG during normal years.

As provided in the Draft 2020 Urban Water Management Plan, BAWSCA provided single and five-consecutive dry-year allocations for East Palo Alto.

For planning purposes, Wholesale Agency drought allocations assume an equal percent reduction across all agencies when the average Wholesale Customers' RWS shortages are greater than 20%. These percent reductions assume the implementation of the Bay-Delta Plan Amendment in 2023.

Table 3-2 Wholesale Supply Availability During Normal and Dry Years

Base Year	Normal Year	Single Dry Year	Multiple Dry Years				
			Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
2025	100%	64%	64%	55%	55%	55%	55%
2030	100%	64%	64%	55%	55%	55%	55%
2035	100%	64%	64%	54%	54%	54%	50%
2040	100%	63%	63%	54%	54%	48%	48%
2045	100%	54%	54%	54%	54%	46%	46%

4.0 EAST PALO ALTO WATER SUPPLY RESTRICTIONS

The City has implemented water planning policies which have limited its ability to approve new development projects due to the normal year water supply shortfall consistently reported in its water planning documents.

4.1 Restrictions

In September 2012, the City adopted the Ravenswood/4 Corners TOD Specific Plan which shapes future development of the northeastern portion of the City. The EIR Mitigation for the lack of water supply included a Specific Plan intended to ensure that an adequate water supply exists to support new development in the Ravenswood/4 Corners area. Policy UTIL-2.2 imposes the following requirement on the City's Planning Division:

> *Before individual development projects are approved in the Plan Area, require the developer to demonstrate verifiable, enforceable proof that either they have secured new water supplies to serve the new development or that the proposed development will create no net increase in total water demand in East Palo Alto. Ensure that environmental review is carried out for augmentations to the supply from additional groundwater pumping in the Specific Plan area and within a quarter mile radius.*

While Policy UTIL-2.2 applies only to the Ravenswood/4 Corners area, the General Plan Update builds upon this policy and establishes water supply policies for the City of East Palo Alto. The following policies under Infrastructure, Services, and Facilities Goal ISF-2 provide for instituting long-term strategies to sustainably manage limited water resources and lack of water supplies:

> *Policy 2.4 - Water supply planning and demand offset regulations for new or intensified development.*
>
> *Consider and adopt a water offset ordinance or other policy to reduce the water demand and to ensure adequate water supply exists to meet the needs of new projects or intensified development. Allow the City the right to require a Water Supply Assessment of any development project. The policy will consider the type or size of projects that might be exempt, the water offset ratio, the method for analyzing the projected water demand and methods for offset demand, the types of demand reduction/mitigation implementation options (e.g., onsite or offsite design or building modification), including an in-lieu fee, that will be required, a method for estimating the savings from onsite or offsite efficiency measures, and the appropriate regulatory instruments to enforce, implement, and monitor the offset policy.*
>
> *Policy 2.6 - Water infrastructure for new development.*
>
> *Require development projects to pay for their share of new water infrastructure or improvements necessitated by that development, including but not limited to water supply, storage, and conservation: and recycled water.*

5.0 WATER DEMANDS

5.1 City Water System Demands

The City of East Palo Alto managed water system receives all of its domestic water from the SFPUC RWS. The City is able to and has drawn groundwater out of this basin through its Gloria Way Well.

SFPUC has made available and the City has purchased water above the Individual Supply Guarantee (ISG) in the past. Consistent with existing agreements, this has been possible because other wholesale agencies have not used their full contractual supply.

Under the terms of the dissolution of the East Palo Alto County Waterworks District, the City is required to transfer up to 243 AFY of SFPUC water to the City of Menlo Park. The City does not consider water that is received on behalf of and immediately sold to the City of Menlo Park to be a part of its water supply or demand.

The following tables summarize the City water purchases from SFPUC as well as the groundwater production from the Gloria Way well.

Table 5-1 East Palo Alto Historical SFPUC Deliveries

Year	Purchase from SFPUC (AF)*
2010	1,933
2011	1,982
2012	2,083
2013	2,320
2014	1,863
2015	1,758
2016	1,577
2017	1,688
2018	1,737
2019	1,706
2020	1,755

**From 2020 DRAFT Urban Water Management Plan*

5.2 Proposed Project Demands

The Proposed Project site will consist of a new four story, approximately 110,000 square foot office building, surface parking lot, and landscaping. The Proposed Project would be built to the California Green Building Standards Code (CALGreen) and would be designed to achieve the equivalent of LEED Silver certification and would include water efficient landscaping with irrigation design and low flow indoor water fixtures among other green building features. Existing water demand is estimated to be approximately 316 gpd. Proposed project water demand of 0.055 gpd/sf for office space is based on experience and previously approved BKF (project engineer) projects within East Palo Alto. Landscaping will consist of primarily California Native low and very low water usage plants. Landscaping water demand is estimated to be 930 gpd. The required water demand for this office building is 6,005 gpd. The Proposed Project would increase the water demand for the site by 6,619 gpd or 7.4 AF annually.

Table 5-2 Proposed Project Usage

Site Use	Square feet	New Water Demand (AFY)
Building	110,000	6.4
Landscaping	21,865	1.0

The Proposed Project is considering constructing an on-site sanitary sewer treatment facility to serve the proposed office building. The on-site treatment facility would have a capacity of 6,000 gpd or 6.72 AFY and would be located on site. Approximately 4,800 gpd, 5.4AFY, could be used for non-potable and landscape use. It is estimated that the non-potable demand for the building is 4,016 and landscape demand is 930 gpd for a total non-potable use of 4,946 or 5.5 AF per year. The total potable water demand for the Proposed Project would be reduced to approximately 2.0 AFY.

6.0 WATER SUPPLY ANALYSIS

The City purchases water from the SFPUC to meet its potable water demands within the service area. In 2020 the City purchased approximately 1,755 AF. Over the period of 2015 through 2020 the City did not produce any groundwater for potable use. The City brought the Gloria Way well back on-line and is in the process of constructing the Pad D Well and plans to use groundwater in the City's future. The City's existing and future water supplies are summarized in Table 6-1.

Projected water demands are being updated in the 2020 UWMP developed by EKI Environmental & Water Inc. During the process, passive water conservation was considered and savings associated with existing water uses in the City's service area have been subtracted from the water demand projections. The total projected potable water demand in the City's service area, accounting for this projected passive conservation savings is estimated to be 1,078 MG, or 3,308 AF in 2045.

Table 6-1 Current and Projected Available Water Supply (AF)

Potable Water Sources	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**
SFPUC	3,879	3,879	3,879	3,879	3,879	3,879
Groundwater	15	48	48	48	48	48
Total	**3,894**	**3,927**	**3,927**	**3,927**	**3,927**	**3,927**

Table 6-2 through 6-4 give the city's supply reliability scenarios for years 2025 through 2045:

Table 6-2 Supply and Demand Comparison Normal Water Year (AF)

	2025	**2030**	**2035**	**2040**	**2045**
Supply	3,927	3,927	3,927	3,927	3,927
Demand	2,124	2,213	2,391	2,845	3,308
Surplus/Deficit	*1,803*	*1,714*	*1,536*	*1,082*	*619*

Table 6-3 Water Use Supply and Demand Comparison During Single Dry-Year (AF)

	2025	**2030**	**2035**	**2040**	**2045**
Supply	1,394	1,449	1,538	1,817	1,817
Demand	2,124	2,213	2,391	2,845	3,308
Surplus/Deficit	*(730)*	*(764)*	*(853)*	*(1,028)*	*(1,491)*

Table 6-4 Supply and Demand Comparison During Multiple Dry-Years (AF)

	2025	2030	2035	2040	2045
Year 1					
Supply	1,394	1,449	1,538	1,817	1,817
Demand	2,124	2,213	2,391	2,845	3,308
Surplus/Deficit	*(730)*	*(764)*	*(853)*	*(1,028)*	*(1,491)*
Year 2					
Supply	1,203	1,246	1,326	1,572	1,817
Demand	2,124	2,213	2,391	2,845	3,308
Surplus/Deficit	*(920)*	*(966)*	*(1,065)*	*(1,273)*	*(1,491)*
Year 3					
Supply	1,203	1,246	1,326	1,572	1,817
Demand	2,124	2,213	2,391	2,845	3,308
Surplus/Deficit	*(920)*	*(966)*	*(1,065)*	*(1,273)*	*(1,491)*
Year 4					
Supply	1,203	1,246	1,326	1,394	1,550
Demand	2,124	2,213	2,391	2,845	3,308
Surplus/Deficit	*(920)*	*(966)*	*(1,065)*	*(1,451)*	*(1,758)*
Year 5					
Supply	1,203	1,246	1,225	1,394	1,550
Demand	2,124	2,213	2,391	2,845	3,308
Surplus/Deficit	*(920)*	*(966)*	*(1,166)*	*(1,451)*	*(1,758)*

As shown in the 6-2 through 6-4, the City will not be able to meet the demands of the City including the Proposed Project during single and multiple dry-year scenarios.

7.0 CONCLUSION

The Proposed Project is estimated to increase water demand on the City water system by 7.4 AFY. By year 2025, the current available City water supply will not be able to meet the demands of the water system during single and multiple dry-year conditions.

The City SFPUC supply is limited by its contractual limitations while the groundwater basin is not adjudicated and there are currently no groundwater pumping restrictions. As shown in this assessment, the City's existing water supplies are not sufficient to meet the demands associated with this Proposed Project and the City's expected growth. In order for the demands associated with the Proposed Project to be met during dry year scenarios, new water supplies must be acquired and developed.

The City is developing new water supplies to meet the demands for the proposed future growth. The City has committed or pending funding from sources including the San Mateo County Community Development Block Grants, Environmental Protection Agency State and Tribal Assistance Grants, and Integrated Regional Water Management Grants. On June 16, 2015, the City Council approved a Water Capital Improvement Surcharge for supply and storage projects that is estimated to generate approximately $500,000 per year for investing in supply and storage projects. The City is also planning to implement water supply and storage connection fees.

Additionally, Policy UTIL-2.2 and requires a development in the Ravenswood/4 Corners area to provide the City with enforceable, verifiable proof that an adequate water supply exists to supply the new or intensified development. The City has secured 1,500,000 gpd of additional SFPUC water and is seeking additional SFPUC water. Additionally, the capacity of the Gloria Way well is limited to 15 AFY and the planned Pad D well will be limited to 33AFY. The wells will not meet the demands during single and multiple during dry-years.

Groundwater Opportunities

The City is addressing the supply shortfall by developing a new groundwater well and treatment facility at Pad D. These projects are expected to produce 33AFY. The groundwater would be treated meet California drinking water standards. In the event shortages occur, the City could update permitting of the Pad D well and system to use it as a standard potable water source to supplement dry year supplies. The project is described more in Section 2.3.

Transfer and Exchange Opportunities

The SFPUC Agreement allows for the transfer or exchange of water among parties, both inside and outside of the RWS. It is possible to transfer ISG and/or unused portions of water allocations among contracting agencies within the SFPUC system. The Water Shortage Allocation Plan adopted by SFPUC and its wholesale customers provide for voluntary transfers of water among wholesale customers during periods when mandatory rationing is in effect within the RWS. Some wholesale customers have the capacity to draw more heavily on other water supplies, such as the State Water Project or groundwater, and may be willing to transfer a portion of their ISG to other customers.

The SFPUC Agreement and state law also allow purchase and transfer of water from outside the SFPUC service area. As permitted by the SFPUC Agreement and state law, water may be purchased from outside of the RWS and conveyed to SFPUC and/or East Palo Alto through third-party transmission systems. Additional water could be secured either by SFPUC or East Palo Alto to augment its water supply. Such an arrangement would require both a contract with the third-party water supplier and an agreement between East Palo Alto and the SFPUC on the water quality, price, and operational terms.

In addition to acquiring transferred water individually, BAWSCA has statutory authority to assist the wholesale customers of the Hetch Hetchy regional water system in planning for and acquiring supplemental water supplies. BAWSCA continues to evaluate the feasibility of water transfers as part of its implementation of Phase II of its Long Term Reliable Water Supply Strategy.

Recently, the City has acquired 1,500,000 gpd and seeking other opportunities. The cost of acquiring additional water would be at the market rate at the time of acquisition.

Recycled Water Opportunities

The City does not supply recycled water, but is currently investigating recycled water options. All wastewater generated within the City is collected by the East Palo Alto Sanitation District (EPASD) and West Bay Sanitation District, conveyed outside the City limits, and treated by wastewater treatment facilities. These facilities provide treated wastewater that meets the regulatory requirements for recycled water as defined in California Code of Regulations, Title 22, Article 3 (Title 22). There is no infrastructure in place to transfer recycled water back into East Palo Alto.

The EPASD serves portions of the City and the City of Menlo Park through a collection system comprised of approximately 35 miles of gravity sewer mains ranging from 6-inch diameter to 24-inch diameter pipe. The EPASD discharges all collected wastewater to the City of Palo Alto’s Regional Water Quality Control Plant (RWQCP). The EPASD has an annual average treatment capacity allotment from the RWQCP of 3.06 mgd (7.64% of the plants total treatment capacity). The RWQCP has a dry-weather capacity of 39 mgd and a wet-weather capacity of 80 mgd. The EPASD collects approximately 400 MG of wastewater from the City’s service area annually.

Palo Alto operates a tertiary wastewater treatment plant and water reclamation facility and discharges most of its effluent to the San Francisco Bay. For effluent that is not discharged to the Bay, the RWQCP has a 4.5 mgd recycled water facility that filters and disinfects the effluent to meet the requirements for disinfected tertiary recycled water “unrestricted use” as defined in Title 22. The plant current production averages 0.6 mgd.

In June 2015, the California Department of Transportation began construction on the San Francisquito Creek Bridge Replacement Project, which involves the replacement of the Highway 101 bridge over San Francisquito Creek, as well as the West Bayshore Road and East Bayshore Road bridges over the San Francisquito creek. The project is being developed through a partnership with the San Francisquito Creek Joint Powers Authority (SFCJPA), a recently-established government agency consisting of the cities of East Palo Alto, Menlo Park, and Palo Alto, San Mateo County, and the Santa Clara Valley Water District. The City has been involved in the water planning for this project, including the installation of a four-inch pipeline to supply recycled water for construction from the Palo Alto RWQCP through its participation in the SFCJPA. Upon completion of the project, this recycled water pipeline will be turned over to the City. This could allow recycled water to be used for irrigation within the City's service area. Recycled water could offset the potable water demand for the Proposed Project or other projects.

In July 2019, the City of Palo Alto and Valley Water prepared a Northwest County Recycled Water Strategic Plan Report. The City of East Palo Alto was evaluated for the potential expansion of the recycled water system. It was estimated that the City of East Palo Alto could use 450 AFY of recycled water for non-potable uses. The concept of extending the recycled water system into the City of East Palo Alto, is considered low cost and a reasonable investment compared to other concept options in the report.

Emergency Ordinances

The City Council has previously adopted an emergency ordinance temporarily prohibiting new or expanded water service connections within the City's water service area during drought conditions. The emergency ordinance, if implemented, would allow staff time to study the current water shortage issue, to develop new water supply and water demand offset policies for the City Council to consider for adoption. Any application not approved prior to the implementation of the ordinance would not be approved. The ordinance would not apply to developments that have been approved by the City Council and the City has executed an agreement for reimbursement of water supply development costs with the project applicant(s).

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